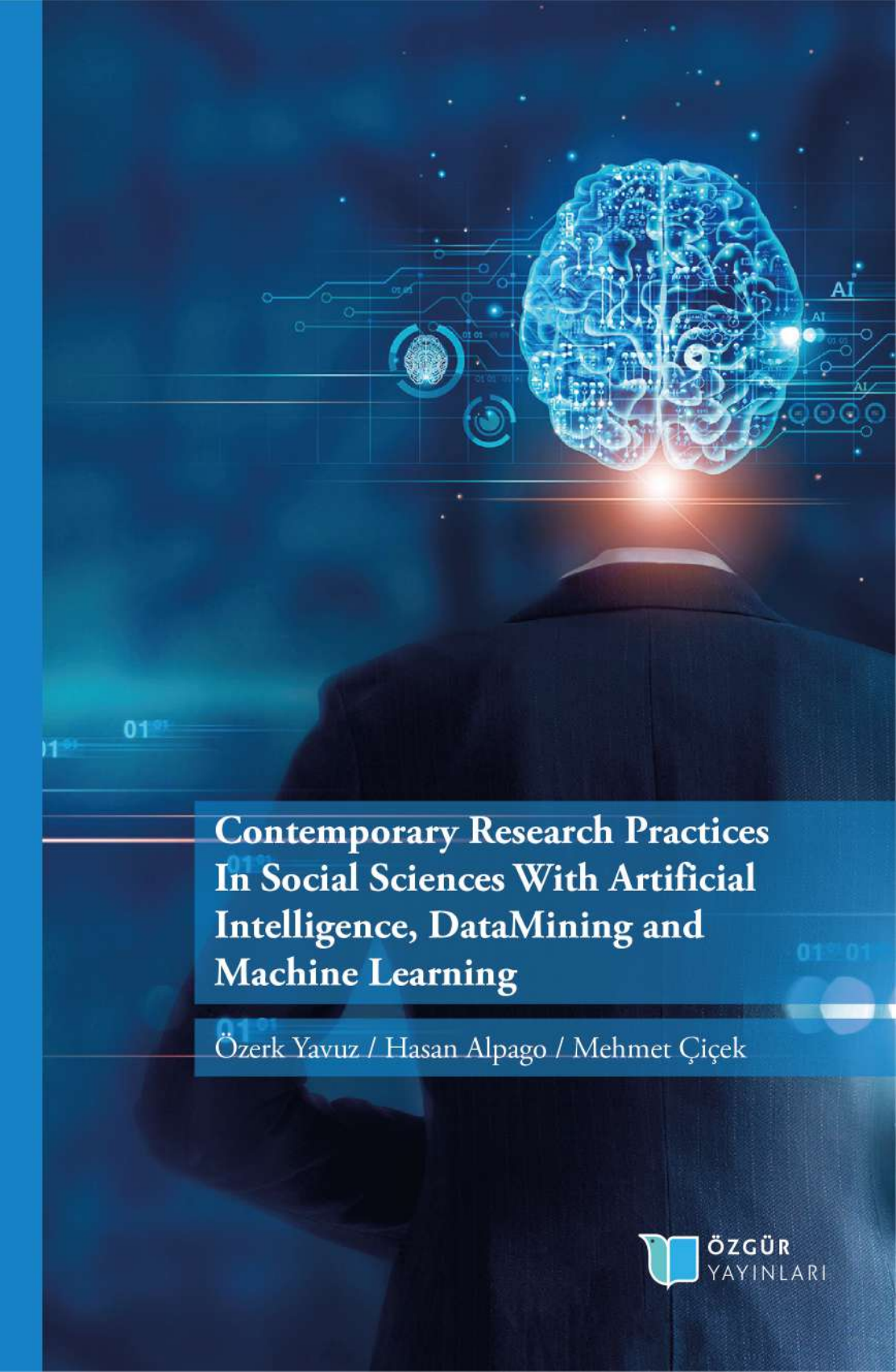

Contemporary Research Practices In Social Sciences With Artificial Intelligence, DataMining and Machine Learning

Özerk Yavuz / Hasan Alpago / Mehmet Çiçek

ÖZGÜR YAYINLARI

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Preface

In the last decade usage and application of Artificial Intelligence, Machine Learning and Data Mining in different disciplines as social sciences, Medical Sciences and Engineering gained momentum. Today with the help of decision support systems supported with these smart approaches and algorithms give decision makers several advantages. In this way more targeted and focused decisions with higher success rates can be maintained for a more sustainable economy and world. In this book, unique contributions of 3 distinguished Professors have been compiled with the aim of providing insights to the reader about several phenomena in social sciences blended with artificial intelligence, machine learning and data mining practices. Hope you enjoy.

With my warmest and kindest regards,

Professor Özerk Yavuz

Eskişehir, 2022

İçindekiler

CHAPTER 1

A Machine Learning Approach in Analysing Brand Switching Behavior and Its Antecedents

Asst. Prof. Dr. Özerk YAVUZ[1]

INTRODUCTION

"Sky is Clear."

-Asst. Prof. Dr. Özerk Yavuz

"Sky and Colors are everybody's."

-Asst. Prof. Dr. Özerk Yavuz

"Dont call the things that you see right for yourself, too much for others"

-Anonymus

"Do not be afraid of the struggle for which you are right! Let it be known that they call the best of the horse doru coloured and the good of the brave crazy."

-**Sheikh Edebali**

"Why hate when there is love,

Why war when there is peace

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ozerk@alumni.bilkent.edu.tr

Why quarrel when there is brotherhood
Why enmity when there is friendship
Why bigotry when there is tolerance,
Why captivity when there is freedom,
Why injustice when there is justice?"
-Hacı Bektaşi Veli

Success of the brands in the marketplace is affected and influenced by several micro and macro factors in many levels. As suggested in literature for the successful positioning of goods and services right product, service, price, place and features should be designed and utilized. As Porter suggests overall cost leadership and core competitive advantage may provide several advantages in the marketing of goods, services and increasing sales revenue. Service quality considerations highlighted by Parasuraman in literature may provide several distinct advantages in positioning the services in this context. It is known that Brand switching behavior is generally seen with the negative customer perception, positive and negative feelings towards brands, past experiences, customer satisfaction. Therefore marketing instruments which are highlighted in literature should be designed and formulated in a way that satisfies customer needs which generates customer loyalty, increases customer value and sales revenue in a customer centric fashion. It is a known fact that customers are in a tendency to not to engage in brand, product or service switching behaviors where they are satisfied, their expectations and needs are met with customer centric approaches, where positively leveraged associations towards a brand is stronger. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008).

As indicated in Wikipedia, competence, courtesy, credibility, security, access, communication, knowing the customer, tangibles, reliability, responsiveness. Wikipedia and Parasuraman explains these constructs as follow in its knowledge base. "Competence is the possession of the required skills and knowledge to perform the

service. For example, there may be competence in the knowledge and skill of contact personnel, knowledge and skill of operational support personnel and research capabilities of the organization. Courtesy is the consideration for the customer's property and a clean and neat appearance of contact personnel, manifesting as politeness, respect, and friendliness. Credibility includes factors such as trustworthiness, belief and honesty. It involves having the customer's best interests at prime position. It may be influenced by company name, company reputation and the personal characteristics of the contact personnel. Security enables the customer to feel free from danger, risk or doubt including physical safety, financial security and confidentiality. Access is approachability and ease of contact. For example, convenient office operation hours and locations. Communication means both informing customers in a language they are able to understand and also listening to customers. A company may need to adjust its language for the varying needs of its customers. Information might include for example, explanation of the service and its cost, the relationship between services and costs and assurances as to the way any problems are effectively managed. Knowing the customer means making an effort to understand the customer's individual needs, providing individualized attention, recognizing the customer when they arrive and so on. This in turn helps to delight the customers by rising above their expectations. Tangibles are the physical evidence of the service, for instance, the appearance of the physical facilities, tools and equipment used to provide the service; the appearance of personnel and communication materials and the presence of other customers in the service facility. Reliability is the ability to perform the promised service in a dependable and accurate manner. The service is performed correctly on the first occasion, the accounting is correct, records are up to date and schedules are kept. Responsiveness is the readiness and willingness of employees to help customers by providing prompt timely services, for example, mailing a transaction slip immediately or setting up appointments quickly." (Wikipedia, 2022; Parasuraman, 1988)

As seen in many behavioral forms and cited by several behavioral theorists, scholars indicate there are several elements and many antecedents that lead to a behavior to occur. As highlighted in literature by Professor Özerk perceived positive feelings, perceived negative feelings towards a brand, perceived service quality, attitude of service personnel, service pricing may be cited as some of the influential factors and antecedents of brand switching behavior.

Perceived positive feelings refer to the positive emotions and feelings perceived towards the brand, perceived negative feelings towards a brand refers to the negative emotions and feelings toward a brand, perceived service quality is the perception of the customer for the quality of the service received, attitude of the service personnel is the demeanor of the staff providing the service to the client, service pricing refers to the total financial and psychological costs for the customer.Services differ from goods with some of the distinctive attributes that they have such as being intangible, perishable, not availability of return or storage and being mostly heterateragenous in nature.

We are living in a highly competitive world and many of today's marketers are aiming to sail their ships with the famous marketing mix instruments of Philip Kotler composed of product, price, place and promotion. It is no doubt that in order to win in the marketplace products and services with distinctive specialization, cutting edges, competitive advantages strengthened by research-development, design and production efforts are necessary for the product and service features offered. This should be strengthened with the best pricing options determined based on the purchasing power of the targeted market segments. Later rather vertically/horizontally integrated or in other various options, best inbound logistics, outbound logistics, sales channels that attract the customer and that gives the organization a competitive advantage should be preferred. The last and maybe one of the most influential instruments of the famous marketing mix is promotion which is composed of PR and advertisement activities. Among all the marketing mix elements of Kotler, Porter's approach in gaining

competitive advantage strategies composed of cost leadership, differentiation, cost focus and differentian focus remains to be true and effective in enhancing market coverage (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter, 2008). Customer relationship management practices for managing the relationships with the customer with a customer centric focus in the every phase of customer decision making process composed of need recognition, information search, evaluation of alternatives, purchase decision, post purchase behavior can be helpfull. As Kotler indicates "Customer Relationship Management (CRM) is the process of carefully managing detailed information about individual customers and all customer "touch points" to maximize customer loyalty.". Attracting new customers and customer retention policies may be necessary in preserving the customer base and customer portfolio as well as attracting new customers which would lead to a sustainable growth of the organization with a customer sales revenue. Researches suggest that attracting new customers is seven times costly then maintaining the customers with a customer retention plan and customer satisfaction policy in many cases. Also utilizing the service quality instruments cited in literature as Parasuraman's for the best parameter combinations may provide many distinct advantages to the marketers and businesses in this context ((Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008; Parasuraman, 1988).

The market offerings, brand, product, service and organizational associatins should be strengthened by leveraging associations in the minds of the customers in conveying the right messages for the target groups. These messages can be conveyed in large PR events and meetings that are planned for the larger audiences or in the advertisement forms which can be in several conventional and unconvential information technology or information systems driven technologies as in social media. As indicated in the communication theory communication is composed of a message

sender, message receiver, message that is needed to be transmitted and the transmission medium. Alternative routes can be preferred in message transfer as in elaboration likelihood model of Cappacio which may follow a central route or a peripheral route for the persuasion which may require a higher or lesser degree of cognitive ability based on the content and encoded message sent to the audience. In the promotion activities composed of PR and advertisement the effect and influence of the message can be strengthened with using opinion leaders and celebrities which are respected, perceived credible and which have large fan bases. In this way encoded message would be more influential in the minds of the customers. Also sex appeals, attention gatherers with other beneficial advertisement and PR techniques as cited in literature, with the right themes and messages, considering the characteristics of the targeted market segments can be preferred and can be beneficial in building a strong image in the minds of the cutomers. Consumer behavior and psychology focused studies that aim to analyse several behavioral forms of consumers can be used to formulate the right marketing strategies for the targeted market segments and customer groups in this sense.As cited by many notable scholars in literature celebrity endorsement, public relations and advertisement are important parts of marketing campaigns and may provide many rewards, advantages and opportunities to the businesses, countries, employees and society at large (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008).

After the formulation of marketing mix elements maybe the last and maybe most exiting part of marketing is wait, see the results in the management dashboard/cockpit. Of course, famous 5 forces model of Porter should not be forgotten. The master captain is the one who approaches the harbour or runway safely without any accidents. Therefore, rivalry among existing competitors, threat of new market entrants, threat of substitutes, bargaining power of buyers and finally bargaining power of suppliers should always

be assessed and considered in flying the plane or sailing the ship. Corrective actions and manipulations in the marketing instruments following the monitoring process can be helpful. Additionaly fairplay should not be forgotten in the marketplace and wishing the enlargement of the market for all market sharers with boosting sales revenues have always place in the wishfull thinking of todays business landscape (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008).

Wish everybody the best with full of happiness, joy and peace. Enjoy!

RESEARCH METHOD

Data mining is defined as a methodological approach in the analysis of quantitative data as indicated in the literature. The data mining process is formed of a set of structured steps that make up the data mining research process and methodology. Initially, the understanding and analysis of the business situation and problem are completed, this is later followed by the review and pre-processing of the data. Subsequently, a conceptual framework or model is developed following the literature review and analysis approaches, model testing is performed with supervised and unsupervised versions of machine learning approaches (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In supervised learning, learning process is usually triggered and activated by anticipatory (feed-forward) approaches which are then followed by backward propagation processes which aim to minimize the cost functions in a stochastic manner. Using the mapping functions, the input layers of the model are mapped to the output layer taking into account the independent dependent values. The functions and equations involved in this mapping are calculated. Subsequently, in many ways, the rules generated with the lowest error rate measured by respective entropy values

are assesed. As in gradient descent forms the lowest cost for the respective variable weights are searched. The equation with the slope which is zero in local minimum or global minimum, which is also the derivative of the cost in the reverse parabolic cost weight diagram is presented as the main association rule. This value can also be calculated by finding the tangent of that point which can be calculated by dividing edge looking to the angle (opposing edge) to adjacent edge in a triangular. To reach the point with the slope zero which is the intersection of the lowest weight and respective weight value meaning the lowest cost in the function at this point is steep to the weight, an iterative traversal is necessary for the opposite direction of the gradient. In this manner rules that provide the closest proximity to the actual results are selected and presented as distinctive association rules. To assess this, a stochastic backpropagation technique is used in many respects. In unsupervised machine learning grouping of several construct value combinations for different variables are assigned to respective clusters by applying mimicry for the pre-unlabeled data (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative

relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and understanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

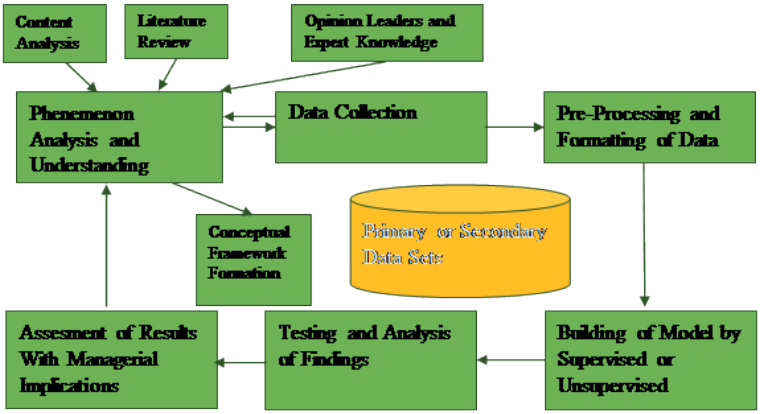

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are

evaluated. The best performing algorithm for this problem with the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

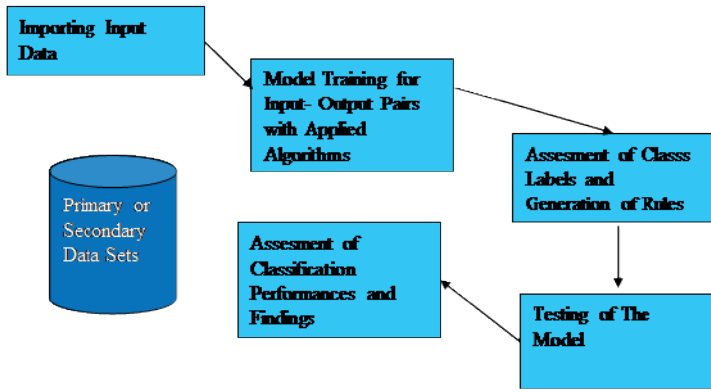

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

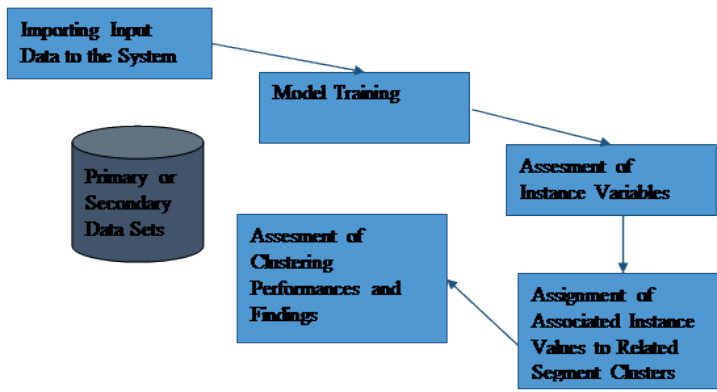

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

DATA GATHERING AND PROCESSING

Initially data has been gathered in Nişantaşı University, İstanbul from the target customer groups for pre-processing step of data mining process of the analysis. Data has been pre-processed and made ready for further analysis. Later in order to enhance exploratory and confirmatory understanding classification and clustering focused supervised, unsupervised machine learning approaches available in data mining literature employed. In model training and testing, 10 folds cross-validation approach has been used. In this way a solution for the research questions "what are the important antecedents of online and conventional purchase behaviors" with how influential is different factors for conventional and online purchasing behaviors are tried to be examined and understood (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Table 1. List of Variables Used in Analysis

Variable Name	**Scale Type**
Perceived Positive Feelings Towards Brand	Likert Scale (5 Points)
Perceived Negative Feelings Towards Brand	Likert Scale (5 Points)
Perceived Service Quality	Likert Scale(5 Points)
Perceived Service Quality	Likert Scale(5 Points)
Attitude of Service Personnel	Likert Scale(5 Points)
Price	Nominal/Categorical Scale
Brand Switching Behavior	Nominal/Categorical Scale

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions

are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using multilayer perceptron, Bayesian networks, random forrest algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis, 10 fold cross-validation technique was used to train the model, and then the model is tested with a test dataset composed of the same variables. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain

additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. Voted Perceptron has been the top scorer among all machine learning algorithms with the highest classification rate, lowest RMSE, and misclassification performance. The maing finding were given in the Table 3.

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	Key Performance Indicators			
	RMSE	Precision	% Correctly Classified	% Misclassified
J48	0.37	0.76	77.27	22.72
Multilayer Perceptron	**0.26**	**0.86**	**86.36**	**13.63**
Bayesian networks	0.31	0.90	86.36	13.63
SimpleLogistic	0.36	0.77	77.27	22.72
PART	0.32	0.81	81.81	18.18
Random Tree	0.34	0.83	81.81	18.18
Vote	0.47	N/A	22.72	77.27

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

I	Cluster analysis revealed that perceived negative feelings, perceived service quality, Attitude of Service Personnel are higher, perceived negative feelings and price is low in no- brand switching behavior cluster whereas perceived positive feelings, attitude of service personnel have lower values, perceived negative feelings and price values are higher in brand switching behavior cluster
II	If price is low then no-brand switching behavior, if price is high then brand switching behavior status indicator is true
III	In the case of perceived service quality is smaller than 2.5 and price is low if Perceived Positive Feelings is less than than brand switching behavior is possible if Perceived Positive Feelings is greater than 4.5 than brand switching behavior occurs
IV	In the case of perceived service quality is greater than 2.5 and perceived negative feelings is greater and equal than 4, if price is low no brand switching behavior occurs if price is high brand switching behavior occurs
V	If perceived positive feelings towards brand is greater than and equal to 4.5 and price is low than if attitude of the service personnel is good than no brand switching behavior occurs, if attitude of the service personnel is not good than brand switching behavior is possible or no brand switching behavior
VI	If perceived positive feelings towards brand is greater than and equal to 4.5 and price is high than brand switching behavior is possible
VII	If perceived negative feelings is smaller than 0.5 than brand switching behavior is possible if rate of perceived negative feelings is greater and equal to 4 then brand switching behavior occurs
VIII	If perceived service quality is smaller than and equal to 2 then brand switching behavior occurs if perceived service quality is greater than 2 than no brand switching behavior
IX	If attitude of service personnel is good than no brand switching behavior occurs if attitude of service personnel is not good brand switching behavior follows

In the analysis machine learning algorithms revealed that celebrity endorsement has moderate influence on online and traditional purchase behavior. Cluster analysis revealed that

perceived negative feelings, perceived service quality, attitude of Service Personnel are higher, perceived negative feelings and price is low in no- brand switching behavior cluster whereas perceived positive feelings, attitude of service personnel have lower values, perceived negative feelings and price values are higher in brand switching behavior cluster. If price is low then no-brand switching behavior, if price is high then brand switching behavior status indicator is true. In the case of perceived service quality is smaller than 2.5 and price is low if Perceived Positive Feelings is less than than brand switching behavior is possible if Perceived Positive Feelings is greater than 4.5 than brand switching behavior occurs. In the case of perceived service quality is greater than 2.5 and perceived negative feelings is greater and equal than 4, if price is low no brand switching behavior occurs if price is high brand switching behavior occurs. If perceived positive feelings towards brand is greater than and equal to 4.5 and price is low than if attitude of the service personnel is good than no brand switching behavior occurs, if attitude of the service personnel is not good than brand switching behavior is possible or no brand switching behavior. If perceived positive feelings towards brand is greater than and equal to 4.5 and price is high than brand switching behavior is possible. If perceived negative feelings is smaller than 0.5 than brand switching behavior is possible if rate of perceived negative feelings is greater and equal to 4 then brand switching behavior occurs. If perceived service quality is smaller than and equal to 2 then brand switching behavior occurs if perceived service quality is greater than 2 than no brand switching behavior. If attitude of service personnel is good than no brand switching behavior occurs if attitude of service personnel is not good brand switching behavior follows. Neural network generated model of brand switching behavior is as seen in Figure 4.

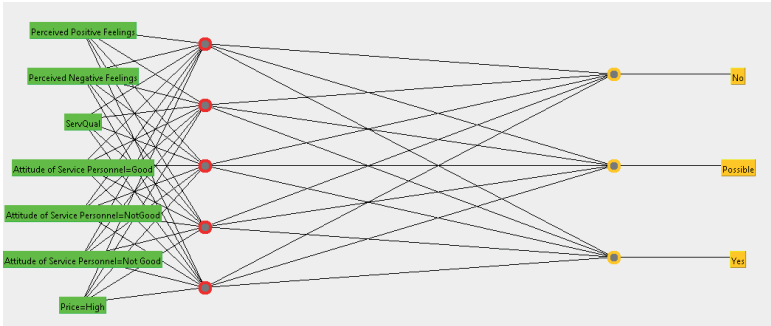

Figure 4. A Neural Network View of the Generated Model (Multilayer Perceptron: Brand Switching Behavior Is the Dependent Variable)

In the conducted analysis, the Multilayer perceptron method has been the best performing algorithm among other applied supervised machine learning approaches. This technique creative generated a correct classification rate of 86.36 percent with an RMSE of 0.26 and a misclassification rate of 13.63. Performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

Success of the brands in the marketplace is affected and influenced by several micro and macro factors in many levels. As suggested in literature for the successful positioning of goods and services right product, service, price, place and features should be designed and utilized. As Porter suggests overall cost leadership and core competitive advantage may provide several advantages in the marketing of goods, services and increasing sales revenue. Service quality considerations highlighted by Parasuraman in literature may provide several distinct advantages in positioning the services in this context. It is known that Brand switching behavior is generally seen with the negative customer perception, positive and negative feelings towards brands, past experiences, customer satisfaction. Therefore marketing instruments which are highlighted in literature should be designed and formulated in a way that satisfies customer needs which generates customer loyalty, increases customer value and sales revenue in a customer centric fashion. It is a known fact that customers are in a tendency to not to engage in brand, product or service switching behaviors where they are satisfied, their expectations and needs are met with customer centric approaches, where positively leveraged associations towards a brand is stronger.

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personnel is the demeanor of the staff providing the service to the client, service pricing refers to the total financial and psychological costs for the customer.Services differ from goods with some of the distinctive attributes that they have such as being intangible, perishable, not availability of return or storage and being mostly heterateragenous in nature.

In the research part a quantitative research methodology that employs a artificiall intelligence driven machine learning approach. The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and understanding with the option of knowledge discovery, prediction, or forecasting that it offers.

Cluster analysis revealed that perceived negative feelings, perceived service quality, attitude of Service Personnel are higher, perceived negative feelings and price is low in no- brand switching behavior cluster whereas perceived positive feelings, attitude of service personnel have lower values, perceived negative feelings and price values are higher in brand switching behavior cluster. If price is low then no-brand switching behavior, if price is high then brand switching behavior status indicator is true. In the case of perceived service quality is smaller than 2.5 and price is low if Perceived Positive Feelings is less than than brand switching behavior is possible if Perceived Positive Feelings is greater than 4.5 than brand switching behavior occurs. In the case of perceived service quality is greater than 2.5 and perceived negative feelings is greater and equal than 4, if price is low no brand switching behavior occurs if price is high brand switching behavior occurs. If

perceived positive feelings towards brand is greater than and equal to 4.5 and price is low than if attitude of the service personnel is good than no brand switching behavior occurs, if attitude of the service personnel is not good than brand switching behavior is possible or no brand switching behavior. If perceived positive feelings towards brand is greater than and equal to 4.5 and price is high than brand switching behavior is possible. If perceived negative feelings is smaller than 0.5 than brand switching behavior is possible if rate of perceived negative feelings is greater and equal to 4 then brand switching behavior occurs. If perceived service quality is smaller than and equal to 2 then brand switching behavior occurs if perceived service quality is greater than 2 than no brand switching behavior. If attitude of service personnel is good than no brand switching behavior occurs if attitude of service personnel is not good brand switching behavior follows.

In the conducted analysis, the Multilayer perceptron method has been the best performing algorithm among other applied supervised machine learning approaches. This technique creative generated a correct classification rate of 86.36 percent with an RMSE of 0.26 and a misclassification rate of 13.63. Studies of this type can be used in order to formulate more targeted marketing campaigns and strategies that give importance to customer preferences, customer characteristics and expectations with the right marketing mix elements in a customer centric fashion. It can also provide exploratory and confirmatory understanding for research community, business leaders, political leaders and society at large for similar research domains.

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CHAPTER 2

Inspecting and Scrutinizing Crime Rates along with Vilonce Against The Person Rates As Well As Their Antecedents in London with Supervised and Unsupervised Machine Learning Algorithms

Asst. Prof. Dr. Özerk YAVUZ[2]

"Somebody has to spend the money for businesses to boost their sales revenues and hire people. That would end the recessions and unemployment. These are the rules of the game in 21st Century Business Landscape. Hope I hit the jackpot and be a lucky star for contributing to a sustainable economy with my spendings some day."

-Dr. Özerk Yavuz

"The more you earn, the more you can make a contribution to the growth of economy which means more jobs and pay slips

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for our distinguished world citizens. Maybe these will be the ones who will go to heaven who knows. “

-Dr. Özerk Yavuz

“Citizenship and unemployment salary seems to be the most effective methods for all world citizens to sustain their lifes and satisfy their needs with goods and services that they purchase.”

-Dr. Özerk Yavuz

“We need to increase employment rates, bring job security and increase the education level of individuals for a more peacefull society with lower or may be no crime rates”

-Dr. Özerk Yavuz

“Citizenship and unemployment salary can make a positive impact on crime rate reduction in a society.**”**

-Dr. Özerk Yavuz

“Insanity is doing the same thing over and over again and expecting different results.”

-Albert Einstein

“Poverty is the mother of crime.”

- Marcus Aurelius

“Poverty is the parent of crime and revolution.”

-Aristotle

‘Nothing in the world is harder than speaking the truth and nothing easier than flattery

-Fyodor Dostoyevsky

INTRODUCTION

Human kind has long thought and debated about importance of living in a peacefull society with lower crime rates where everbody has a good standard of living, education, a good wellfare,

in a society where everybody can have a sustainable income for affording her/his needs as indicated in the needs hierarchy of Maslow composed of physiological needs, safety needs, love and belonging needs, esteem needs and self actualization needs, where everybody respects each other's views, opinions, life styles and rule of law. Today needs of human beings are satisfied in many ways including products and services provided by businesse, states and governments. In order to sustain a good standard of living and afford one's needs, a person mostly needs to work which in many cases requires some skills and education for you to be hired. If you are lucky enough then you can maybe hit the jackpot or use the inheritances that are left to you from your parents and grandparents. Unfortunately everybody is not as much as lucky some of the people who do not have the enough capabilities and education can lead to unemployment which two are mainly highlighted as the antecedents of many crimes. This is usually because of the fact that people are engaging in criminal behaviors to pay their expenses and continue their lives switching to a wrong direction. Of course this is not an excuse to commit a crime but unfortunately researches suggests that rates of high unemployment, insufficient income and poor education are highly correlated with high crime rates (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008; Ades, 2020; LSE, 2016; Anser, 2020).

Usually some of the individuals not thinking rationaly are engaging in dangerous behavioral patterns and criminal behaviors to earn money for continuing their lifes. If the parents have not enough income to support the education of their offspring, when the individual does not have enough capabilities, education or skills then she/he can not be hired in a highly compatitive capitalist structure where compatition is immense. If there is not a security provided to the unemployment citizens in the form of unemployment salary of citizenship salary, some may engage in criminal behaviors threating the wellfare, peace of the society and constitutional order following a wrong path. After their penalties and jailtime since they can not

be employed because of their criminal records they give up on searching jobs and same dangerous path follows with additional offenses, criminal activities which threatens the innocent individuals and society which means more penalties and jailtime in many cases. As suggested in literature in countries and communities where education level is high and unemployment rate is low generally crime rates are lower comparably to ghettos and countries with higher unemployment rates and lower educational levels in many cases. However happily this doesn't change the fact that there are always success stories and exceptions associated with different demographies and citizen characteristics. When the individuals and citizens are given the enough support and resources with good consuling and mentoring there is no reason that they would suceed in life (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008 ; Ades, 2020; LSE, 2016; Anser, 2020).

Additionaly drop of income and unemployment means less demand and spending which would lead to a poor production and supply of goods and services because of the lessened revenues of other businesses. This would usually be followed by lay offs of employees and recession if it is not properly managed by governments by increasing the liquidity and governmental spending to break the recession deadlock cycle. Legislative reforms for internal and external shocks triggered by market dynamics in the global market place arising from the domino effect and band wagon tendencies of the customers, world citizens and businesses. Increasing the consumer confidence index with the help of legislative reforms, using marketing instruments as product, price, place, promotion of famous Kotler in consumer decision making, or other macro or micro level leading indicators of inflation, economy and currency crises should be utilized. In this way an improvement in the lagging indicators would usually be observed (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008 ; Ades, 2020; LSE, 2016; Anser, 2020).

Similary governmental legislations, increased consumer spending leaded by consumer confidence,Government to Business (G2B), Business to Business(B2B), Customer to Business (C2B) sales transactions, bileteral trade agreements, governmental subsidaries and incentives, sustaining job and income security with permanent contracts, citizenship salary or unemployment salary may provide several benefits to the economies, businesses, countries, states and society at large. Also educational plans, programs and reforms that is suitable for the contemporary world conditions can be helpfull for training the individuals and youth with necessary skills, knowledge, capabilities and competencies necessary for them to be hired in many cases in the highly competitive market place. In this research some of the leading indicators of crime rates as education status, income, employment status are analysed with the aim of providing insights to political leaders, business leaders and society at large (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022; Kotler, 1991; Kotler 2000; Porter , 2008 ; Ades, 2020; LSE, 2016; Anser, 2020).

Data mining is defined as a methodological approach in the analysis of quantitative data as indicated in the literature. The data mining process is formed of a set of structured steps that make up the data mining research process and methodology. Initially, the understanding and analysis of the business situation and problem are completed, this is later followed by the review and pre-processing of the data. Subsequently, a conceptual framework or model is developed following the literature review and analysis approaches, model testing is performed with supervised and unsupervised versions of machine learning approaches (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022 ; Ades, 2020; LSE, 2016; Anser, 2020).

In supervised learning, learning process is usually triggered and activated by anticipatory (feed-forward) approaches which are then followed by backward propagation processes which aim to minimize the cost functions in a stochastic manner. Using the mapping functions, the input layers of the model are mapped to

the output layer taking into account the independent dependent values. The functions and equations involved in this mapping are calculated. Subsequently, in many ways, the rules generated with the lowest error rate measured by respective entropy values are assesed. As in gradient descent forms the lowest cost for the respective variable weights are searched. The equation with the slope which is zero in local minimum or global minimum, which is also the derivative of the cost in the reverse parabolic cost weight diagram is presented as the main association rule. This value can also be calculated by finding the tangent of that point which can be calculated by dividing edge looking to the angle (opposing edge) to adjacent edge in a triangular. To reach the point with the slope zero which is the intersection of the lowest weight and respective weight value meaning the lowest cost in the function at this point is steep to the weight, an iterative traversal is necessary for the opposite direction of the gradient. In this manner rules that provide the closest proximity to the actual results are selected and presented as distinctive association rules. To assess this, a stochastic backpropagation technique is used in many respects. In unsupervised machine learning grouping of several construct value combinations for different variables are assigned to respective clusters by applying mimicry for the pre-unlabeled data (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only

without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

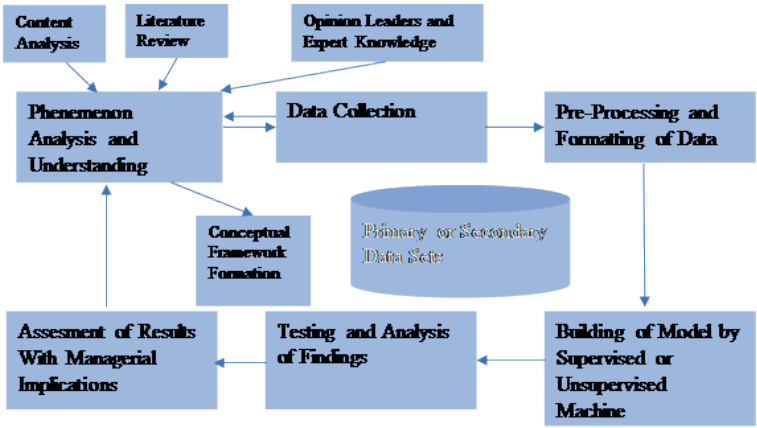

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with

the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

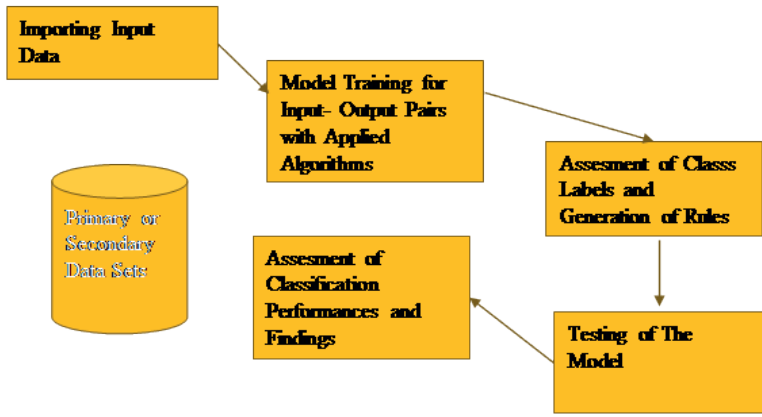

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

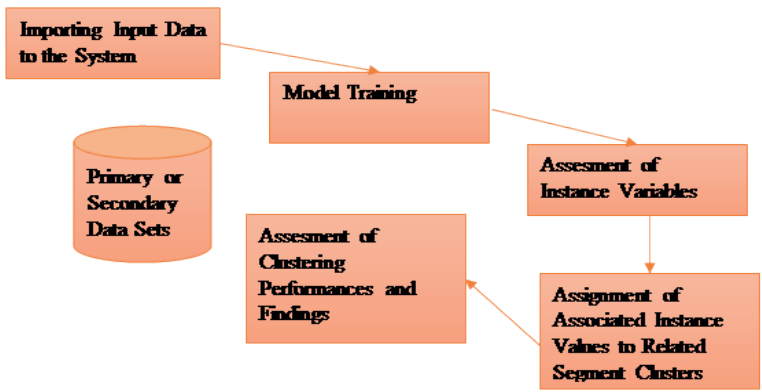

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

DATA GATHERING AND PROCESSING

For the data set and sampling secondary data has been used from London Mayorship and greater London authority. available in data mining literature employed. In model training and testing, 66 percent of the data has been used for training of the model purposes whereas remaining part of the data has been used for model testing purposes. In this way a solution for the research questions "What are the relations between education, unemployment and crime rates in Greater London Area.". Some of the main hypothesis tested has been as follow. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Table 1a. Main Hypothesis of the research

h1: Education has influence on crime rate	Accepted
h2: Employment rate has influence on crime rate	Accepted
h3: Education has influence on Violence against the person rate	Accepted
h4: Employment rate has influence on Violence against the person rate	Accepted

Table 1b. List of Variables Used in Analysis

Variable Name	**Variable**
Number of jobs in area	Nominal (Categorical)
Employment per head of resident wa population	Nominal (Categorical)
In employment (16-64)	Nominal (Categorical)
Average gcse capped point scores	Nominal (Categorical)
% With no qualifications	Nominal (Categorical)
A-level average point score per student	Nominal (Categorical)
% With level 4 qualifications and above	Nominal (Categorical)
Crime rate - 2014/15	Nominal (Categorical)
Violence against the person rate	Nominal (Categorical)
Deliberate fires per 1,000 population	Nominal (Categorical)

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using multilayer perceptron, Bayesian networks, random forrest algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the

classifications and clusterings were compared and evaluated. During the analysis, 66 percent of the data was used to train the model as the training set, and then the model is tested with a test dataset composed of the same variables with the remaining part of the data as the test set. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. Random Forrest has been the top scorer among all machine learning algorithms with the highest classification rate, lowest RMSE, and misclassification performance. The maing finding were given in the Table 3.

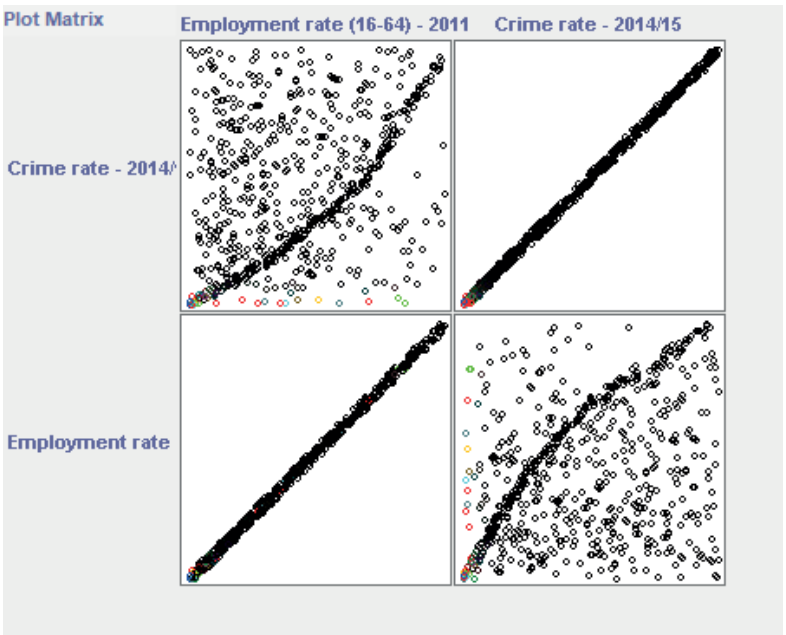

Figure 4. Employment Rate and Crime Rate Change

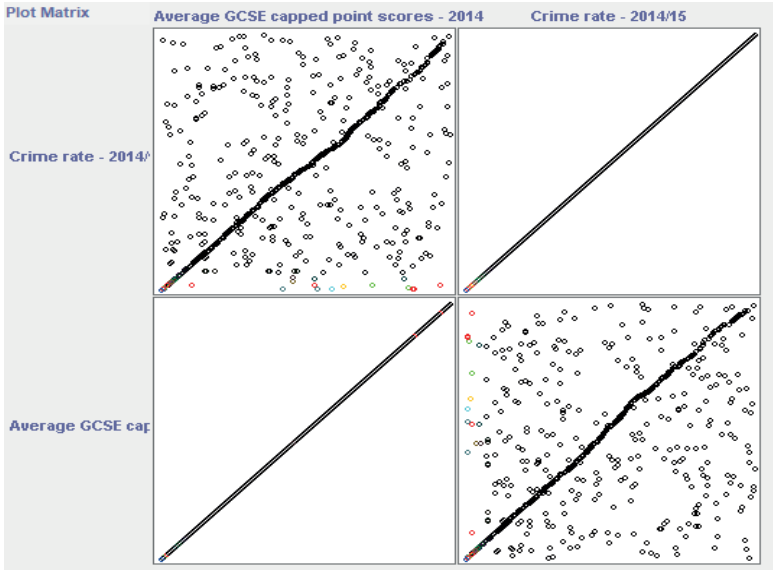

Figure 5. Average GCSE capped point scores and Crime Rate Change

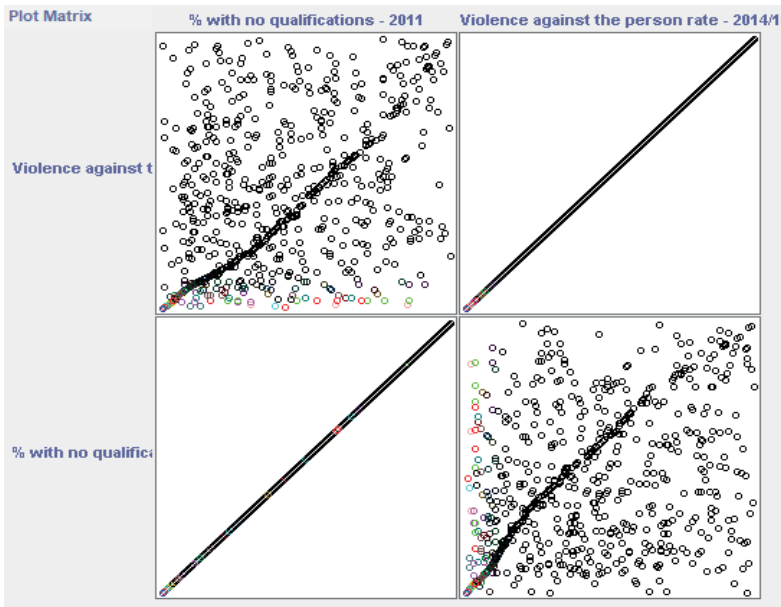

Figure 6. Percentage of non-qualifiers and Violence against the person rate change

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	Key Performance Indicators			
	RMSE	Precision	% Correctly Classified	% Misclassified
OneR	0.35	N/A	81.25	18.75
Naive Bayes	0.29	N/A	83.03	16.96
Multilayer Perceptron	0.29	N/A	81.69	18.30
Hoeffding Tree	0.29	N/A	83.03	16.96
Random Forest	**0.29**	**N/A**	**83.92**	**16.07**

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

Table 3. Predicted and Discovered Rules of Data Mining Algorithms

I	In the cluster analysis of unsupervised machine learning it was found out that Emloyment rate is lower, Average GCSE capped point score is lower, percentage of unqualified individuals are higher with higher crime rates and higher violence against the person rate whereas Emloyment rate is higher, Average GCSE capped point score is higher, percentage of unqualified individuals are lower with lower crime rates and lower violence against the person rate
II	Crime rate is high if intensely populated, moderate if less intensely populated
III	If employment rate is moderate then vilonce against the person rate is low, if employment rate is low vilonce against the person rate is moderate
IV	If % with Level 4 qualifications and above is moderate, then crime rate is high If % with Level 4 qualifications and above is high then crime rate is moderate
V	There is an inverse relation between education level and crime rates
VI	There is an inverse relation between employment rate and vilonce against the person rate

In the cluster analysis of unsupervised machine learning it was found out that Emloyment rate is lower, Average GCSE capped point score is lower, percentage of unqualified individuals are higher with higher crime rates and higher violence against the person rate whereas Emloyment rate is higher, Average GCSE capped point score is higher, percentage of unqualified individuals are lower with lower crime rates and lower violence against the person rate. Crime rate is high if intensely populated, moderate if less intensely populated. If employment rate is moderate then vilonce against the person rate is low, if employment rate is low vilonce against the person rate is moderate. If % with Level 4 qualifications and above is moderate, then crime rate is high If % with Level 4 qualifications and above is high then crime rate is moderate. There is an inverse relation between education level and crime rates. There is an inverse relation between employment rate and vilonce against the person rateNeural network generated research models can be found in Figure 7 and Figure 8.

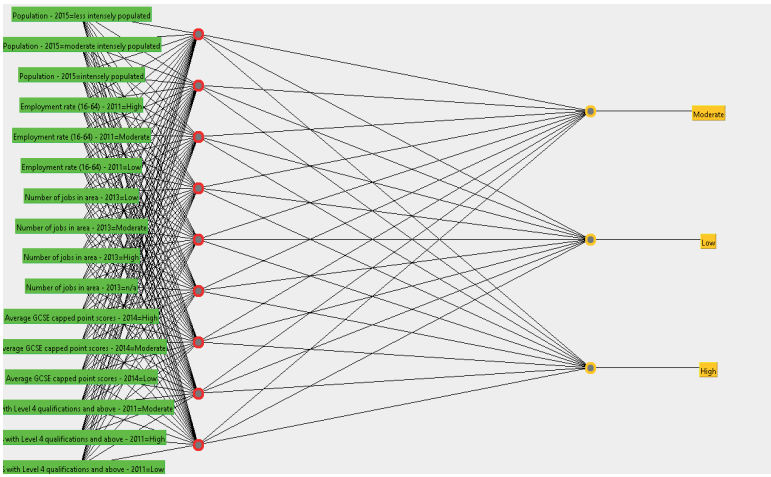

Figure 7. A Neural Network View of the Generated Model (Multilayer Perceptron: Crime Rate is the Dependent Variable)

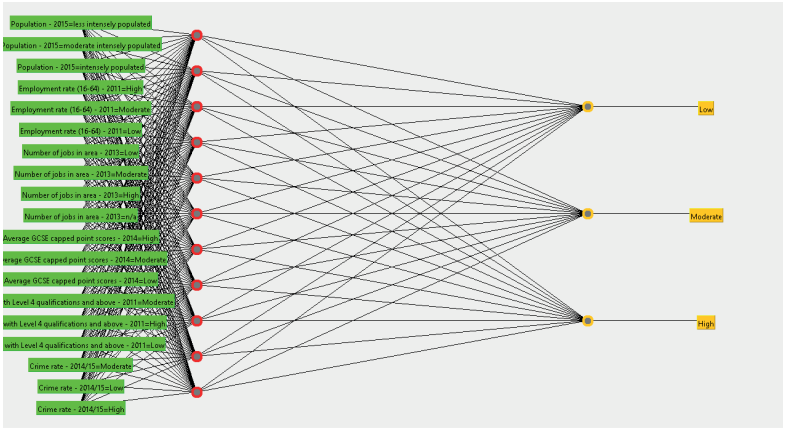

Figure 8. A Neural Network View of the Generated Model (Multilayer Perceptron: Violence against the person rate is the Dependent Variable)

In the conducted analysis, the Multilayer perceptron method has been the best performing algorithm among other applied supervised machine learning approaches. This technique creative generated a correct classification rate of 75.39 percent with an RMSE of 0.42 and a misclassification rate of 24.60. Performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

Human kind has long thought and debated about importance of living in a peacefull society with lower crime rates where everbody has a good standard of living, education, a good wellfare, in a society where everybody can have a sustainable income for affording her/his needs as indicated in the needs hierarchy of Maslow composed of physiological needs, safety needs, love and belonging needs, esteem needs and self actualization needs, where everybody respects each other's views, opinions, life styles and rule of law. Today needs of human beings are satisfied in many ways including products and services provided by businesse, states and governments. In order to sustain a good standard of living and afford one's needs, a person mostly needs to work which in many cases requires some skills and education for you to be hired. If you are lucky enough then you can maybe hit the jackpot or use the inheritances that are left to you from your parents and grandparents. Unfortunately everybody is not as much as lucky some of the people who do not have the enough capabilities and education can lead to unemployment which two are mainly highlighted as the antecedents of many crimes. This is usually because of the fact that people are engaging in criminal behaviors to pay their expenses and continue their lives switching to a wrong direction. Of course this is not an excuse to commit a crime but unfortunately researches suggests that rates of high unemployment, insufficient income and poor education are highly correlated with high crime rates. In this research some of the leading indicators of crime rates as education status, income, employment status are analysed with the aim of providing insights to political leaders, business leaders and society at large.

In the cluster analysis of unsupervised machine learning it was found out that Emloyment rate is lower, Average GCSE capped point score is lower, percentage of unqualified individuals are higher with higher crime rates and higher violence against the person rate whereas Emloyment rate is higher, Average GCSE capped point score is higher, percentage of unqualified individuals

are lower with lower crime rates and lower violence against the person rate. Crime rate is high if intensely populated, moderate if less intensely populated. If employment rate is moderate then vilonce against the person rate is low, if employment rate is low vilonce against the person rate is moderate. If % with Level 4 qualifications and above is moderate, then crime rate is high If % with Level 4 qualifications and above is high then crime rate is moderate. There is an inverse relation between education level and crime rates. There is an inverse relation between employment rate and vilonce against the person rate.

To conclude in this research some of the leading indicators of crime rates as education status, income, employment status are analysed with the aim of providing insights to political leaders, business leaders and society at large. To Sum up, as the research findings suggest, importance of good education and unemployment reductions can make a positive impact on crime rate reductions and lead to a more peacefull and tranquilly society free from criminal activities where everybody is happy and not threatened.

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CHAPTER 3

Evaluation of the Turkish Economy in the Framework of Macroeconomic Indicators During the Covid 19 Pandemic

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Introduction

The COVID 19 pandemic has reshaped the social and economic life on a regional and country basis as well as globally and opened the doors of a new era. In this period, especially working at home or at home and digital working methods pioneered the establishment of a new type of life in business and social life by using the developing technology. In this process, while state regulations gained weight especially in the economy and social life, the internet and social media in private life took an important place in the daily lives of individuals and started a new era.

The public policies followed during the pandemic have become the main triggers for internal and external balances to be questioned and for changes and transformations on the basis of

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thought. In this article, this change and transformation process, which is required by the COVID 19 pandemic, has been tried to be evaluated in a macro-economic framework for Turkey.

From a macroeconomic point of view, similar measures were taken in Turkey during the COVID 19 pandemic. In this respect, there is stability and parallelism in terms of taking similar economic, health and social measures against the pandemic on a global basis. On the other hand, there were large differences in proportion between the measures taken by the countries according to their reserves and economic power. For example, while Turkey has been following a policy of self-sacrifice by collecting SMS aids inside, it has followed a policy of giving a different message to the outside world. In this context, a policy of prestige was followed in foreign policy by following the policy of transferring some medical materials such as masks to foreign countries. The basis of these two policies is to alleviate the rising heavy burden of the economy. Although Turkey's pandemic aid remains quite low compared to EU countries, it has been focused on measures to alleviate the burden placed on the economy by the pandemic.

This policy of the government continued in parallel with the development of different approaches to domestic politics. Especially for citizens who have difficulty in paying their expenses such as electricity, metropolitan municipalities have launched support campaigns for citizens with suspended invoice campaigns. On the other hand, while people who work informally or do not have any social security, intellectual and art workers who work independently, are the most affected by the pandemic bans, the public support given to this group has remained at a minimum when compared to many other countries.

As a result, the economy, which was partially relieved by the removal of all pandemic restrictions, has entered a difficult period this time in the face of high exchange rates, low purchasing power and rising prices due to inflation. It is seen that how the results of this will develop will depend on the policies to be followed by the government as well as the developments on a global basis.

Theoretical and Conceptual Framework

The corona crisis or COVID-19 is a new coronavirus, a deadly and contagious disease caused by SARS-COV-2. The outbreak of this pandemic was first detected on December 1, 2019 in Wuhan, Hubei Province of China, and spread very quickly around the world. Spread through respiratory droplets produced during speaking, coughing and sneezing, the disease has sparked a wave of impact that has shaken not only the healthcare system but also the economic and social overhang. From the poor to the rich, from the baby to the old, this virus has shown the risk of contagion to everyone, ignoring the economic and other class distinctions and shocked everyone deeply. Thus, it led not only to a global public health problem, but also to a global economic depression. After World War II, the world's health sector and the economy faced such a huge challenge can be described as a new turning point. In this article, in which the effects of the COVID-19 epidemic on global social, economic and health are discussed, the Turkish economy has been acted on. The aim is to make an objective and complementary contribution to the Turkish and world economy. From the beginning of 2021, a global fighting spirit has developed, with COVID-19 vaccines being distributed worldwide. It is hoped that this will lead to joint initiatives that ensure peace, a greener environment, a world where peace and equality take precedence, and human well-being.

Analysis of Turkey's Macroeconomic Indicators

The Turkish economy was showing signs of significant economic crisis before the COVID 19 pandemic. In particular, the government's low interest and high export policy could not show sufficient success. Most importantly, the new economic approach, which was tried to be developed contrary to the basic economic teachings, did not show sufficient success in terms of solving the structural economic and social problems of the country that have existed since the past. Although the foreign investments, which were tried to be increased with the government's low interest

policy, were partially successful, the incoming capital remained mostly hot money and the sudden exit during the crisis made the already existing economic fluctuations even more fragile. While the government was looking for solutions to this fragile structure, the COVID 19 pandemic exploded. After this period, as in the rest of the world, the first priority in Turkey started to come to the fore as to control the pandemic and to maintain the existence of a minimum sustainable economic structure during the pandemic (Alpago, 2020).

On the other hand, post-pandemic economic growth in Turkey has weakened significantly in 2022. While his government targeted strong, short-term growth, which is associated with high financial and economic risks, with its low interest rate policy, the inflation rate rose sharply and Turkey lost significantly. Since this weakened the purchasing power of the citizens, the middle class, which is considered as the cornerstone of the economy, began to feel the economic crisis to a significant extent. In addition, the debt ratio increased exponentially in both the public and private sectors. The foreign debt ratio in government revenues, which is trying to be covered by swaps, also showed a significant increase compared to previous years. On the other hand, the CBRT's foreign exchange reserves are low and the deposits of the banks are heavily dependent on borrowing. In addition to this economic outlook, unemployment in the country increased and the living index began to display a negative outlook. In addition to such negative economic situations, the increase in geopolitical and political tensions in the region where Turkey is located brought another burden to the economy (TCMB, 2022)..

The CBRT's response to the devaluation pressure on the Turkish lira with its monetary policy is seen as a pressure to cause some policy changes in the long run. The CBRT lowered the key interest rate several times, most recently it reduced it by 100 basis points to 13. With interest rates well below the inflation rate, the real interest rate in April 2022 became minus 56 percent. On the other hand, the CBRT's policy of increasing the policy

interest rates of the US Central Bank and the European Central Bank in response to this low interest policy means that the unique economic policy followed by the Turkish economy continues. As a result, while international investors tend to withdraw funds from riskier countries such as Turkey, new policies to be developed by the government will be decisive. On the other hand, although the government's increase in the minimum wage to 5500 TL contributes to the resistance of the citizens against inflation, it remains insufficient in the medium and long term. On the other hand, the government's complete end of all pandemic restrictions and the foreign exchange earnings from the revival of tourism may bring some relief to the economy. However, the success of the government's other policies and the result of the general elections planned to be held in 2023 will shape the future course and general outlook of the Turkish economy (IMF, 2022).

On the other hand, high exports and increase in production in Turkey are among the main factors contributing to strong economic growth in 2021. Also, Turkey could benefit from the change in supply chains as a result of the corona pandemic. At the same time, the weak exchange rate strengthens the international competitive position of the suppliers in Turkey, while the loss of purchasing power throughout the country has a negative impact on the general welfare level, creating a long-term negative effect in terms of sustainable growth and economic development. However, the production sector in Turkey is highly dependent on imported intermediate goods. Therefore, especially the increase in foreign currency and the depreciation of the Turkish lira negatively affects not only the fixed income citizens but also the production sector. In addition, the increase in raw material, energy and logistics prices on a global scale due to the increase in the exchange rate creates pressure especially on the earnings and sustainable strategies of Turkish companies (Erken, 2020).

In order to maintain its economic program, the government in Turkey continues its interventionist policies after the pandemic and continues to restrict the functioning of the free market. For

example, on January 3, 2022, a decree was enacted that companies operating in Turkey must exchange a quarter of their export earnings in euro, dollar and sterling with Turkish lira at the central bank. This rate has now been increased to 40 percent. As of March 19, 2022, companies were obliged to issue all invoices in lira (TCMB, 2022).

The increase in the price of foreign currency and the continuing depreciation of the Turkish lira makes it more expensive to obtain and repay foreign loans, making foreign borrowing more difficult. In other words, while borrowing in Turkish lira becomes cheaper, foreign exchange and foreign borrowing becomes more difficult. This makes it difficult to invest internationally and may cause firms to shrink inward. In addition, high exchange rate volatility may increase uncertainty by making price and cost calculations and long-term planning difficult, and may cause speculative investments to come to the fore instead of real investments. Thus, not only the citizens whose purchasing power has decreased, but also the investor who is indecisive in the face of uncertainties have difficulties in the decision-making process. However, this situation may change according to the results of the policies followed after the pandemic.

However, companies already in the country are looking to the future and planning numerous projects. On the other hand, almost no new companies settle in Turkey. Due to the increase in online commerce caused by the corona pandemic, high investments are being made in storage. Real estate service providers are also seeing higher demand for industrial space.

With an investment volume of over 14 billion US dollars (US$) since 1980, Germany is one of Turkey's largest foreign investors. However, German companies have clearly been taking a step back since 2015. Most of the investment inflows recorded in recent years are related to maintaining existing commitments. At the end of 2021, Turkey statistics registered about 7,800 German companies in Turkey (Adıgüzel, 2021).

Inflation averaged 70 percent in April 2022. In addition, there is the war in Ukraine, which has increased gas and grain import prices. Most companies only respond with salary increases that reduce losses. The positive effects on consumption of the significant fall in the key interest rate from 19 percent to 14 percent since September 2021 are offset by high inflation. Further rate cuts can stimulate consumption in the short run through credit expansion. However, public debt is already high. In addition, interest rate cuts are seen as the driving force of inflation (IMF ,2022).

Turkey managed to significantly increase the value of its exports in 2021. In addition to the weak exchange rate, rising product prices were also effective in this. Imports also increased sharply, but to a lesser extent than exports. But rising import prices seem likely to change the situation: they rose by more than 80 percent in the first quarter of 2022 (TUİK, 2022).

On the other hand, in tensions between Russia and Ukraine, Turkey tries to be least affected by the crisis by having to follow an intense diplomatic policy due to its intense commercial and political relations with both countries. In this context, Turkey does not plan sanctions against Russia and continues its relations with both countries.

Table 1. Turkey: Macroeconomic Indicators

MAKRO GÖSTERGELER - MACRO INDICATORS	2019	2020	2021	2022	2022
REEL EKONOMİ - REAL ECONOMY					Tahmin/Ağustos (*)
GSYH (Milyar TL) - GDP (Billion TRY)	4.318	5.047	7.209	12.565	
GSYH (Milyar $) - GDP (Billion $)	761	717	803	763	
Kişi Başına GSYH - GDP Per Capita ($)	9.146	8.577	9.481	8.899	
GSYH Büyümesi - GDP Growth Rate (%)	0,9	1,8	11,0	3,7	
Gini Katsayısı (Referans Yılı) - Gini Coefficiant (Reference Year) (0 - 1,00)	0,410				
ENFLASYON VE FAİZ - INFLATION & INTEREST RATE (%)					Temmuz/July
Yİ - ÜFE (Yılsonu) - PPI (Yearend)	7,36	25,15	79,89	144,61	
TÜFE (Yılsonu) - CPI (Yearend)	11,84	14,60	36,08	79,60	
Gösterge Faiz (%)	11,71	14,89	22,78	20,31	Ağustos/August
İŞSİZLİK ORANI - UNEMPLOYMENT RATE (%)					Haziran/June
Arındırılmış İşsizlik Oranı (Yılsonu) - Seasonally Adj.Un. Rate (Yearend)	13,6	12,7	11,3	10,3	
Geniş İşsizlik Oranı (Yılsonu) - Inactive Unemployment Rate (Yearend)	19,7	28,4	22,6	20,4	
BÜTÇE (Milyar TL) - BUDGET (Billion TRY)					Temmuz/July
Bütçe Giderleri - Budget Expenditures	999,5	1.202,2	1.599,6	1.432,9	
Bütçe Gelirleri - Budget Revenues	875,8	1.029,5	1.407,4	1.462,4	
Bütçe Dengesi - Budget Balance	-123,7	-172,7	-192,2	29,5	
Bütçe Dengesi / GSYH - Budget Balance / GDP (%)	-2,9	-3,4	-2,7	0,2	
Faiz Dışı Bütçe Dengesi - Primary Budget Balance	-23,8	-38,7	-11,4	180,9	
Faiz Dışı Bütçe Dengesi / GSYH - Primary Budget Balance / GDP (%)	-0,6	-0,8	-0,2	1,4	
BORÇ GÖSTERGELERİ - DEBT INDICATORS					Haziran/June
Merkezi Yönetim İç Borç Stk (Milyar TL) - Cent.Gov.Dom.Debt Stk (Bil.TRY)	755,1	1.060,3	1.316,3	1.610,8	
Merkezi Yönetim Dış Borç Stk (Milyar $) - Cent.Gov.Foreign Debt Stk.(Bil. $)	96,4	102,3	109,7	109,0	
Merkezi YönetimTop.Borç Stk. (Milyar TL) - Cent. Gov.Tot. Debt Stk (Bil. TRY)	1.329,1	1.812,8	2.707,8	3.431,1	
Türkiye'nin Dış Borç Stoku - Turkey's Total Debt Stock (Billion $)	416,2	433,0	441,1	451,2	2022/I Ç.
ÖDEMELER DENGESİ (Milyar $) - BALANCE OF PAYMENTS (Billion $)					Mayıs/May
İhracat - Exports (FOB)	182,2	168,4	224,7	125,7	
İthalat - Imports (FOB)	199,0	206,3	253,9	166,7	
Dışticaret Dengesi - Trade Balance	-16,8	-37,9	-29,2	-41,0	
Cari İşlemler Dengesi - Current Account Balance	5,3	-36,8	-14,5	-32,7	
12 Aylık Cari Denge / GSYH - 12 Months Current Account Balance / GDP (%)	0,7	-5,1	-1,8	-4,3	
TCMB REZERVLERİ - CBRT RESERVES (Billion $)	106,3	93,2	111,1	108,7	Ağustos/August
Brüt Döviz Rezervleri - Gross FX Reserves	81,2	50,0	72,6	67,8	
Brüt Altın Rezervi - Gross Gold Reserves	25,1	43,2	38,5	40,9	
MEVDUAT & FON (Milyar TL) - DEPOSITS & FUNDS (Bil TRY)	2.566,9	3.455,0	5.303,5	7.587,5	Ağustos/August
Dolarizasyon Oranı - Currency Substitution Rate (%)	51,0	55,3	64,5	72,0	
KREDİ STOKU (Milyar TL) - CREDIT STOCK (Billion TRY)	2.654,8	3.575,9	4.899,6	6.515,9	Ağustos/August
Kredi / Mevduat Oranı - Credit / Deposit Rate (%)	103,4	103,5	92,4	85,9	
Kaynak: HMB, TCMB, TÜİK, BDDK					
Tahmin (*) TCMB Piyasa Katılımcıları Anketindeki sonuçlar kullanılarak tahmin edilmiştir.					

Source: Mahfi Eğilmez, Kendime Yazılar, ,https://www.mahfiegilmez.com/p/gostergeler.html/26.08.2022

Turkey's COVID 19 Report Card

According to official figures, as of August 2022, 16,671,848 COVID 19 cases were detected in Turkey and 100,400 people died as a result of COVID 19 (https://www.worldometers.info/coronavirus/country/turkey).

These figures show that approximately one quarter of the population in Turkey has encountered the COVID 19 virus. This situation also reflected on the economy at a similar rate, leading to a general stagnation or slowdown in the economy. On the other hand, both the loss of life caused by this virus and the burden of the virus on the health sector negatively affected the economy.

Various economic packages have been implemented by the government to limit the impact of the quarantines imposed on the Turkish economy due to COVID-19. Announced in March and September 2020, and most recently in March 2021, these economic packages included measures such as tax cuts and postponements, short-time work support, the establishment of committees to coordinate measures, and the provision of digital education opportunities.

Although Turkey is one of the few countries that achieved economic growth in 2020 Corona, the reflection of this growth on the citizens was incomplete. Of the 20 most important industrialized and developing countries (G20), only China achieved a slightly higher increase of 2.3 percent. It can be said that Turkey owes its relatively good performance primarily to a credit boom. Public banks almost doubled their loans in the second half of the year (European Commission (EC), (2020).

Table 2. Turkey's Socio-Economic Advantages and Disadvantages in terms of Macroeconomics

Strengths of Turkish Economy	**Weaknesses of Turkish Economy**
A consumer potential of more than 80 million	Recurrent economic crises
High rate of young population	Inadequate structural reforms
Being in a strategic position between Asia and Europe	Geopolitical risks
Membership in institutions such as NATO, OECD	Inadequate measures against earthquake possibilities
The provision on the constitutional protection of democracy and human rights	Inflation, interest rate, currency crises and other structural economic problems
Export and Tourism	Outsourcing dependency

Source: Authors own projections

However, in return for these loans, the exchange rate of the lira fell to new record levels last year, again due to the cheap monetary policy. This increased inflation as many goods had to be purchased from abroad. It can be said that this situation not only makes it difficult to establish economic balances, but also exacerbates economic fragility.

On the other hand, other services, including tourism, which is important for Turkey, contracted by 4.3 percent. While the construction sector, which has been the driving force of growth in recent years, has declined by 3.5 percent, it can be assumed that the Turkish economy will grow despite a restrictive monetary policy. However, the direct reflection of this on the citizens may be less due to the fact that the economic balances are established on other parameters instead of the citizens. As the government tried to close the public finance deficit by printing money, this situation increased inflation even more. As a result, the COVID 19 pandemic has led to a decrease in public resources and a decrease in private sector earnings in Turkey, as in every country. As a result, the government had to follow a mixed policy with short-term social and economic content to prevent the deepening of economic and social crises, instead of following a policy of increasing revenues and decreasing expenses.

Conclusion

As a result, the COVID 19 pandemic can be considered as the beginning of a new era on a global basis. The basis of this new era consists of an approach that includes change and transformation. Change and transformation, on the other hand, is based on the development of permanent and structural approaches on an intellectual basis in economy, politics and social life.

In this context, it highlights the importance of the principle of good management of the scarce resources, which form the basis of economic theories, against environmental disasters, epidemics, and most importantly, in the face of endless needs, of purely earnings-based neo-liberal economic policies.

The main result of considering the subject in terms of the Turkish economy is that Turkey is a country that has been facing some structural economic problems for a long time. Different approaches of governments have so far been far from solving these problems in a permanent way. Moreover, epidemics such as COVID 19 have the potential to further deepen these problems.

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CHAPTER 4

A Data Mining form of Artificial Intelligence Driven Analysis Approach in Understanding House Pricing and Several Factors as Its Leading Indicators in United Kingdom

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INTRODUCTION

The UK housing market remained buoyant in July, with price growth accelerating at an annual rate of 11%, according to the country's largest building community. The Nationwide Building Society said the average price of a home last month was £271,209, up 0.1% from June after allowing for seasonal effects and a 12th month increase in a row. Thus, the annual change increased from 10.7% to 11%. The housing market has managed to remain

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surprisingly strong and economically viable throughout the Covid 19 pandemic and despite the deepening cost of living crisis. A strong job market, backed by a constant real estate shortage in the market and a race for space as working from home hit an all-time low has played a role.

Accordingly, although there are preliminary signs of a slowdown in activity with the decrease in the number of mortgage approvals for home purchases during the pandemic in the country, it can be said that this has not yet affected the price increase. On the other hand, it can be said that demand continues to be supported by strong labor market conditions, with the unemployment rate hovering close to the lowest level in 50 years and job deficits close to record levels. At the same time, the limited housing stock in the market helped maintain the upward pressure on housing prices. In addition, low-income households, especially those living in rental housing, are disproportionately under cost of living pressure.

As many real estate agents remain employed, buyer motivation is changing. Where price growth was once fueled by a trusting market, today's market is fueled by people's desperation to find a home before interest rates rise higher and the cost of living crisis bites deeper. However, he expects the market to slow and inflation to hit double digits this fall as pressure on household budgets increases in the coming quarters. If macro interest rate hikes from the Bank of England also affect mortgage rates, it will cool the market.

Mortgage deals by first-time buyers have remained resilient and have increased the deposit barrier and, coupled with higher interest rates, boosted mortgage repayments, even though home price growth is now 5% above pre-pandemic levels, well above wages. Cash transactions account for just over a third of all transactions, partly due to an aging population with more people fully owning homes. But investment properties such as vacation homes or rental apartments are also an important part of the cash market.

Purchases for mortgages and sub-leases also remain above pre-pandemic levels. Especially if they view the property as a hedge against inflation, which may encourage landlords to enter the market, which will likely be compounded by the fact that rent demand remains strong, with upward pressure on rents. More and more people are moving from large, expensive cities like London to rural areas and working from home due to the pandemic. It is observed that housing activity outside the city centers has increased. The pandemic has also increased the demand for a bigger house, a bigger garden, as people have increased their leisure time and the need to do their work at home. This has become a global trend and housing prices are increasing despite the economic contraction.

THEORETICAL AND CONCEPTUAL FRAMEWORK

The housing, home or homeownership is a living space used as a permanent or semi-permanent home for an individual, family, household or several families. It is usually a house, apartment or other building, or alternatively a mobile home, boathouse, dormitory or other portable shelter. The constitutional law principle regarding the right to privacy in Article 12 of the Universal Declaration of Human Rights is the inviolability of the individual's home as a place of residence and refuge.

Residences often offer spaces and facilities for sleeping, preparing food, eating and hygiene. Larger groups may live in a nursing home, orphanage, convent, or similar institution. The farmhouse also includes lodging land and facilities for pets. Where safer housing is lacking, people can live in informal and sometimes illegal huts found in slums and shanty towns. More generally, a residence can be thought of as a geographic area such as a town, village, suburb, city or country.

The annual housing price change graph shows the nominal price change. You can look at the real housing price change graph for the inflation-adjusted version. On the other hand, setting the right price for buying or selling a house is not a surefire method.

There is a uniqueness in every country, even every flat price, and the market price or recommended selling price depends on supply and demand at the time of valuation. The actual selling price obtained then depends on the bargaining skills, the market situation, the housing supply and the buyer**.**

In this study, we focused on the UK housing market and its pricing. British house prices are climbing as fast as they have since 2007. Due to the trend towards working from home, many Britons are investing in larger houses. The market is competitive. But that's just one factor driving prices up. UK house prices rose at their fastest rate since July 2007 at the end of 2021. December was up 9.8 percent year-on-year, according to Friday's monthly figures from mortgage lender Halifax. A number of factors have encouraged people in the UK to buy a new home, including greater demand for home office space, a lack of alternative consumption options and a tax break on purchases that expired at the end of September.

Despite some post-Brexit economic turmoil in the UK, the UK property market continues to perform brilliantly. In September, the strongest price increase in 14 years was measured at 7.4 percent compared to the same month last year. The average house is now more expensive than ever according to Halifax, which calculates the home price index.

On average across all regions, a typical home, which tends to be small on the island, now costs £267,500 (€310,000), according to the Halifax Index. Prices have risen by £28,000 since the end of the first corona lockdown in the summer of 2020. The national average hides huge differences. A cottage or apartment in London costs twice as much as in the rest of the country. Prices well over a million pounds are the norm in better neighborhoods. Forecasters did not expect the strong upturn in the real estate market in the year and a half after Brexit and especially during the Corona period (The Daily mirror, 2022).

Several factors have boosted prices during the Corona period. On the one hand, homebuyers benefit from the low interest rates and cheap mortgage loans. On the other hand, the state has supported the labor market. Many Britons have wanted more living space since the corona lockdowns, the demand for larger houses has increased. At times there was talk of fleeing to the countryside. There was also another special pandemic effect. During the lockdowns, the middle and upper classes saved more money than usual, and many now want to spend this money.

Tax policy was also an important factor. The real estate and construction industry is important to the island's economy. Most Britons are homeowners, more than two thirds of them own their own home, this is the bulk of their wealth. The development of prices is therefore also a political issue. A slump was predicted by pessimists for Brexit, but this did not happen. Only in London have prices dropped temporarily, especially in the top segment. Average national price increases slowed to around 2 percent in 2018 and 2019, before picking up sharply in 2020 and 2021 (OECD, 2021).

Burrell finds it difficult to say how much the Brexit, which took effect on January 1, 2020, really affected the real estate market. Some EU citizens have left the country, particularly from Greater London. There was talk of several hundred thousand EU foreigners moving away. Less immigration to Britain is expected in the future. High rents in London have fallen somewhat.

In the top segment of absolute luxury real estate, however, there is currently no dent; on the contrary, prices are climbing further record highs. Last spring, a Chinese billionaire paid more than £210 million (€245 million) for a seven-story, 45-room swanky period building in upscale Knightsbridge. Super-rich Asians, Russians and Arabs are buying luxury apartments and second homes in the British metropolis. According to estate agent Beactive, there are currently 317 properties on the market with asking prices in excess of £10m. It is said that the global elite is currently increasingly buying in London. At the lower end of the

market, on the other hand, complaints are piling up that rising prices are making it difficult for first-time buyers to afford a small home. Next year, economists expect interest rates to rise. That could dampen the market (Eurostat, 2021).

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

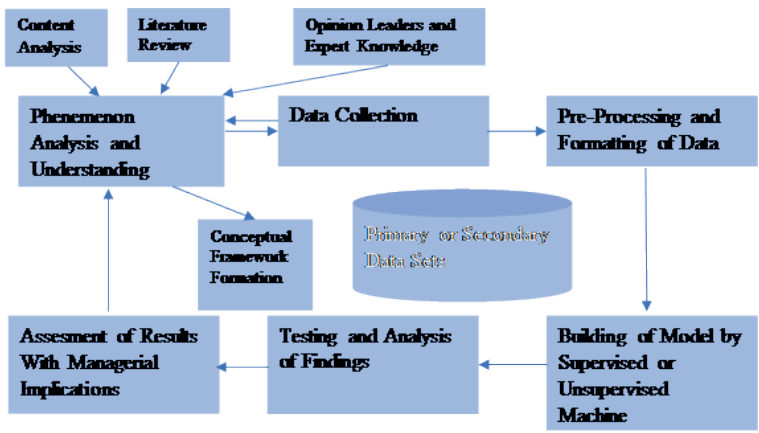

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment

clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

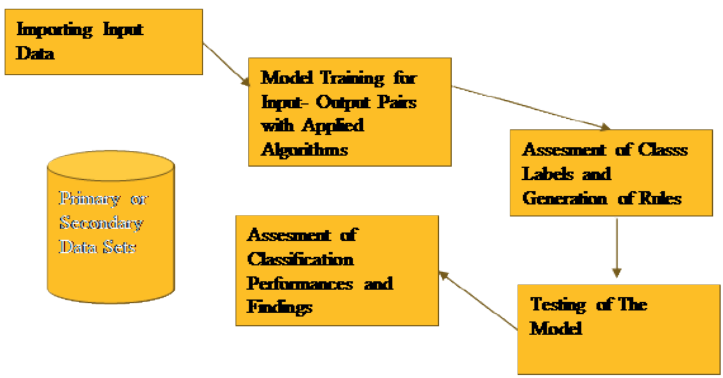

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

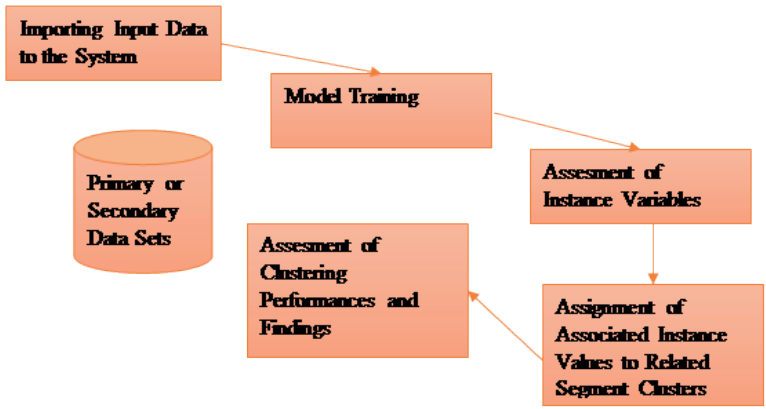

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

DATA GATHERING AND PROCESSING

For the data set and sampling secondary data has been used from US Department of Labor. In model training and testing, 10 fold cross validation method has been applied. In this way a solution for the research question "What are the leading indicators of median house price and number of properties sold" Some of the main hypothesis tested as follow. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Table 1a. Main Hypothesis of the research

h1: Population density has influence on median house price	Accepted
h2: % not born in uk has influence on median house price	Accepted
h3: Rate of new registrations of migrant workers has influence on median house price	Accepted
h4: Employment rate (16-64) has influence on median house price	Accepted
h5: In employment Rate (16-64) has influence on median house price	Accepted
h6: Age mean has influence on median house price	Accepted
h7: Employment (16-64) rate has influence on Number of properties sold	Accepted

Table 1b. List of Variables Used in Analysis

Variable Name	Variable
Population density (persons per sq km)	Nominal (Categorical)
% Not Born in UK	Nominal (Categorical)
Rate of new registrations of migrant workers	Nominal (Categorical)
Employment rate (16-64)	Nominal (Categorical)
In employment (16-64)	Nominal (Categorical)
Age Mean	Nominal (Categorical)
Median House Price (£)	Nominal (Categorical)
Number of properties sold	Nominal (Categorical)

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context,

the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using several algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis 10 fold cross validation technique has been used for model training and testing. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. The maing findings and performances of the algorithms were given in the Table 3.

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	**Key Performance Indicators**			
	RMSE	**Precision**	**% Correctly Classified**	**% Misclassified**
J48	0.05	N/A	6.06	93.93
Naive Bayes	0.05	N/A	4.54	95.45
Multilayer Perceptron	0.05	N/A	5.30	94.69
Random Tree	0.05	N/A	4.69	95.30

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

B

Table 3. Predicted and Discovered Rules of Data Mining Algorithms

I	If population desnsity is low then median house price in £ is High whereas if population density is high then median house price in £ is comparably low
II	If % Not Born in UK is low then it indicates higher median house prices whereas If % Not Born in UK is high then it indicates lower median house prices
III	If Rate of new registrations of migrant workers is high then it indicates a higher median house price value in GBP (£)
IV	If Rate of new registrations of migrant workers is low then it indicates a lower median house price value in GBP (£)
V	If Employment rate (16-64) is high than it is associated with higher median house price value in GBP (£)
VI	If Employment rate (16-64) is low value than it is associated with lower median house price value in GBP (£)
VII	If age mean is low value than it is associated with lower median house price value in GBP (£) whereas If age mean has a higher value than it is associated with higher median house price value in GBP (£)
VIII	If In employment (16-64) rate is high then Number of properties sold is high whereas if If In employment (16-64) rate is low then Number of properties sold is low

If population desnsity is low then median house price in £ is High whereas if population density is high then median house price in £ is comparably low. If % Not Born in UK is low then it indicates higher median house prices whereas If % Not Born in UK is high then it indicates lower median house prices. If Rate of new registrations of migrant workers is high then it indicates a higher median house price value in GBP (£). If Rate of new registrations of migrant workers is low then it indicates a lower median house price value in GBP (£). If Employment rate (16-64) is high than it is associated with higher median house price value in GBP (£). If Employment rate (16-64) is low value than

it is associated with lower median house price value in GBP (£). If age mean is low value than it is associated with lower median house price value in GBP (£) whereas If age mean has a higher value than it is associated with higher median house price value in GBP (£). If In employment (16-64) rate is high then Number of properties sold is high whereas if If In employment (16-64) rate is low then Number of properties sold is low. Neural network view of the research model can be seen in figure 7.

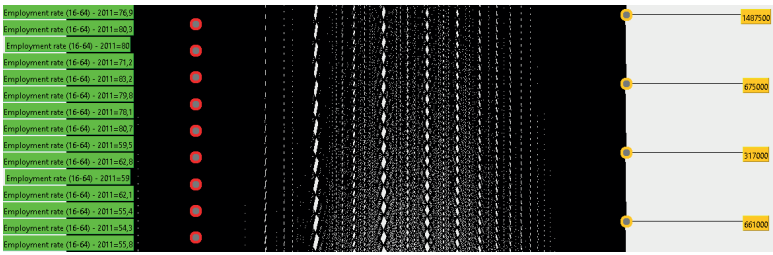

Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron: Median House Price (£) is the Dependent Variable)

In the analysis performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

In the applied analysis, the same input load was tested with the same parameters using several algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis 10 fold cross validation technique has been used for model training and testing. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used.

Data Mining driven analysis method employed revealed the following findings. If population desnsity is low then median house price in £ is High whereas if population density is high then median house price in £ is comparably low. If % Not Born in UK is low then it indicates higher median house prices whereas If % Not Born in UK is high then it indicates lower median house prices. If Rate of new registrations of migrant workers is high then it indicates a higher median house price value in GBP (£). If Rate of new registrations of migrant workers is low then it indicates a lower median house price value in GBP (£). If Employment rate (16-64) is high than it is associated with higher median house price value in GBP (£). If Employment rate (16-64) is low value than it is associated with lower median house price value in GBP (£). If age mean is low value than it is associated with lower median house price value in GBP (£) whereas If age mean has a higher value than it is associated with higher median house price value in GBP (£). If In employment (16-64) rate is high then Number of properties sold is high whereas if If In employment (16-64) rate is low then Number of properties sold is low. Neural network view of the research model can be seen in figure 7.

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CHAPTER 5

Analysing Antecedents of Unemployment Rate with K-Means Algorithm of Artificial Intelligence and Data Mining in USA

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INTRODUCTION

The unemployed are people of working age who are unemployed, fit for the labor market and actively seeking employment. Consistent application of this definition allows for estimates of unemployment rates that are more internationally comparable than estimates based on national unemployment definitions. This indicator shows the percentage of the unemployed in the workforce and is seasonally adjusted. The labor force is defined as the total number of unemployed and employed. Data are based on Labor Force Surveys (LFS). Monthly unemployment figures for European Union Member States for which monthly LFS data are not available are estimated by Eurostat.

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Theoretical and Conceptual Framework

The unemployment rate describes the percentage of registered unemployed in the working population in the USA. If the number increases, then this is an indication of a deterioration in the labor market and thus falling consumer spending. If, on the other hand, it falls, this is considered an indication of a recovering labor market and thus increasing consumer spending. When the unemployment rate is higher than expected, it usually causes the US Dollar (USD) to fall in the currency markets. Conversely, the US dollar (USD) will appreciate when analyst estimates are better than expected. In this respect, this situation has been re-evaluated from an algorithmic point of view in this study (Jia LuoJunfeng, 2016).

On the other hand, from a chronological point of view, the change in the unemployment rate in the USA shows a development within the framework of certain turning points. In fact, after an economic crisis in the early 1920s, the American economy boomed during and unemployment fell to a relatively low level. That changed after "Black Friday" in October 1929, which triggered the devastating global economic crisis. At the peak of the "Great Depression" in 1933, 24.9 percent of the labor force was unemployed, almost a quarter. The economic slump was only really overcome when the USA entered the war on the Allied side in 1941/42 (Miltiades N. Georgiou, 2021).

After the Second World War, fluctuations in the unemployment rate remained relatively small and remained at around 5.2 percent on average until 1980. The lowest value was reported in 1953 at 2.9 percent, the highest value was reached in 1975: As a result of the first oil crisis and the Vietnam War, there was so-called staggation and an unemployment rate of 8.5 percent, (John Kaufman and others, 2020).

The development of the unemployment rate in the USA since 1980 can be found here. Unemployment was particularly high at just under ten percent in 1982 as a result of the second oil crisis and in 2010 as a result of the global financial crisis. According to

the IMF, the unemployment rate in 2018 was less than 3.9 percent (Jinhua Li, (2013).

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis,

data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

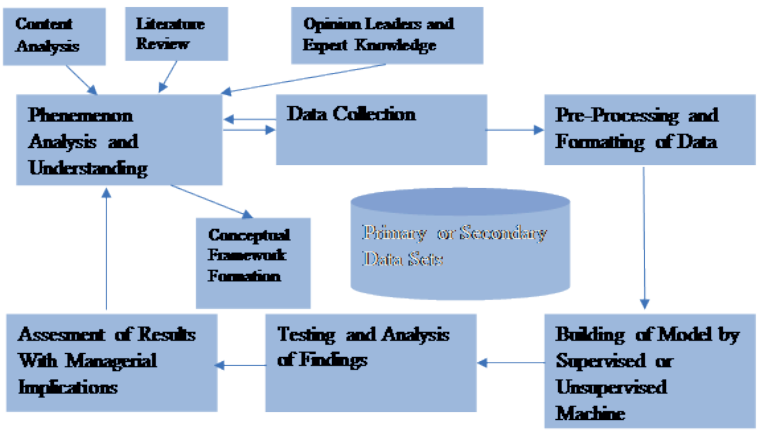

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class

labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

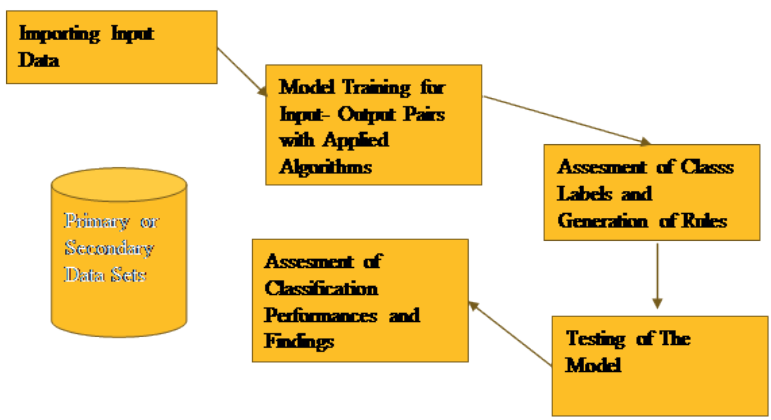

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

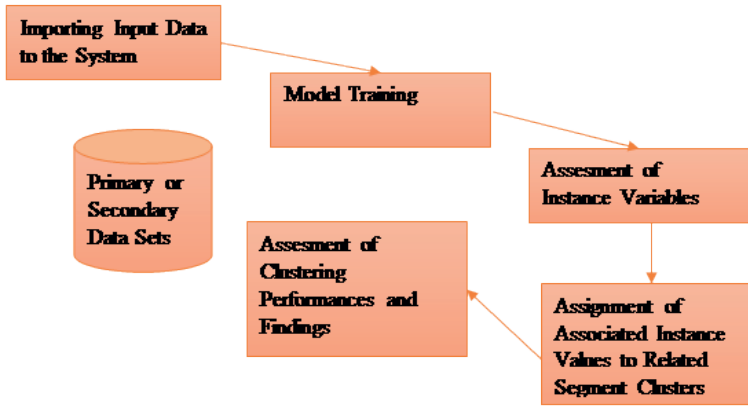

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

Figure 4 Overview of Women and Men Unemployment Rates According to Race

DATA GATHERING AND PROCESSING

For the data set and sampling secondary data has been used published publicly composed of following variables. In the analysis following research question has been analyzed and investigated "Do different Genders and Races have different unemployment rates? ". Initially 66 percent of the data has been used for training purposes and model building whereas remaining part has been used for testing.

Table 1a. Main Hypothesis of the research

h1: Gender has influence on Unemployment rate	**Accepted**
h2: Race has influence on Unemployment rate	**Accepted**

Table 1b. List of Variables Used in Analysis

Variable	**Variable Type**
Race	Nominal (Categorical)
Gender	Nominal (Categorical)
Unemployment Rate	Numerical

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using several algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the General Fertility Rate. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules calculated are shown in Tables 2. The maing findings and performances of the algorithms were given in the Table 3.

Figure 5. Unsupervised Machine Learning Outputs Generated by K-means

```
Initial starting points (random):

Cluster 0: '9,6','7,8'
Cluster 1: '7,6',7
Cluster 2: '8,3','7,8'
Cluster 3: '10,9','12,1'
Cluster 4: '11,4','9,7'

Missing values globally replaced with mean/mode

Final cluster centroids:
                        Cluster#
Attribute    Full Data          0          1          2          3          4
                (5.0)      (1.0)      (1.0)      (1.0)      (1.0)      (1.0)
==========================================================================
Women             8,3        9,6        7,6        8,3       10,9       11,4
Men               7,8        7,8          7        7,8       12,1        9,7
```

Table 2. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

Table 3. Predicted and Discovered Rules of Data Mining Algorithms

I	According to unsupervised machine learning results Asian cluster has the following unemployment rates for women and men respectively (9.6-7.8)
II	White cluster has the following unemployment rates for women and men respectively (7.6-7)
III	Black cluster has the following unemployment rates for women and men respectively (10.9-12.1)
IV	Black cluster has the following unemployment rates for women and men respectively (11.4-9.7)
V	Total cluster has the following unemployment rates for women and men respectively (8.3-7.8)

Cluster analysis revealed that low employment rates lead to low fertility rates in women whereas higher employment rates are associated with more female fertility rates Low population rates

lead to higher fertility rates in women whereas lower population rates are associated with more female fertility rates. Locations with higher levels of crime are associated with lower levels of fertility whereas locations with lower levels of crime rates are associated with higher levels of general fertility. In post young category there exists both low and moderate fertility rates whereas in young category there exists low, moderate and high fertility rates togetherNeural network view of the research model can be seen in figure 7.

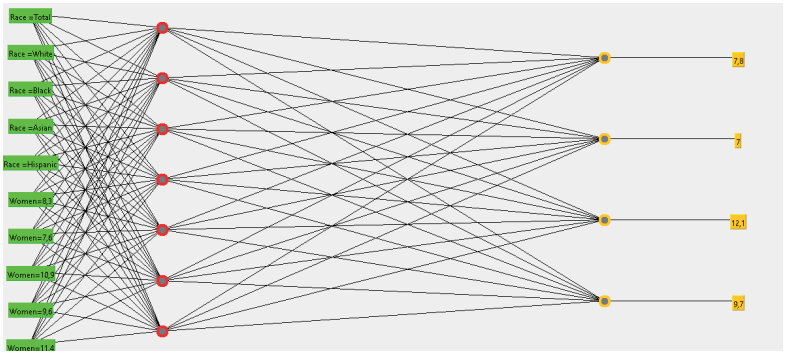

Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron)

In the analysis performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with

approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

In the analysis supervised and unsupervised forms of machine learning has been used with the aim of providing exploratory and confirmatory understanding to business leaders, political leaders and society at large. Initially 66 percent of the data has been used for training purposes and model building whereas remaining part has been used for testing.

For the data set and sampling secondary data has been used published publicly composed of gender, race and unemployment rate variables. In the analysis following research question has been analyzed and investigated "Do different Genders and Races have different unemployment rates? ". Following hypothesis have been tested. h1: Gender has influence on Unemployment rate. h2: Race has influence on Unemployment rate.

According to unsupervised machine learning results Asian cluster has the following unemployment rates for women and men respectively (9.6-7.8). White cluster has the following unemployment rates for women and men respectively (7.6-7). Black cluster has the following unemployment rates for women and men respectively (10.9-12.1). Black cluster has the following unemployment rates for women and men respectively (11.4-9.7). Total cluster has the following unemployment rates for women and men respectively (8.3-7.8)

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CHAPTER 6

Applying Machine Learning, Data Mining and Artificial Intelligence in The Analysis of Employment Rate as a Leading Indicator of Female and Male Life Expectancies in UK

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INTRODUCTION

The corona pandemic has a tremendous impact on all industries, especially workers. In this study, we want to show how the employees are affected by the crisis according to the situation of women or men, based on the example of England. In this respect, the use of artificial intelligence algorithms in the evaluation of macroeconomic data, which varies sharply during the pandemic period, will make an important contribution to obtaining more

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meaningful results. In this context, it will be a very effective approach to apply especially to data mining, machine learning and artificial intelligence algorithms in the analysis of macroeconomic data.

This study is based on a re-evaluation of our previous studies and focusing on the example of England. Our main goal here is that our previous studies are independent from each other, as well as consisting of thesis, data and basic approaches that support each other.

The United Kingdom includes England, Wales, Scotland and Northern Ireland. The country left the European Union on February 1, 2020 (Brexit). The reason why we focus on England in this study is important in terms of both being a European country and being in the EU orbit and carrying out socioeconomic policies independent of the EU. In addition, in England, which has an economic and social structure according to the contemporary values of the West, it is important to measure the equality of men and women, the dimensions of this equality in working life, and the impact on people's quality of life and life expectancy. The average age (median age) in Great Britain in 2021 is around 39.6 years. According to forecasts, the average age of the British population will increase to around 44.9 years by 2050. This statistic shows the average age (median age in years) of the population in Great Britain from 1950 to 2021 and projections up to the year 2050. This is the median age, i.e. half of the population is older and the other half is younger than the given value. Evaluation of employment indicators in terms of equality between women and men is important in terms of income level and quality of life in macroeconomic terms.

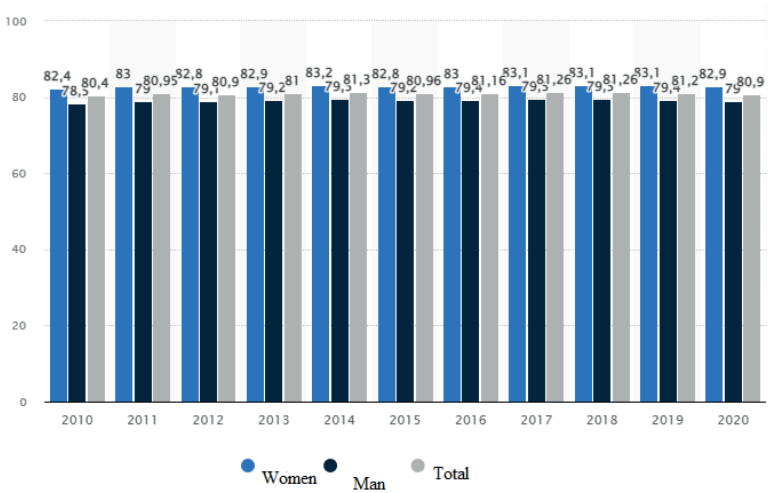
Theoretical and Conceptual Framework

The population of Great Britain continues to grow and reached approximately 67.5 million people in 2021. In 2022 the total population to around 67.8 million people. This means that the

trend of recent years remains unbroken and the British population as a whole is increasing by around 0.4 to 0.5 million people every year. It is questionable whether this trend will continue in the future - Brexit will certainly have an impact on population growth. For the year 2025, the total population of Great Britain has so far been forecast by the IMF at around 68.7 million inhabitants (IMF, 2020)

In 2020, the average life expectancy at birth in the UK was around 80.9 years, with life expectancy of around 82.9 years for women and around 79 years for men. The statistic shows the development of life expectancy at birth in Great Britain by gender from 2010 to 2020 (oecd, 2021).

Graph: United Kingdom: Life expectancy at birth by gender from 2010 to 2020(years)



Source: Eurostat 2021 / https://ec.europa.eu/eurostat

Compared to the EU countries, Great Britain performs well with a relatively high fertility rate, but the rate is well below the replacement level. Without a positive migration balance in Great Britain, the total population of the country would decrease

continuously. The declared promise of the Brexiteers, on the other hand, is to drastically reduce net migration from the EU states. In 2019, over 3.6 million EU citizens lived in the UK.

In 2021, the gross domestic product in Great Britain was estimated at around 3.19 trillion US dollars. UK GDP is forecast to be around $3.38 trillion in 2022, which could set a new high. The statistic shows the gross domestic product (GDP) of Great Britain from 1980 to 2020 with forecasts up to the year 2027 (Eurostat 2021).

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political

science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

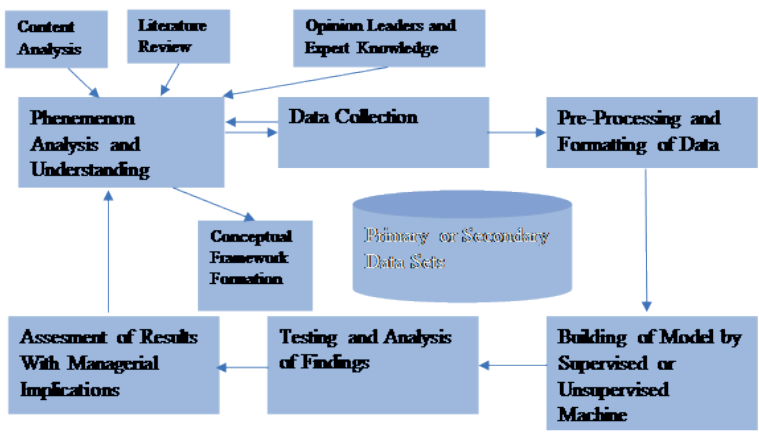


Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

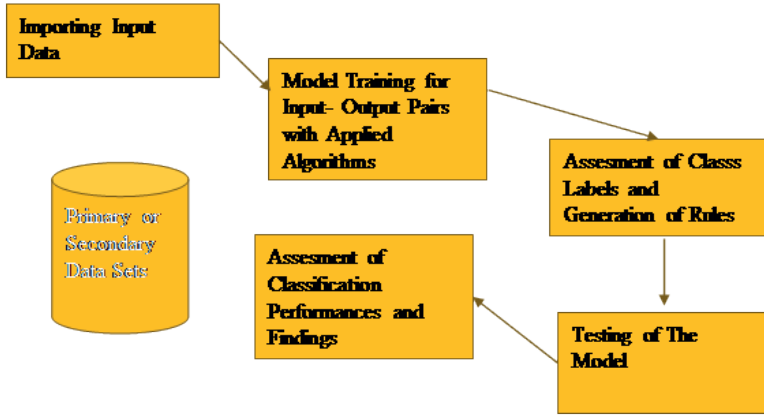


Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

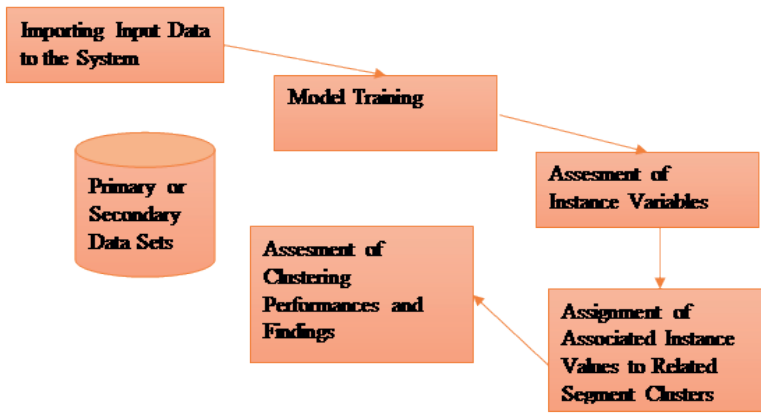


Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

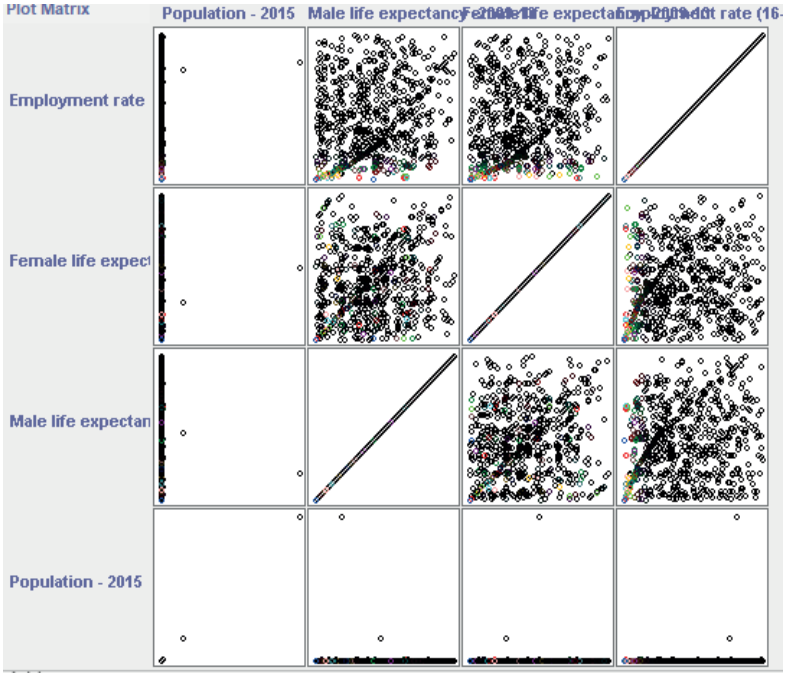


Figure 4 Overview of Population, Female Life Expectancy, Male Life Expectency, Employment Rate

DATA GATHERING AND PROCESSING

For the data set and sampling secondary data has been used from US Department of Labor. In model training and testing, 10 fold cross validation method has been applied. In this way a solution for the research question "What are the leading indicators of median house price and number of properties sold" Some of the main hypothesis tested as follow. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Table 1a. Main Hypothesis of the research

h1: Population Rate has influence on Male Life Expectancy	**Accepted**
h2: Population Rate has influence on Female Life Expectancy	**Accepted**
h3: Population Rate has influence on Employment Rate	**Accepted**
h4: Employment Rate has influence on Female Life Expectancy	**Accepted**
h5: Employment Rate has influence on Male Life Expectancy	**Accepted**

Table 1b. List of Variables Used in Analysis

Variable Name	**Variable**
Population Rate	Nominal (Categorical)
Employment Rate	Nominal (Categorical)
Male Life Expectancy	Nominal (Categorical)
Female Life Expectancy	Nominal (Categorical)

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and

machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using several algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis 10 fold cross validation technique has been used for model training and testing. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used Multilayer Perceptron, Decision Table , JRip and Naïve Bayes can be considered as the top performing algorithms for the same input load whereas Random Tree had a slightly lower classification rate compared to the othe methods. For the assessment RMSE, Precision, Correct classification rate and incorrect classification rate have been used for the key performance indicators in the performance assessment (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. The main findings and performances of the algorithms were given in the Table 3.

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	Key Performance Indicators			
	RMSE	Precision	% Correctly Classified	% Misclassified
Random Tree	**0.35**	**N/A**	**76.06**	**23.93**
Multilayer Perceptron	0.35	N/A	76.21	23.78
Decision Table	0.35	N/A	76.21	23.78
JRip	0.35	N/A	76.21	23.78
Naive Bayes	0.35	N/A	76.21	23.78

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

Table 3. Predicted and Discovered Rules of Data Mining Algorithms

I	**Cluster analysis revealed that high employment rate is associated with higher female and male life expectancy**
II	Cluster analysis revealed that low employment rate is associated with lower female and male life expectancy
III	Higher male life expectancy is associated with higher female life expectancy
IV	If population is high then it leads to a higher employment rate whereas if population is low then it leads to a lower employment rate
V	If employment rate is high then it leads to a high population rate whereas if employment rate is low then it leads to a low population rate
VI	Male life expectancy is lower compared to female life expectancy for all cluster values
VII	Higher population rate(1616718.75), higher female life expectancy (84.1), higher male life expectancy (79.7) and higher employment rate (75.1) is in one cluster whereas lower population rate (25554.6774), lower female life expectancy (84), lower male life expectancy(81.8) and lower employment rate is in other cluster (70.4)
VIII	If male life expectancy is high, population is high density then employment rate is low
IX	If male life expectancy is short, population status is under population and female life expectancy is middle then employment status is low

Cluster analysis revealed that high employment rate is associated with higher female and male life expectancy. Cluster analysis revealed that low employment rate is associated with lower female and male life expectancy. Higher male life expectancy is associated with higher female life expectancy. If population is high then it leads to a higher employment rate whereas if population is low then it leads to a lower employment rate. If employment rate is high then it leads to a high population rate whereas if employment rate is low then it leads to a low population rate. Male life expectancy is lower compared to female life expectancy for all cluster values. Higher population rate(1616718.75), higher female life expectancy (84.1), higher male life expectancy (79.7) and higher employment rate (75.1) is in one cluster whereas lower population rate (25554.6774), lower female life expectancy (84), lower male life expectancy(81.8) and lower employment rate is in other cluster (70.4). If male life expectancy is high, population is high density then employment rate is low. If male life expectancy is short, population status is under population and female life expectancy is middle then employment status is low. Neural network view of the research models employed can be seen in Figure 7, Figure 8 and Figure 9 respectively.

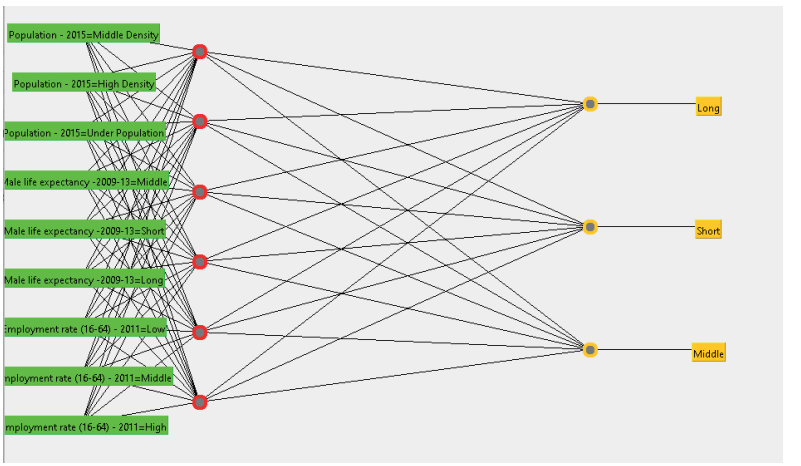


Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron: Female Life Expectancy is The Dependent Variable)

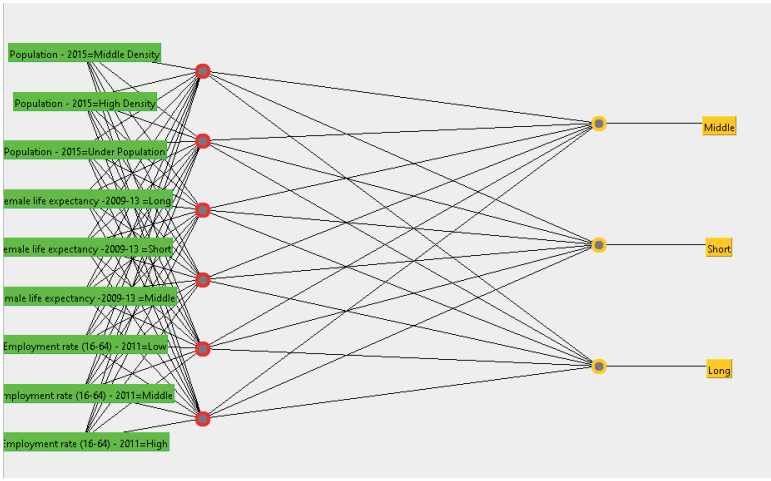


Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron: Male Life Expectancy is The Dependent Variable)

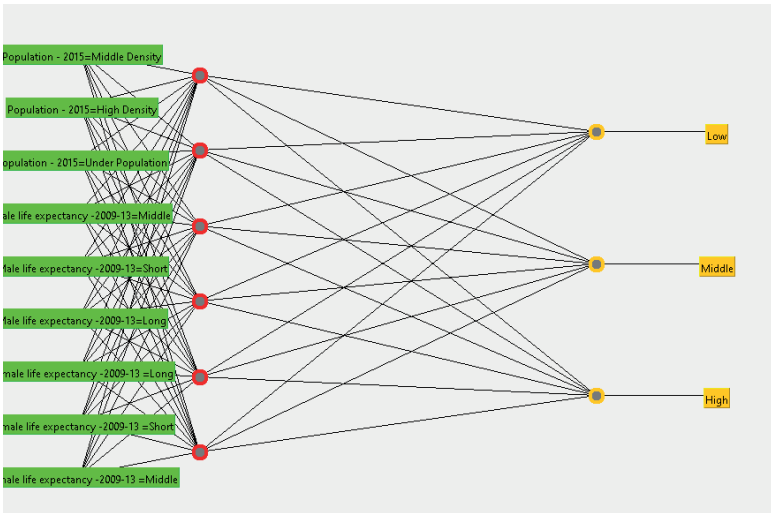


Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron: Employment Rate is The Dependent Variable)

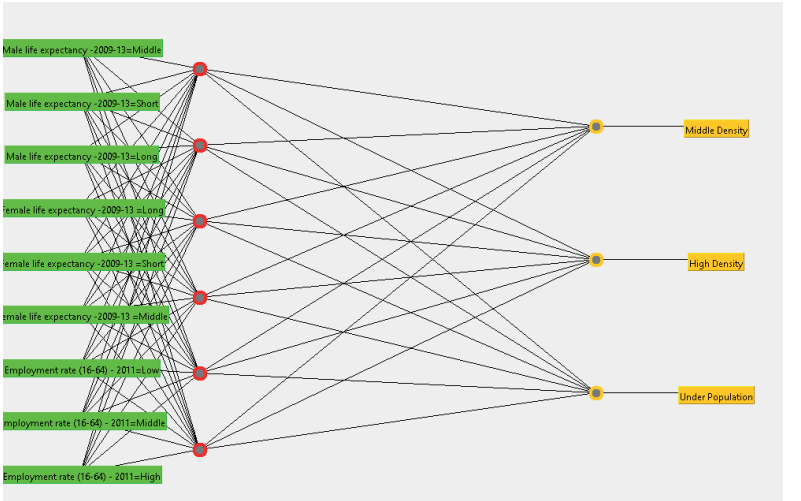


Figure 7. A Neural Network Cross Sectional View of the Generated Model (Multilayer Perceptron: Population Rate is The Dependent Variable)

In the analysis performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and

unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Cluster analysis revealed that high employment rate is associated with higher female and male life expectancy. Cluster analysis revealed that low employment rate is associated with lower female and male life expectancy. Higher male life expectancy is associated with higher female life expectancy. If population is high then it leads to a higher employment rate whereas if population is low then it leads to a lower employment rate. If employment rate is high then it leads to a high population rate whereas if employment rate is low then it leads to a low population rate. Male life expectancy is lower compared to female life expectancy for all cluster values. Higher population rate(1616718.75), higher female life expectancy (84.1), higher male life expectancy (79.7) and higher employment rate (75.1) is in one cluster whereas lower population rate (25554.6774), lower female life expectancy (84), lower male life expectancy(81.8) and lower employment rate is in other cluster (70.4). If male life expectancy is high, population is high density then employment rate is low. If male life expectancy is short, population status is under population and female life expectancy is middle then employment status is low.

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CHAPTER 7

Analysing Influence of Race, Ethnicity and Gender as Leading Indicators of Unemployment Rates with Machine Learning and Data Mining Techniques in the Country of USA

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INTRODUCTION

"It takes 20 years to build a reputation and five minutes to ruin it. If you think about that, you'll do things differently". Warren Buffett. We are living in an era where the technology is improving so fast. At this point, innovation is very important. Branding is very important. Digital transformation is very important. For sustainability, what we need is Intellectual Property Rights (IPR). We need to feed IPR with Brand Protection (BP), digital support, and legal support. In other words, "DigitaLegal" (Çiçek, 2020).

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Within today's world of money and business, reputation is the most precious strategic wealth, the stigma that annihilates institution's efforts to improve its output with of course quality. A strong and sound reputation, with successful brand, is a great and unique selling proposition, a big competitive advantage. Wide range of products, global presence, and leadership in technology serve for success in DigitaLegal. Hereby, digital transformation is an asset. Reputation expands to include brand, awareness, ability to compete, and trust in any product or service within the brand. Building a strong reputation for any entity starts from the inside of this entity. First through concentration on digital and legal issues. Raising the spirit of stakeholders with effective communication is very important. For success, we need 4S; Strategy + Structure + Stakeholders + Sympathy of God (Çiçek, 2020).

There is no strong relation between corporate reputation and spending on all corporate communication programs and activities, but some relations between reputation and specific categories of spending (Hutton, Goodman, and Alexander, 2001).

Morgan and Hunt (1994) considered trust as a central factor of successful marketing that leads to increase in efficiency, productivity, and effectiveness of organizations; effective service marketing depends on the management of trust that the customers always buy service before experiencing it.

Article makes important inroads into the understanding of racial inequality in the labor market and the effects of unemployment. Article contributes theoretical insights that assist in conceptualizing how Race, Ethnicity and Gender act together as leading indicators of Unemployment Rates with Machine Learning and Data Mining Techniques in the country of USA. Together, theoretical and empirical insights expand conceptions of how race and unemployment jointly shape the labor market outcomes of workers with implications for understanding the complex ways that social categories combine in the production of economic welfare.

The role of gender in the association between unemployment and mental health has been discussed in classical literature (Jahoda 1982) and has been received with considerable interest in modern research; however, results to date have tended to be inconclusive.

Research indicates that individuals of different races, ethnic backgrounds, and class origins differ in their unemployment rates. We know less, however, about whether these differences result from the differing groups' unequal hazards of entering or exiting unemployment and even less about how economic fluctuations moderate the ethnoracial and class-origin gaps in the long-term risks of transitioning into and out of unemployment.

As emphasized by Ewing et al. (2005), it is important to analyse the unemployment rates disaggregated by both race and gender so as to help policy makers evaluate and compare the effects of monetary and fiscal policies on the unemployment rates across men and women and across Whites and Blacks.

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a

divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

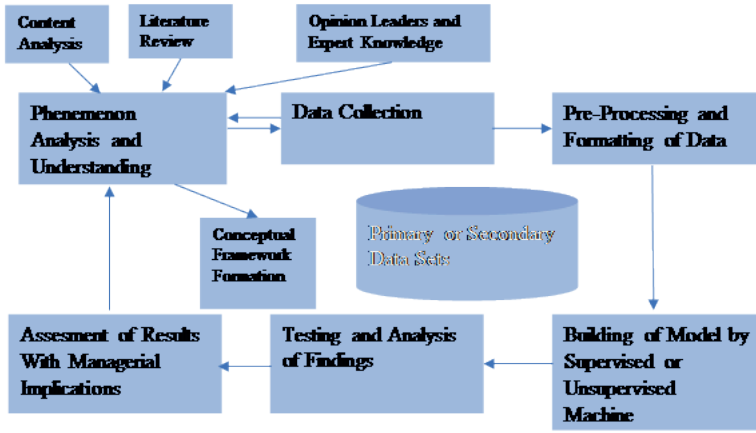

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with

the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

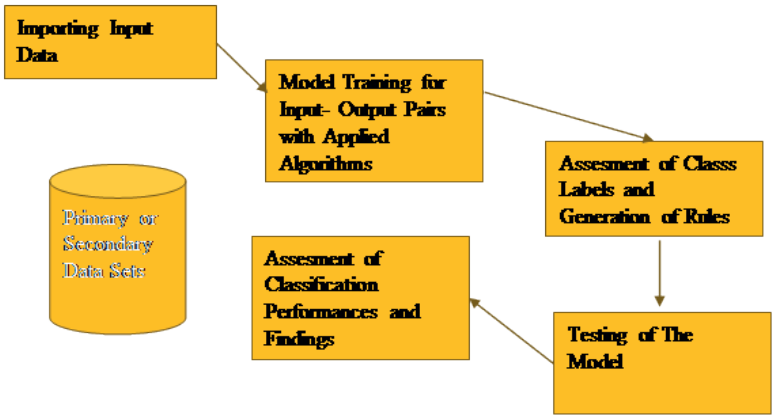

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

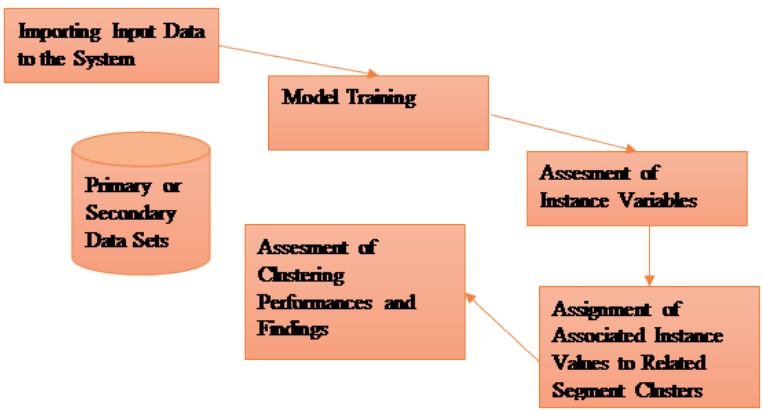

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

DATA GATHERING AND PROCESSING

For the data set and sampling secondary data has been used from US Department of Labor. In model training and testing, 66 percent of the data has been used for training of the model purposes whereas remaining part of the data has been used for model testing purposes. In this way a solution for the research questions "What are the relations between women unemployment rate, men unemployment rate and Several Races in USA" Some of the main hypothesis tested has been as follow. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Table 1a. Main Hypothesis of the research

h1: Race has influence on unemployment rates of women	Accepted
h2: Race has influence on unemployment rates of men	Accepted
h3: Unemployment rate differs according to different races	Accepted

Table 1b. List of Variables Used in Analysis

Variable Name	**Variable**
Unemployment Rate of Men	Nominal (Categorical)
Unemployment Rate of Women	Nominal (Categorical)
Race Indicator	Nominal (Categorical)

FINDINGS

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant

rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using multilayer perceptron, Bayesian networks, random forrest algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis, 66 percent of the data was used to train the model as the training set, and then the model is tested with a test dataset composed of the same variables with the remaining part of the data as the test set. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification,

and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. The maing findings and performances of the algorithms were given in the Table 3.

Figure 4. Employment Rate According to Gender and Race

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	Key Performance Indicators			
	RMSE	Precision	% Correctly Classified	% Misclassified
J48	0.5	N/A	50	50
Naive Bayes	0.4	N/A	50	50
Multilayer Perceptron	0.5	N/A	0	100
Hoeffding Tree	0.4	0.50	50	50

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

B

Table 3. Predicted and Discovered Rules of Data Mining Algorithms

I	In the cluster analysis it was revealed that Hispanic women has the highest unemployment rate which is followed by black men. Lowest unemployment rate is white mens, next lowest unemployment rate belongs to white women.
II	Total women unemployment rate is higher than total men unemployment rate.
III	If Race and Hispanic ethnicity is equal to White then unemployment rate is 7
IV	If Race and Hispanic ethnicity is equal to Black then unemployment rate is 12.1
V	If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 7.8
VI	If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 9.7

Analysis results revealed that Hispanic women has the highest unemployment rate which is followed by black men. Lowest unemployment rate is white mens, next lowest unemployment rate belongs to white women. Total women unemployment rate is higher than total men unemployment rate. If Race and Hispanic ethnicity is equal to White then unemployment rate is 7. If Race and Hispanic ethnicity is equal to Black then unemployment rate is 12.1. If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 7.8. If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 9.7. Neural network view of the research model can be seen in figure 7.

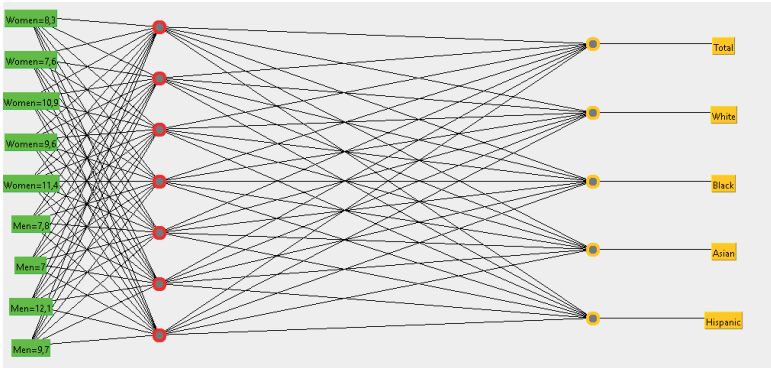

Figure 7. A Neural Network View of the Generated Model (Multilayer Perceptron: Crime Rate is the Dependent Variable)

In the conducted analysis, the Multilayer perceptron method has been the best performing algorithm among other applied supervised machine learning approaches. This technique creative generated a correct classification rate of 75.39 percent with an RMSE of 0.42 and a misclassification rate of 24.60. Performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs.

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and Hispanic ethnicity is equal to Black then unemployment rate is 12.1. If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 7.8. If Race and Hispanic ethnicity is equal to Asian then unemployment rate is 9.7.

We should continue sharing the vision. We should continue working hard day and night to make it possible the global outcomes. The DigitaLegal success story could not have been written if even one of you were missing from the Picture.

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CHAPTER 8

Employing a Qualitative and Quantitative Research Methodology in Analysing Mechanics Behind Gas Pressure and Volume

Asst. Prof. Dr. Özerk YAVUZ[12]

"If world, world citizens, leaders and god loves me I can even be elected as the President."

-Profesör Özerk Yavuz

"Anything is possible in life."

-Profesör Özerk Yavuz

"If 'We the people' want then it can be possible in a democratical, constitutional setting."

-Profesör Özerk Yavuz

"In democracies, the remedies are inexhaustible."

-Süleyman Demirel

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INTRODUCTION

Pressure is the unit force applied to an area. It is defined as the perpendicular force per unit area and calculated with the P=F/S formula where force is divided by surface. When the same force applied to a larger area less pressure occurs whereas same force for a limited surface leads to a limited pressure. Similary high force values for the same surface areas leads to higher pressures whereas low force values applied to the same surface areas leads to a lesser degree of pressure. Similarly in gas pressure which is explained by ideal gas law, pressure value is found by P.V=n.R.T equation. It is positively correlated with temperature whereas negatively correlated by volume. Mol number identified with the Avogadro constant makes a positive contribution to the pressure smilar to the R which indicates the gas constant. In the ideal gas equation of P.V=n.R.T, P indicates the pressure, V indicates volume, N indicates mol number, R indicates gas constant and finally T indicates temperature. Understanding dynamics of pressure and force its antecedents, characterics may help scientists in responding the needs of consumers by designing more focused and targeted devices which may ease life of consumers, end users and society at large. Machine Learning form of data mining can be applied in using mechanics behind pressure, volume, temperature, mol number and gas constant relations (Wikipedia, 2022; Clapeyron, 1834; Clapeyron, 1835; Clapeyron, 1837; Davis, 2002; Krönıg, 1856; Clausıus, 1857; Moran, 2000) .

In wikipedia it is stated that “The ideal gas law, also called the general gas equation, is the equation of state of a hypothetical ideal gas. It is a good approximation of the behavior of many gases under many conditions, although it has several limitations. It was first stated by Benoît Paul Émile Clapeyron in 1834 as a combination of the empirical Boyle’s law, Charles’s law, Avogadro’s law, and Gay-Lussac’s law. where P, V and T are the pressure, volume and temperature; {\displaystyle n}n is the amount of substance; and R is the ideal gas constant. It can also be derived from the microscopic kinetic theory, as was achieved (apparently independently) by

August Krönig in 1856 and Rudolf Clausius in 1857. The state of an amount of gas is determined by its pressure, volume, and temperature. The modern form of the equation relates these simply in two main forms. The temperature used in the equation of state is an absolute temperature: the appropriate SI unit is the kelvin." (Wikipedia, 2022; Clapeyron, 1834; Clapeyron, 1835; Clapeyron, 1837; Davis, 2002; Krönıg, 1856; Clausıus, 1857; Moran, 2000)

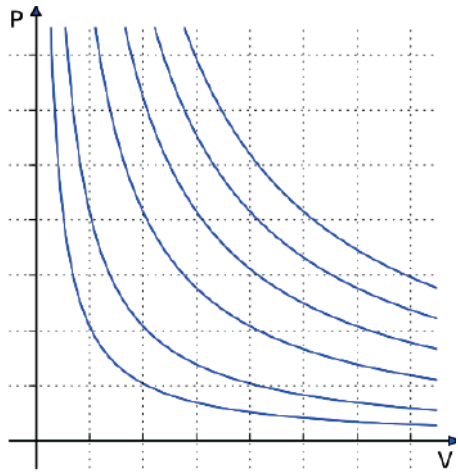

Figure1: Pressure and Volume Change in Response to Temperature Changes

Source: Wikipedia

In the wikipedia it is indicated that "Isotherms of an ideal gas for different temperatures. The curved lines are rectangular hyperbolae of the form y = a/x. They represent the relationship between dpressure (on the vertical axis) and volume (on the horizontal axis) for an ideal gas at different temperatures: lines that are farther away from the origin (that is, lines that are nearer to the top right-hand corner of the diagram) correspond to higher temperatures." (Wikipedia, 2022; Clapeyron, 1834; Clapeyron, 1835; Clapeyron, 1837; Davis, 2002; Krönıg, 1856; Clausıus, 1857; Moran, 2000). Wikipedia explains ideal gas law with the

following formula in literature " $pV = nRT = nk_{\mathrm{B}}N_{\mathrm{A}}T = Nk_{\mathrm{B}}T$. P is the absolute pressure of the gas, V is the volume of the gas, n is the amount of substance of gas (also known as number of moles), R is the ideal, or universal, gas constant, equal to the product of the Boltzmann constant and the Avogadro constant, k_B is the Boltzmann constant. N_A is the Avogadro constant. T is the absolute temperature of the gas. N is the number of particles (usually atoms or molecules) of the gas." (Wikipedia, 2022; Clapeyron, 1834; Clapeyron, 1835; Clapeyron, 1837; Davis, 2002; Krönıg, 1856; Clausıus, 1857; Moran, 2000).

Data mining is defined as a methodological approach in the analysis of quantitative data as indicated in the literature. The data mining process is formed of a set of structured steps that make up the data mining research process and methodology. Initially, the understanding and analysis of the business situation and problem are completed, this is later followed by the review and pre-processing of the data. Subsequently, a conceptual framework or model is developed following the literature review and analysis approaches, model testing is performed with supervised and unsupervised versions of machine learning approaches (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In supervised learning, learning process is usually triggered and activated by anticipatory (feed-forward) approaches which are then followed by backward propagation processes which aim to minimize the cost functions in a stochastic manner. Using the mapping functions, the input layers of the model are mapped to the output layer taking into account the independent dependent values. The functions and equations involved in this mapping are calculated. Subsequently, in many ways, the rules generated with the lowest error rate measured by respective entropy values are assesed. As in gradient descent forms the lowest cost for the respective variable weights are searched. The equation with the slope which is zero in local minimum or global minimum, which

is also the derivative of the cost in the reverse parabolic cost weight diagram is presented as the main association rule. This value can also be calculated by finding the tangent of that point which can be calculated by dividing edge looking to the angle (opposing edge) to adjacent edge in a triangular. To reach the point with the slope zero which is the intersection of the lowest weight and respective weight value meaning the lowest cost in the function at this point is steep to the weight, an iterative traversal is necessary for the opposite direction of the gradient. In this manner rules that provide the closest proximity to the actual results are selected and presented as distinctive association rules. To assess this, a stochastic backpropagation technique is used in many respects. In unsupervised machine learning grouping of several construct value combinations for different variables are assigned to respective clusters by applying mimicry for the pre-unlabeled data (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

RESEARCH METHOD

Data Mining techniques, which is considered to be a sub-part of artificial intelligence, are mainly composed of supervised and unsupervised forms of machine learning. In this case classification and regression are two forms of supervised learning whereas association and clustering are examples to unsupervised learning. In classification form of supervised learning the interpretations are handled based on input and output labes where dependent classification variables are pre-labeled whereas in unsupervised learning interpretation is merely done based on input data only without any pre-labeling process. In the regression form of supervised learning a relation between indipendent variables and dependent variables are seeked. Respective influence of the indipendent variables on the dependent variable is calculated by finding the slopes which is equal to the tangent value at that point. In clustering approach while similarities and convergence for the in group variable values are aimed to be maximized, a divergence

from out group member values for other segments and clusters are applied. In association form of unsupervised learning associative relations for several situations and categories are tried to be discovered within the data sets. Both supervised and unsupervised machine learning forms employ several techniques composed of statistics, mathematics and heuristics. In todays world data mining driven research methods are frequently used in several research domains and research topics in medical science, marketing, political science, public and cultural studies as a research method. It is also an important field itself in the scientific body of knowledge and literatures of computer science and quantitative research with its several techniques and algorithms that it employs (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

The data mining approach can be viewed as a systematic and structured investigative process that focuses on situation analysis, data collection, model building, and model testing. The ideas and insights uncovered from these analyses can be used as a starting point for decision-making by leaders, the scientific community, and society as a whole. Machine learning technique, which is a famous approach in quantitative research methodologies based on data mining, is a form of machine learning. The use of machine learning from data mining can provide an exploratory and confirmatory understanding of the phenomena in question and can provide in-depth insight and uwnderstanding with the option of knowledge discovery, prediction, or forecasting that it offers (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

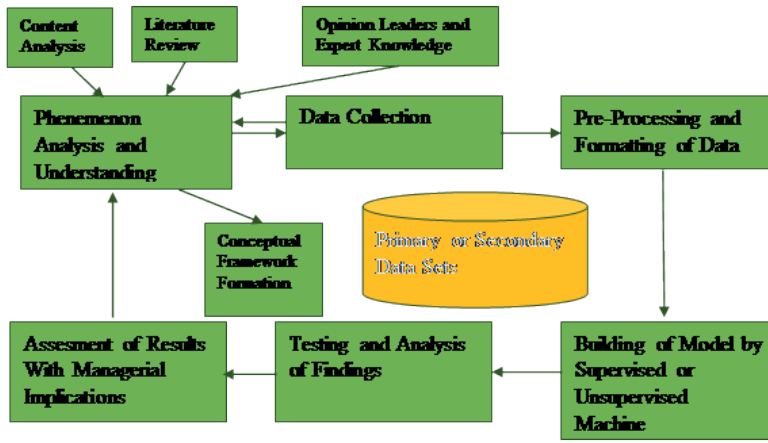

Figure 1. Athena Data Mining Model (Prepared by the Researcher)

In data mining process Athena data mining model has been employed as seen in Figure 1. In this research, several machine learning algorithms have been applied. Among these algorithms, unsupervised machine learning algorithms here assess the instance values and assign these independent values to the respective segment clusters whereas supervised machine learning algorithms mainly focus on mapping the multivariate variables in input layers to class labels in output layers with transformation and mapping functions. Additionally, class-based metrics are evaluated and associated rules are generated in a reinforced fashion some applying forward feeding and backpropagation approaches based on the algorithmic designs and architectures Prediction-focused machine learning functions are also involved in input-output transformation processes which generates the predicted values for the respective variables and attributes Depending on the algorithmic design, algorithmic architecture, complexity of the algorithms these algorithms can generate different results for similar, same or distinct problem For the same dataset with the same parameters performance indicators of the algorithms have been assessed and their results are evaluated. The best performing algorithm for this problem with

the respective dataset and parameters has been discovered with the analysis conducted. Knowledge patterns and rules found out have been interpreted and listed. For the supervised machine learning approach, Niagara Falls Model as depicted in Figure 2 is followed. For the unsupervised machine learning approach, Manavgat Falls Model has been employed as depicted in Figure 3. (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

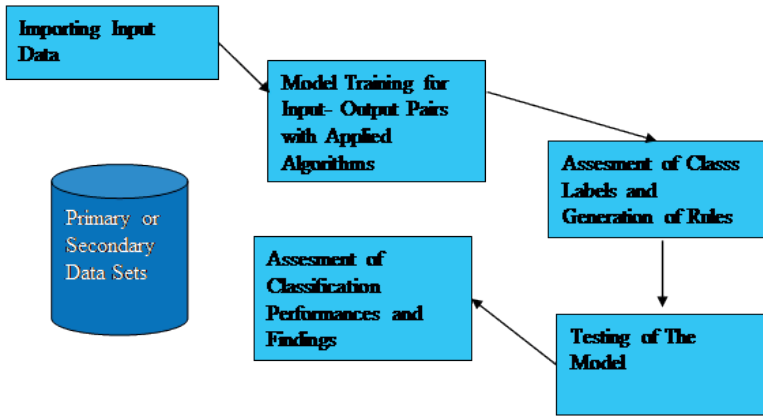

Figure 2. Niagara Falls Machine Learning Flow of Supervised Learning (Prepared by the Researcher)

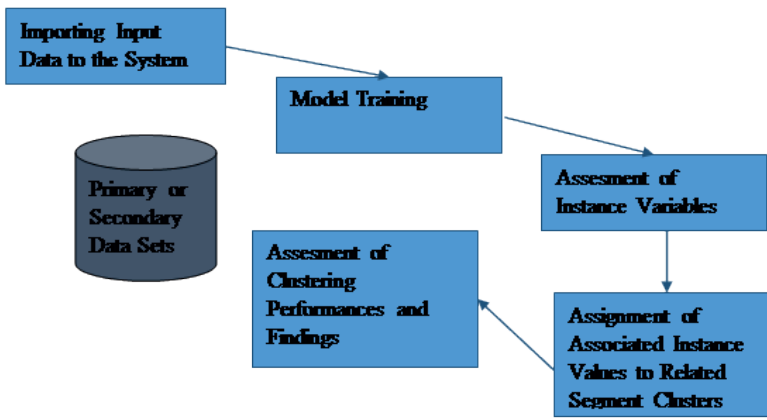

Figure 3. Manavgat Falls Unsupervised Machine Learning Algorithm Flow Composed of Model Building and Testing (Prepared by the Researcher)

DATA GATHERING AND PROCESSING

For the data set and sampling primary data has been collected and pre-processed in Nişantaşı University, İstanbul. Observations made with observation form of qualitative research methodology made in İstanbul in Room Temperature and Lower temperatures provided by Grundig NoFrost Refrigirator. Later in order to enhance exploratory and confirmatory understanding classification and clustering focused supervised, unsupervised machine learning approaches available in data mining literature employed. In model training and testing, 70 percent of the data has been used for training of the model purposes whereas 30 percent of the data has been used for model testing purposes. In this way a solution for the research questions "What are the relations between Absolute pressure of the gas (Pressure), Volume of the gas (Volume), Amount of substance of gas (also known as number of moles (Mole Number), Ideal, or universal, gas constant (Ideal Gas Constant), Absolute temperature of the gas (Temperature)" is tried to be examined and understood (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

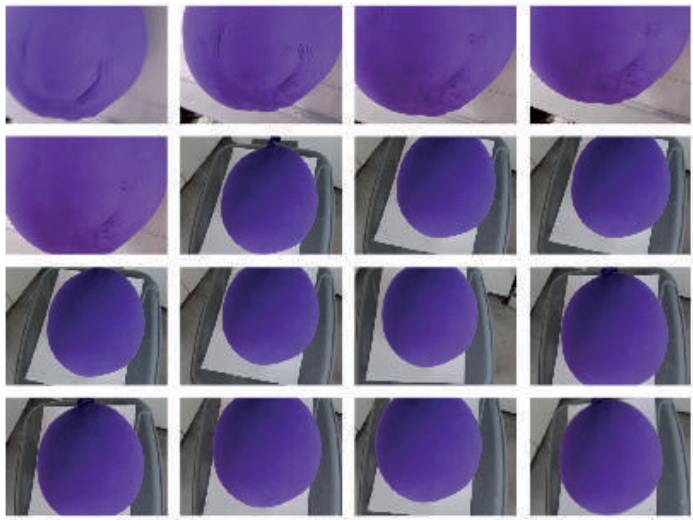

Figure 4: Pressure and Volume Changes Observed with temperature changes applied over time

Table 1. List of Variables Used in Analysis

Variable Name	**Variable**
Absolute pressure of the gas (Pressure)	Nominal/Categorical
Volume of the gas (Volume)	Nominal/Categorical
Amount of substance of gas (also known as number of moles (Mole Number)	Nominal/Categorical
Ideal, or universal, gas constant (Ideal Gas Constant)	Nominal/Categorical
Absolute temperature of the gas (Temperature)	Nominal/Categorical
Baloon Color	Nominal/Categorical

FINDINGS

In the research both observation form of qualitative research methodology and classification and clustering forms of machine learning methodologies employed. Qualitative and Quantitative techniques provided consistent and alligned results and findings consequently.

In data mining analysis, the rules of the association, predictive knowledge with insights have been discovered using classification and clustering algorithms for the relevant domain and problem set. In these approaches, the input-output mapping functions are used to create association rules that correspond to the outer layer projection from inner layers. In some, feed-forward and backward propagation techniques have been applied. The relevant rules with the lowest error rate have been presented as the main rules discovered with the analysis conducted (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

Many data mining processes today employ a technical approach to supervised learning in which independent or multivariate indicators and variables are assigned to output class labels using mapping functions. In unsupervised versions of data mining and machine learning, the fundamental values of each group (focal points, centroids) are calculated, the sample and the corresponding characteristic values are assigned to the respective groups in order to maximize convergence and minimize differences in the same group while divergence is expected among members of different groups. In the supervised and unsupervised machine learning process, rules are created to improve the exploratory and confirmatory understanding of the phenomenon this context, the Model 1. research design path can offer several advantages in understanding these phenomena and can be a good decision support tool for key business leaders, political leaders, and the society (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

In the applied analysis, the same input load was tested with the same parameters using multilayer perceptron, Bayesian networks, random forrest algorithms. In the analysis of the University of Waikato's Weka data mining package, which includes supervised and unsupervised machine learning applications have been implemented. Then the key performance indicators of the classifications and clusterings were compared and evaluated. During the analysis, 10 fold cross-validation technique was used

to train the model, and then the model is tested with a test dataset composed of the same variables. Based on the performance metrics associated with data mining analysis, a high-performing algorithm was selected that can be used for such areas and problem sets to gain additional information and insights. For this, the mean square of the error, accuracy (precision), coefficient of correct classification, and coefficient of misclassification were used (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022). The rules and performance indicator values calculated are shown in Tables 2 and 3. Voted Perceptron has been the top scorer among all machine learning algorithms with the highest classification rate, lowest RMSE, and misclassification performance. The maing finding were given in the Table 3.

Table 2. Performance Estimations of Machine Learning Algorithms

Machine Learning Algorithm	Key Performance Indicators			
	RMSE	Precision	% Correctly Classified	% Misclassified
Voted Perceptron	0.24	1	%100	%0
Random Tree	0	1	%100	%0
PART	0	1	%100	%0
Multilayer Perceptron	0.01	1	%100	%0
J48	0	1	%100	%0
Bayesian networks	0.0044	1	%100	%0

Table 3. Association Rules Generated by Supervised and Unsupervised Machine Learning Algorithms

I	Cluster analysis revealed that high absolute pressure, small volume, lowered temperature is in the same cluster whereas low absolute pressure, big volume, heightened temperature are in the other cluster where mol number and ideal/Universal Gas Constant is constant.
II	If volume is big then absolute pressure is low, if volume is small then pressure is high for the sampling used in the study
III	If absolute pressure is low then pressure is big whereas if absolute pressure is high then volume is small.
IV	If absolute pressure is low then temperature is heightened whereas if absolute pressure is high then temperature is lowered
V	The volume of the balloon that preserves the gas molecules is big when temperature is heightened. If volume of the balloon is small then temperature is lowered.
VI	Baloon Colour (purple with white patterns) has been seen for all pressure, volume, temperature values in the sampling. No color change has been detected in the experiments. It can also be hypothized that other balloon colours can provide the same reactions and outputs for similar parameter value changes. This variable can also be tested in further empirical and complimentary studies if preferred by the scientific community members.

Unsupervised and supervised machine learning analysis results showed that Cluster analysis revealed that high absolute pressure, small volume, lowered temperature is in the same cluster whereas low absolute pressure, big volume, heightened temperature are in the other cluster where mol number and ideal/Universal Gas Constant is constant. If volume is big then absolute pressure is low, if volume is small then pressure is high for the sampling used in the study. If absolute pressure is low then pressure is big whereas if absolute pressure is high then volume is small. If absolute pressure is low then temperature is heightened whereas if absolute pressure is high then temperature is lowered.The volume of the balloon that preserves the gas molecules is big when temperature is heightened. If volume of the balloon is small then temperature

is lowered. Baloon Colour (purple with white patterns) has been seen for all pressure, volume, temperature values in the sampling. No color change has been detected in the experiments. It can also be hypothized that other balloon colours can provide the same reactions and outputs for similar parameter value changes. This variable can also be tested in further empirical and complimentary studies if preferred by the scientific community members.Neural network generated research models can be found in Figure 5 and Figure 6.

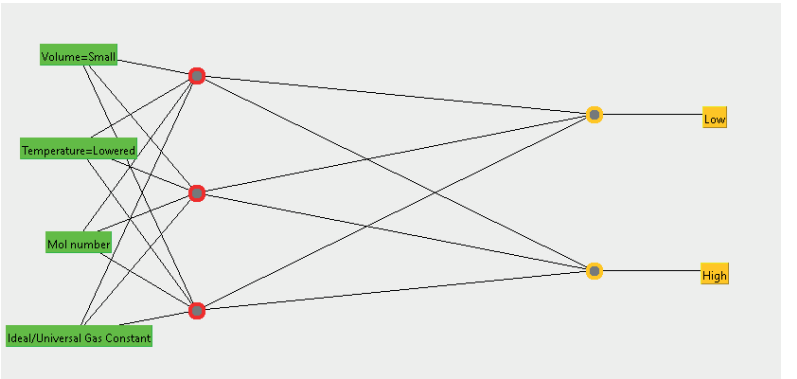

Figure 5. A Neural Network View of the Generated Model (Multilayer Perceptron: Absolute Pressure Is the Dependent Variable)

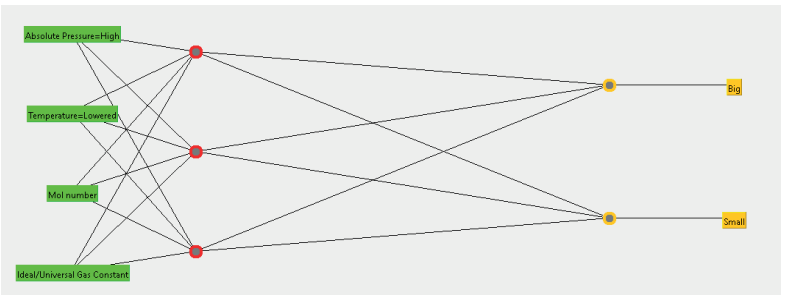

Figure 6. A Neural Network View of the Generated Model (Multilayer Perceptron: Volume is the Dependent Variable)

In the conducted analysis, the Multilayer perceptron method has been the best performing algorithm among other applied supervised machine learning approaches. This technique creative generated a correct classification rate of 75.39 percent with an RMSE of 0.42 and a misclassification rate of 24.60. Performance measures and indicators have been chosen as suggested in the literature. It is further concluded that supervised and unsupervised machine learning algorithms, also known as classification and clustering techniques in the data mining literature, can be used as effective and efficient tools for the discovery of meaningful knowledge and insights. Confirmation and exploration of knowledge and insights are possible with data mining flows as in Athena data mining model. These ideas can be taken into account by policy-makers and society at large in such areas and in a similar set of issues. Processing times can vary based on the input loads, algorithmic design, architecture, and performance of the algorithm which can be evaluated with approximation approaches by using metrics such as Big O or Big Ω which can also be used to assess the efficiency and the complexity of these calculations (Yavuz, 2009; Yavuz, 2013, Yavuz, 2018, Yavuz, 2019; Yavuz, 2021; Yavuz, 2022).

DISCUSSION AND CONCLUSION

Pressure is the unit force applied to an area. It is defined as the perpendicular force per unit area and calculated with the P=F/S formula where force is divided by surface. When the same force applied to a larger area less pressure occurs whereas same force for a limited surface leads to a limited pressure. Similary high force values for the same surface areas leads to higher pressures whereas low force values applied to the same surface areas leads to a lesser degree of pressure. Similarly in gas pressure which is explained by ideal gas law, pressure value is found by P.V=n.R.T equation. It is positively correlated with temperature whereas negatively correlated by volume. Mol number identified with the Avogadro constant makes a positive contribution to the pressure smilar to

the R which indicates the gas constant. In the ideal gas equation of P.V=n.R.T, P indicates the pressure, V indicates volume, N indicates mol number, R indicates gas constant and finally T indicates temperature. Understanding dynamics of pressure and force its antecedents, characterics may help scientists in responding the needs of consumers by designing more focused and targeted devices which may ease life of consumers, end users and society at large. Machine Learning form of data mining can be applied in using mechanics behind pressure, volume, temperature, mol number and gas constant relations.

Unsupervised and supervised machine learning analysis results showed that Cluster analysis revealed that high absolute pressure, small volume, lowered temperature is in the same cluster whereas low absolute pressure, big volume, heightened temperature are in the other cluster where mol number and ideal/Universal Gas Constant is constant. If volume is big then absolute pressure is low, if volume is small then pressure is high for the sampling used in the study. If absolute pressure is low then pressure is big whereas if absolute pressure is high then volume is small. If absolute pressure is low then temperature is heightened whereas if absolute pressure is high then temperature is lowered.The volume of the balloon that preserves the gas molecules is big when temperature is heightened. If volume of the balloon is small then temperature is lowered. Baloon Colour (purple with white patterns) has been seen for all pressure, volume, temperature values in the sampling. No color change has been detected in the experiments. It can also be hypothized that other balloon colours can provide the same reactions and outputs for similar parameter value changes. This variable can also be tested in further empirical and complimentary studies if preferred by the scientific community members.

To sum up in this study volume, pressure and temperature relations with environmental factors have been assesed. As an environmental factor temperature's influence on pressure and volume of a baloon. In the experiments a purple colored baloon with white patterns have been used. Pressure, volume,

temperature, Stress and strain changes in the baloon based on the environmental changes observed and analysed using supervised and unsupervised forms of machine learning in data mining. This study can be considered as a unique contribution to the scientific body of knowledge because of testing some of the theories evolved over time associated with gases in different settings, under several environmental factors and unique combinations of research instruments and tools employed. Hope it would provide an exploratory and confirmatory feedback for the interested parties, leaders, world citizens and science community who are keen on understanding and analyzing this research topic of interest. It can also considered as a case study for the scientific community involved in designing and producing technologies that rely on gas pressure and its mechanics. Hope you enjoy. All the best.

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CHAPTER 9

Comparative Analysis of Macroeconomic Behavior According to Keynes, Veblen, Schumpeter and Marx

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Prologue

The basic teaching of macroeconomics is based on the principle of managing scarce resources in the most efficient way against endless needs. Liberal economic theories are shaped according to this principle. According to this understanding, countries, societies and individuals who can manage scarce resources in the best way increase their welfare and become prosperous. Societies that fail to achieve this become poorer or fall into the underdeveloped country class.

However, the wealth or welfare level of individuals, societies and countries cannot be explained only by the principle of managing scarce resources in the best way. The beliefs, social situation, expectations, political and economic structure of the society play an important role in determining the level of welfare of that society.

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In this sense, factors such as belief, ethnicity, borders of democracy and human rights, individual and social freedom, being open to technology and innovation have an important place in determining the level of welfare in a society. In this respect, it is necessary to correctly evaluate the causes and consequences of people's economic behavior. In this respect, Keynes, Veblen, Schumpeter and Marx put forward important theoretical approaches.

As impoverished people accept this as their own destiny, the generally accepted economic and social system has been built on a structure that prevents the circle of poverty from breaking on a global basis. This situation, like the slavery system that was accepted as normal a century and fifty ago, has become generalized both legally, economically and socio-culturally. For example, international mobility of poor people is limited by visa and passport requirements. Sufficient economic resources are required to obtain a visa. At the local level, the mobility of poor people is indirectly limited by criteria such as economic and social status. Such a circle of poverty becomes unbreakable. In this study, different economic approaches are evaluated to understand such situations. In this study, these basic approaches are evaluated in a comparative analysis from a macroeconomic perspective.

Keynes and Economic Regulation

According to Keynes, only mathematical calculations which based on cost, profit, revenue, income etc. are not adequate to evaluate the production and consumption processes of scarce resources. In this process, instant decision making comes to the fore. Because what will take priority is determined by the real situation people are in at that moment. Thus, Keynes argues that in addition to numbers and theoretical approaches in economics, the current situation created by the conditions is the main determinant for the solution. According to Keynes, just as in the case of underemployment, it is necessary to focus on temporary balances and intermediate solutions to overcome economic crisis. Thus,

the active involvement of the state in the market for a temporary period by means of public expenditure instruments can make the free market functional again (Keynes, 1978).

Carl Menger, one of the theorists of the Austrian school of economics, shares this approach of Keynes as well. According to Menger, it is a kind of auction process that determines the price, and the current conditions play a fundamental determining role (Menger, 1871).

Sedlacek, on the other hand, considers the subject as a part of the evolution of human behavior. Accordingly, people behaved according to their senses and impulses, just like animals, in the process of meeting their needs in prehistoric times. Therefore, they hunted when they were hungry and rested when they were tired. There were no business plans in today's sense. Even though man left the wildlife behind and moved to civilized and predictable cities, he did not stop this behavior. Despite the opportunities offered by modern life, this instinctive behavior still has an effective place in people's decision-making processes (Sedlacek, 2017).

According to Keynes, human behavior is based on instincts as well as rationalist fictions. Therefore, spiritus animalis can also be explained with, instinctive concepts, which are outside of human behavior that are examined through rationalist fiction. Thus, more realistic and tangible evaluations can be made in the decision-making process in the economy. On the other hand, this sudden decision-making behavior, which does not allow mathematical analysis and is considered impossible to predict, is ultimately based on the conditions and experiences of people. Therefore, it can be considered as a logical process according to them rather than a meaningless behavior. Thus, instead of evaluating the behavior of people in an economy based on purely quantitative data, it is necessary to take into account their ideas, lifestyles and life philosophies (Kizilkaya, 2017).

Veblen And Economic Behavior That Differs According To The Structure Of The Society

Veblen's perspective on economic events consists of his observations on the connection between the consumption of scarce resources and social welfare. According to Veblen, economic processes such as production, distribution, consumption can only be associated with the existence of social institutions such as classes, strata, groups, and their ideal norms such as beliefs, canon definitions, group and gender-specific behaviors. According to Veblen, human needs and demands are not the same. This situation may vary and differ according to their motives and socioeconomic cultures. For example, a Buddhist monk would prioritize spirituality and fulfillment over earnings and material well-being, but according to a capitalist approach, any profitable behavior would be a rational approach that should be prioritized. Likewise, halal food in Islam, kosher food in Judaism, and the simple life of the Amish who reject technology and civilization show that profit and economic priorities in human societies can fall into second place according to their beliefs and motives (Sarıöz, 2005).

According to Veblen's approach, the factors affecting human behavior are interrelated. Societies consist of different classes in terms of economic, social and belief. In this context, it is possible to belong to a certain group and to consume certain product combinations unique to them. Within this framework, each group develops a certain consumption and production norm according to itself. As a result, the consumption of certain norms necessitates the consumption of certain products, and thus each society determines its own economic framework. In this economic environment, not only rational behaviors but also social norms and motives play an active role (Tilman, 2007). Consumption of certain products as a result of this process and special situation requires the preference of special norms. Thus, societies develop systems that highlight not only cultural but also economically different priorities. In this context, it can be concluded that beliefs, instincts and cultures are effective in shaping economic life. Indeed, it is possible to observe

economic behaviors based on accessible resources, beliefs, income and cultural values in societies. In this respect, a purely liberal or capitalist approach will not be sufficient in the economy (Güleç, 2015).

The economic basis of Veblen's ideas was extensively worked out by Marxism-Leninism. However, unlike the Marxists, Veblen did not believe that capitalism would turn into communism as a result of a legal history, as expressed in historical determinism, and tried to explain the different economic behaviors he mentioned with the living conditions and social situations of the people (Üstün, Tutal, 2008).

Schumpeter and Creative Destruction

Schumpeter's theory about the economic development of the capitalist economic system goes beyond classical economic approaches and highlights the idea that change, and transformation occur as a result of breaks. According to Schumpeter, economic developments experience radical changes and transformations thanks to the technologies emerging as a result of innovation. Accordingly, old technologies are disabled because new technologies are more productive and therefore more efficient and are preferred by people who aim to achieve maximum gain or return on scarce resources. Thus, new technologies based not only on the current production amount but also on future expectations form the basis of renewal and transformation in an economy. According to Schumpeter, this change primarily depends on dynamic entrepreneurs who innovate, generate leading profits and achieve economic recovery. This process of "creative destruction" enables growth and technical progress. Schumpeter sees the process of creative destruction, in which old goods and production processes are constantly replaced by new ones, as the engine of economic development. According to Schumpeter, the creative, creative entrepreneur plays a central role, repeatedly driving economic and technical progress forward through new ideas and the use of new production methods, techniques and processing options. This

approach of Schumpeter overlaps with the approaches of Keynes, Veblen and Menger. Because all three economists believe that the economy is a dynamic process, both animalistic motives and future expectations are based on an approach that is continuous in economies and requires adaptation to the current situation (Ulutan, 1978).

Marx and the Position of Working Class

With the Latin term proletarius or proletarian class meaning "belonging to the lowest class of the people", Marx developed a new approach to political economy. According to Marx, when an unjust structure is established between production and consumption in the economy, there is an economic system based on permanent inequality. In this order, which the capital class has established and strives to maintain, the working class, which carries out the main production, receives a minimum share of the product obtained, while the capital class, which participates in the production process only on the basis of management, gains maximum profit from the product obtained. According to this approach, which Marx explained with the theory of surplus value, while the working class is exploited, waste of resources, destruction of nature, constant inequality, and as a result of all these, developed and underdeveloped countries or poor and poor people are accepted as ordinary facts in economic and social life. Here, the capital class's maximal profit and minimum cost approach is the main determinant, rather than the priorities and needs of the society, which determine the consumption behavior and the mode and amount of production (Turan, 2017).

Developed in the middle of the 19th century by the political doctrine of communism by Karl Marx and Friedrich Engels, this approach should create a gradual capitalist system and a classless society. However, this approach showed an unsuccessful experience in practice, especially in the example of the USSR. As a result, when the failure of a theory is measured by its applicability,

liberal and mixed economic models have shown viable examples of success despite all their distortions and flaws.

Conclusion

Understanding the source and consequences of economic behavior has an important place in the shaping of macroeconomic theories. Especially since the publication of Smith's book "The Wealth of Nations", both criticisms of Smith's basic theses and various theories supporting them have been developed. The approaches of Marx, Schumpeter, Veblen and Keynes are among the main theories contributing to this field. Considering these theories, it has been concluded that it would be more realistic and appropriate to evaluate economic developments according to socio-cultural and political reasons, rather than simply linking them to economic reasons.

The needs of believers can be divided into two groups. In the first place, basic and compulsory needs such as food, drink, shelter and meeting health expenses come in order to maintain a normal life. In the second place comes the degree of satisfaction of these basic needs. This degree of satisfaction presents an endless state. People never reach the feeling that their basic needs such as food, drink, shelter and health expenses are fully met. They always want more and the best. It is a matter of debate that who or which society is closer to this basic goal. Here, essentially, power and system are the main decision makers. Even if the resources obtained in societies with a fair system are not equal, they show a balanced distribution. In societies where equality and democracy are lacking, the distribution of resources is shaped according to the distribution of power in the society. In addition, this situation leads to the emergence of different economic power between countries. While the welfare level is high in countries that are more effective on other societies militarily, politically and culturally, the welfare level is low in underdeveloped countries despite rich natural resources.

This fact continues the cyclical flow of economic activities, making rich countries constantly rich and poor countries constantly poor. Another point that should be noted here is how much technological innovations countries attach importance to or have this opportunity, just as Schumpeter stated. In addition, as Veblen argues, it is also important which economic and social understanding the society has. It can be seen as a shortcoming that Marx relates the event only to the balance of power between the working class and the capitalist class. On the other hand, Keynes' three motives and general equilibrium approach can be considered as a more realistic and applicable approach in terms of solution.

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Biography of Author

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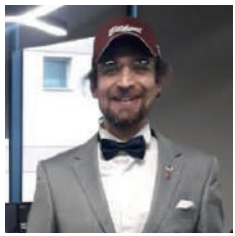

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