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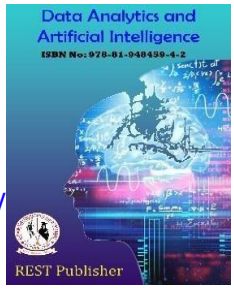

Evaluation of Crime Rate Prediction Using Machine Learning and Deep Learning for GRA Method

***Kishor Kumar Amuda, Praveen Kumar Kumbum, Vijay Kumar Adari, Vinay Chunduru, Srinivas Gonepally**

Incredible Software Solutions, Research and Development Division, Richardson, TX, 75080, USA

**Corresponding Author: Amuda.kishorkumar@gmail.com*

Abstract: *Predicting crime rates using machine learning and deep learning techniques Various factors analysing an inclusive one a complex task. can influence criminal activity. Here's a general outline of how you could approach this problem: Data Collection: Gather historical crime data from reliable sources such as government databases, law enforcement agencies, and crime statistics repositories. This data should include information about Preparing crime data for analysis involves various steps, including handling missing values, normalizing numerical features, and encoding categorical variables. This ensures data consistency and readiness for analysis. The data typically includes information about the type of crime, location (place, date, and time), population, area, socioeconomic factors, weather, and other relevant variables and handling outliers. Feature Selection/Engineering: Identify which features (variables) are likely to have the most impact on crime rates. Feature engineering might involve creating new variables from existing ones or transforming variables to make them more informative. Conducting involves delving into the dataset to gain valuable insights and performing thorough data analysis to better understand the data the relationships between different features and crime rates. Visualization techniques can help you understand patterns, correlations, and potential outliers in the data Model Selection: Choose appropriate machine learning and deep learning models for the prediction task. For crime rate prediction, you could consider time series models (ARIMA, LSTM, GRU), and ensemble techniques. In a sample exercise, you would typically split the data into training and testing sets, often organized into batches. You then choose specific models, train them on the training data, and work on enhancing their performance by adjusting hyper parameters as needed. For deep learning models, this might involve selecting the architecture, tuning the number of layers and units, and adjusting learning rates. When evaluating models, you can employ various metrics, including Mean Absolute Error (MAE), Mean Square Error (MSE), and Root Mean Square Error (RMSE) to assess their performance accurately. These metrics help in measuring the quality of trained models effectively. possibly more domain-specific metrics. Interpretability: If using complex models like deep learning, consider methods to interpret and explain the model's predictions. Methods such as SHAP (Shapley Additive Explanations) and LIME (Local Interpretable Model-Agnostic Explanations) are useful for gaining insights into the influential factors behind model predictions. These techniques aid in understanding the driving factors behind model predictions. Fine-tuning and Iteration: Based on the evaluation results, refine your models and pre-process the data further if necessary. This might involve experimenting with different features, models, or data manipulation techniques. Deployment: After achieving satisfactory model performance, you can apply it to make predictions on new data. This process can be facilitated through a user-friendly interface, whether it involves creating a new system or integrating the model into an existing one, in cities like New York, Los Angeles, Chicago, Houston, and Phoenix. Unemployment Rate, Poverty Rate, Education Index and Crime Rate. the Result of final GRG Rank of GRA Crime rate Prediction Using Machine Learning and Deep Learning Chicago is got the first rank whereas is the and New York is having the Lowest rank*

Keywords: *MCDM, Unemployment Rate, Poverty Rate, Education Index and Crime Rate.*

1. INTRODUCTION

Violence against women is a prevalent issue, particularly pronounced in our country. Numerous nations are grappling with the challenge of curbing such crimes, making prevention a crucial endeavour. The government of India has recently shown considerable concern for addressing offenses against women. Efforts to rectify this issue are being met with increased attention from society as well.As the frequency of these crimes continues to rise, substantial amounts of data are collected each year based on reports. This data holds immense predictive value and aids in assessing and to some extent preventing these offenses. Analysing this data to extract valuable insights involves a process of data analysis, which includes tasks like data cleaning, conversion, and modelling[1].To ensure meaningful outcomes, data preprocessing is crucial. It involves techniques like K-fold cross-validation, a method that divides the data into smaller samples for better understanding and accurate results. manage bias and minimize inaccuracies in the analysis.In the realm of data processing, This study focuses on various machine learning algorithms that hold significant importance, such as K-Nearest Neighbors (KNN), Decision Trees, Naïve Bayes, Linear Regression, Classification and Regression Trees (CART), and Support Vector Machines (SVM). The research explores multiple methods within the scope of these algorithms.highlighting their diverse applications in tackling this issue. These algorithms are rigorously tested for accuracy to evaluate their performance and utility in objective data analyses [2].Crime and unauthorized entry, both pose threats to justice and demand effective control. Precise offense anticipation and forecasting are essential to enhance metropolitan security through computational means. Utilizing big data for processing intricate information, a task beyond human capacity, is pivotal for achieving early and accurate crime prediction.Obstacles and prospects come hand in hand, driving substantial research endeavours. However, a formidable challenge persists – the development of a predictive algorithm directing police patrols towards potential criminal activities [3]. Employing machine learning techniques in this diverse study, various Rewording Logistic Regression, Support Vector Machine (SVM), Naive Bayes, K-Nearest Neighbors (KNN), Decision Trees, Multi-Layered Perceptron (MLP), Random Forest, and Extreme Gradient Boosting (XGBoost), among others. Furthermore, Long Short-Term Memory (LSTM) and Automated Integral Moving Average (ARIMA) models are also employed. time series analysis, exhibiting their efficacy in fitting crime-related data. Notably, LSTM showcases superior performance across both datasets, significantly reducing Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) [4].Incorporating data from over 35 analyses, the study accurately predicts crime types and annual trends in Chicago and Los Angeles crime rates. While Chicago indicates a modest future increase, Los Angeles sees a decline, notably in severe crimes, as indicated by the ARIMA model. Moreover, the predictive outcomes extend to identifying major crime regions within both cities.Existence of criminal activities significantly impacts people's lives, compromising their quality and triggering a range of social issues [5]. Both public and private sectors are susceptible to the costs associated with crimes, which can range from economic to social consequences. These concerns are paramount when making decisions about where to live or visit, necessitating the consideration of these factors.Enhancing security within design areas falls within the realm of planners' responsibilities. This involves accounting for various influences on crime distribution, which is often tied to factors like politics, economics, culture, education, employment, and legal frameworks. The complex interplay of these factors can significantly affect crime rates [6].Criminology is a key avenue for studying crime and its multifaceted influences. Various factors interact to establish relationships that criminology seeks to uncover. Examples include exploring the connections between economic status and different forms of violence. A wide array of methodologies, from traditional statistics to spatial statistics, are employed to dissect these relationships.In crime forecasting, deep learning and traditional machine learning methods have gained prominence. Traditional techniques, such as multiple regression and indicator variables, can be complemented with more advanced approaches, including deep neural networks, to enhance predictive accuracy [7]. These models are often designed to simulate interactions and relationships among social elements.Case studies demonstrate the applicability of various techniques. For instance, in the Buenos Aires area from 1985-1997, multiple regression helped explain crime inequality, while unemployment did not effectively account for the same. In Chicago, a spatio-temporal forecasting method using machine learning achieved relatively low prediction errors [8].Emerging neuroscience network models are gaining attention, particularly in the spatial and temporal contexts. These models are being integrated into machine learning as innovative approaches are suggested. These encompass traditional in one study, satellite imagery containing crime rates across 12,000 locations was utilized alongside police department reports to implement a CNN model. Remarkably, the deep learning model achieved a 79% accuracy rate [9]. In another case, LSTM was applied to predict daily crime events in Atlanta, while CNN and LSTM were combined to forecast crime existence in Baltimore City, yielding a strong correlation coefficient of 0.8.Various neural network architectures, such as Feedforward Neural Networks (FNN) and Recurrent Neural Networks (RNN), were explored both individually and in combinations like CNN and RNN. The study focused on Chicago and Portland, discussing the accuracy

of different methods, with the results indicating 75.6% and 65.3% accuracy respectively [10].Traditional approaches, predominantly long-term, have been employed for predictive measurements. However, these methods tend to rely on monthly data and often overlook environmental factors that play a crucial role in crime prediction. Such techniques face challenges due to their dependence on historical crime data and their limitations in handling non-linear relationships and data redundancies.Criminal activities represent detrimental incidents that transcend geographical boundaries, occurring both in developed and underdeveloped countries across the globe. These criminal acts significantly impact not only the economy but also the well-being and quality of life of residents [11]. The consequences of crimes extend to social and economic spheres, fostering complex issues that communities grapple with.Safety concerns play a pivotal role, influencing individuals' choices to travel or relocate. The creation of secure environments is of utmost importance, and different types of crimes can uniquely shape outcomes. Crimes, whether public or private, generate dual costs impacting both sectors.A variety of factors contribute to the occurrence of crimes, ranging from fundamental human behavior and critical circumstances to economic situations such as poverty, unemployment, gender inequality, high population density, child labor, and illiteracy. These factors, especially in the case of violent crimes, drive an upsurge in criminal activity [12].The connection between crime rates and urban environments, particularly densely populated cities, is unmistakable. Various contexts, such as commercial buildings and municipal settings, show varying degrees of relevance to crime rates. Societies that are socially stable and exhibit community cohesion often experience a more tranquil environment where individuals can lead active lives. Such communities have a positive influence on reducing crime, fostering an environment of peace and prosperity.Due to this reason, the scrutiny of crime reports and statistical data is essential for enhancing the safeguarding and security of human lives [13]. This necessity arises to promote sustainable development and ensure the continual maintenance of safety. Over recent years, crime prediction has gained widespread popularity, particularly for its potential to augment the capabilities of law enforcement officers in handling crime incidents effectively.Exemplary prognosis relies on algorithms that exhibit a need for further refinement, especially to optimize police patrol strategies, which can result in apprehending criminals more efficiently. Numerous research endeavours have focused on predicting various aspects of crimes, encompassing crime types, crime rates, and identifying hotspots in diverse regions such as South Korea and various parts of the U.S., including Portland [14].These endeavors have expanded to include the identification of precursor factors linked to criminal behavior, spanning residential and commercial domains. The Canadian dataset is another example of a resourceful tool harnessed for research. Implementing innovative machine learning techniques for crime prediction involves deep learning methodologies and machine learning algorithms like Naïve Bayes, Random Forest, Support Vector Machine (SVM), Decision Trees, and regression techniques [15].While accurate crime forecasting remains a challenging yet imperative task, machine learning has made significant strides in this area. The integration of predictive analytics into crime prevention strategies is currently a primary focus, and diverse machine learning methods are being compared and evaluated for their efficiency and capability in handling non-linear data. Substantial research efforts are dedicated to overcoming computational challenges and leveraging opportunities presented by machine learning-based crime prediction. However, existing literature has acknowledged some imprecision, especially when it comes to predicting crime rates and hotspots across multiple cities using large datasets like those from Los Angeles and Chicago [16].Recent studies further emphasize the importance of accurate predictions, indicating that various models, particularly those tailored for high-crime density areas and acts of violence, have demonstrated promise. These trends indicate the potential of time series analysis to enhance crime prediction by accounting for factors such as temporal trends, climate, and the evolution of criminal activities over the years.The elevated crime rate poses a significant obstacle to a country's economic stability, necessitating effective crime prevention and regulatory solutions. Extracting valuable insights from crime data is crucial for this purpose, requiring the collaboration of data analysts and scientists to provide meaningful contributions [17].To address this issue, this study introduces a novel approach utilizing the Particle Swarm-Cuckoo Search (PS-CS) optimization algorithm. By integrating both particle swarm optimization and Cuckoo Search, this method enhances energy and network optimization while refining parameter settings and executing deep neural network training for crime prediction.The proposed PS-CS model offers several advantages, including its capacity to overcome slow convergence and local optima issues seen in traditional methods like backpropagation [18]. This model's implementation in India demonstrates its potential as an efficient tool for predicting crime rates, with promising prospects for controlling and preventing criminal activities, ultimately aiding law enforcement agencies.The study extensively evaluates the performance of various classification models, including linear regression, Support Vector Regression (SVR), Random Forest Regression, and decision trees, besides advanced techniques like residual neural networks (ResNet), Visual Geometry Group (VGG), and EfficientNet-B7. In comparison, the CNN model coupled with the BS-CS approach outperforms other models, achieving an unparalleled accuracy score of 99.87%. Conversely, the other models, including Linear Regression, SVR, Random Forest Regression, and decision trees, yield accuracy scores ranging from 80% to 95%, indicating comparatively less accuracy [19].

2. MATERIALS AND METHOD

2.1. New York: New York is a highly iconic and populous city located in the northeastern United States. It is often referred to as "The Big Apple" and is renowned for its cultural diversity, economic significance, and numerous landmarks. Here are some key points about New York: New York City (NYC) consists of five boroughs: Manhattan, Brooklyn, Queens, The Bronx, and Staten Island. Each borough has its unique characteristics, contributing to the city's rich cultural tapestry. New York is home to several famous landmarks, such as Times Square, Central Park, the Statue of Liberty, Empire State Building, Brooklyn Bridge, and One World Trade Center (Freedom Tower).

2.2. Los Angeles: Los Angeles, often referred to simply as "LA," is a major city located on the west coast of the United States. It is renowned for its association with the entertainment industry, beautiful weather, and diverse cultural scene. Here are some key points about Los Angeles: City of Entertainment: Los Angeles is widely known as the "Entertainment Capital of the World." Hollywood, a neighborhood within LA, is the center of the global film and television industry. Film and Television: Hollywood is home to major film studios, production companies, and renowned landmarks like the Hollywood Walk of Fame and the iconic Hollywood Sign.

2.3. Chicago: Chicago is a prominent city located in the Midwestern United States, known for its rich history, diverse culture, and significant contributions to various fields. Here are some key points about Chicago: City Characteristics: Chicago is situated on the southwestern shore of Lake Michigan. It's the third-most populous city in the United States and a major center for commerce, finance, and culture. Architecture: Chicago is renowned for its architecture, with a skyline featuring iconic skyscrapers. The city played a pivotal role in the development of modern architecture and is home to the world's first skyscraper.

2.4. Houston: Houston is a major city located in the state of Texas, USA. It is known for its diverse economy, energy industry, and cultural attractions. Here are some key points about Houston: Space Exploration: Houston is famous for its association with NASA's Johnson Space Center, which serves as the hub for human spaceflight activities, including mission control for the Apollo program. Energy Hub: The city is often referred to as the "Energy Capital of the World" due to its prominence in the energy industry, particularly in oil and natural gas. Cultural Diversity: Houston is one of the most ethnically diverse cities in the United States, with a rich mix of cultures and communities.

2.5. Phoenix: Phoenix is the capital city of the state of Arizona, USA. It's known for its desert climate, outdoor activities, and growing urban landscape. Here are some key points about Phoenix: Desert Environment: Phoenix is situated in the Sonoran Desert and experiences a hot desert climate with extremely hot summers and mild winters. Outdoor Recreation: The city is surrounded by natural beauty and offers opportunities for outdoor activities such as hiking, biking, and golfing. Cultural Centers: Downtown Phoenix features cultural attractions like the Heard Museum, which focuses on Native American art and culture.

2.6. Unemployment Rate: The unemployment rate is a measure that indicates the percentage of the labor force that is unemployed and actively seeking employment. It's a key economic indicator used to gauge the health of a country's economy. A high unemployment rate can suggest economic challenges, while a low rate often indicates a stronger economy with more job opportunities.

2.7. Poverty Rate: Poverty rate is poverty below the line living of population is the percentage, It is defined by a specific income threshold. The poverty line is typically calculated based on Food accommodation and dress basic like meet the requirements needed to do money high poverty rate indicates a larger portion of the population struggling to meet these basic needs.

2.8. Education Index: The Education Index is a composite statistic that measures a country's level of education attainment and its quality. It takes into account factors such as mean years of schooling and expected years of schooling. The index is used to assess the overall education level of a population and is often used in conjunction with other human development indicators.

2.9. Crime Rate: The crime rate is a measure of the number of reported crimes (such as homicides, robberies, burglaries, etc.) per a specific population size, often per 100,000 people. It's used to understand the prevalence of criminal activities in a given area and can provide insights into the safety and security of a community.

2.10. Method: The concept of Gray Relational Analysis (GRA), originally introduced by Deng, emerged as a solution to address various problems related to attribute selection in complex relationships. In the realm of current literature, GRA has gained recognition for effectively handling these intricacies and variables.The GRA technique, in its different forms, is proposed as an approach suitable for resolving challenges that arise due to complex relationships and various factors. This technique, labeled as the MCTM (Mean Centroid-to-Target Mean) approach, was initially presented [20].By utilizing GRA, problems within the MCTM framework can be effectively addressed and rectified. GRA serves as an evaluative model that aids in analyzing and assessing data collections and records. This analysis involves studying the communication or geometric relationships that exist between different data sets.Derived from the concept of gray systems, Gray Correlation Analysis (GRA) serves as a method that quantitatively utilizes information continuity to establish connections between various elements. The principal tenet of GRA revolves around the idea that the intimacy of communication styles is

determined inversely by the addition of size to series curves [21].GRA is particularly suited to assess the complexity and issues of communication between two factors and variables, making it a valuable tool for judgment in intricate scenarios. The technique of GRA, specifically within the framework of various MCTMs, effectively covers matters of decision-making and attribute selection. In the context of proper regulatory solutions, Gray Correlation Analysis (GRA) presents itself as a suitable approach by simulating and evaluating different techniques [22]. Both GRA and proper solutions utilize similar techniques, providing a level of quality. Parameters such as particle size (10µm), reinforcement (5%), device diameter (8mm), speed (710rpm), feed pressure (139.48N), cross-feed force (92N), thrust force (42.6N), temperature (68.96oC), and floor hardness (0.198µm) are used to understand the impact of variables on response parameters [23].Gray Correlation Analysis (GRA) is a method used for analysis. In its initial stages, it involves comparing indicators from various countries, particularly neighboring ones, to assess their one-dimensionality and vibration statistics. This is performed with the aid of 1D-LBP signals. Once these indicators are collected, statistical solutions are calculated. GRA is a well-known technique in the literature, and it's often categorized using programs. Recently, the 1D-LBP technique and vibration alerts have been integrated into GRA, altering its characteristics. Notably, this study introduces a unique approach by applying GRA to vibration signals, which had not been attempted before [24]. Additionally, GRA is intertwined with fuzzy set theory, which aligns with decision-makers' thought processes. This fuzzy set allows decision-makers to consider information and make informed choices, particularly in tackling problems where multiple standards are of significance and uncertainty is present. This approach is particularly useful for tasks such as job evaluation, dealer selection, factory location, and determining manufacturing structures, where several criteria are involved, and managing uncertainty becomes vital for effective decision-making [25]. GRA (Gray Correlation Analysis) is primarily employed to rank and compare alternatives' overall performance, elucidating their relative positions. This process, known as gray relational generation, involves the comparison of various alternatives in terms of their performance rankings. Subsequently, these scenarios are used to define a super goal sequence. Then, by examining the rows and evaluating the Carey correlation coefficient for all alternatives, the satisfaction of the defined goal is determined. Ultimately, the gray correlation coefficient is calculated based on the collection of data, resulting in the determination of perfect target order and magnitude of variation between the gray contacts [26].The integration of GRA with network distribution is proposed, and GRA is combined with hydropower technology for planning purposes. The AHP technique is also reconstructed in this context. Moreover, GRA is applied to fields such as particle-reinforced stem, electric discharge apparatus, fuel charge, gross domestic product, motor types, travel to power development, and vehicle kilometers to assess their impact.The application of GRA extends to analyzing the overall performance of various domains, such as evaluating Taiwan's box lines and using the Fuzzy-GRA technique for this purpose. Furthermore, for assessing management skills and environmental knowledge, GRA is integrated into provider evaluation methods, offering a comprehensive approach [27].Gray Correlation Analysis (GRA) is commonly utilized in Asian regions. It serves as an evaluative approach that operates on an absolute basis, comparing differences and similarities between rows to determine relationships. The primary objective of GRA is to evaluate the impact and relationships of various elements within arrays using factual evaluation techniques or geometric methods [28]. The rationale behind the GRA technique lies in assessing the degree of similarity or relationship between interrelated elements. This technique is particularly employed to measure the degree of similarity between structures and elements. In environmental contexts, GRA has been employed to analyse factors affecting gas wells and oil pipes, with several studies investigating its impact and assessing the principles of GRA application [29]. Across various domains, GRA has been harnessed to evaluate overall performance characteristics, such as in electro-discharge machining methods. In the United States, GRA has been blended with techniques for assessing expatriate work, while in Beijing, it has been employed to evaluate water resource conservation [30]. The term GRA is used to describe the evaluation process of a given product's components in a comprehensive manner. It has been effectively employed to address challenges related to activities requiring trust and restoration methods. In medical applications, GRA has been utilized in assessing electrocardiograms (ECG) and heart rate discriminators, particularly in the context of different ECG beats and frequency components [31].

3. ANALYSIS AND DISCUSSION

TABLE 1. Crime rate Prediction Using Machine Learning and Deep Learning

	Unemployment Rate	**Poverty Rate**	**Education Index**	**Crime Rate**
New York	0.04	0.19	0.85	450.60
Los Angeles	0.06	0.15	0.78	315.20
Chicago	0.07	0.21	0.72	550.30
Houston	0.04	0.17	0.75	320.70
Phoenix	0.05	0.14	0.68	250.80

Table 1 shows the Crime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix Unemployment Rate in Chicago (0.07) is showing the Highest Value and New York and Houston (both 0.04) is showing the lowest value. Poverty Rate in Chicago (0.21) is showing the Highest Value and Phoenix (0.14) is showing the lowest value. Education Index in New York (0.85) is showing the Highest Value and Phoenix (0.68) is showing the lowest value. Crime Rate in Chicago (550.30) is showing the Highest Value and Phoenix (250.80) is showing the lowest value.

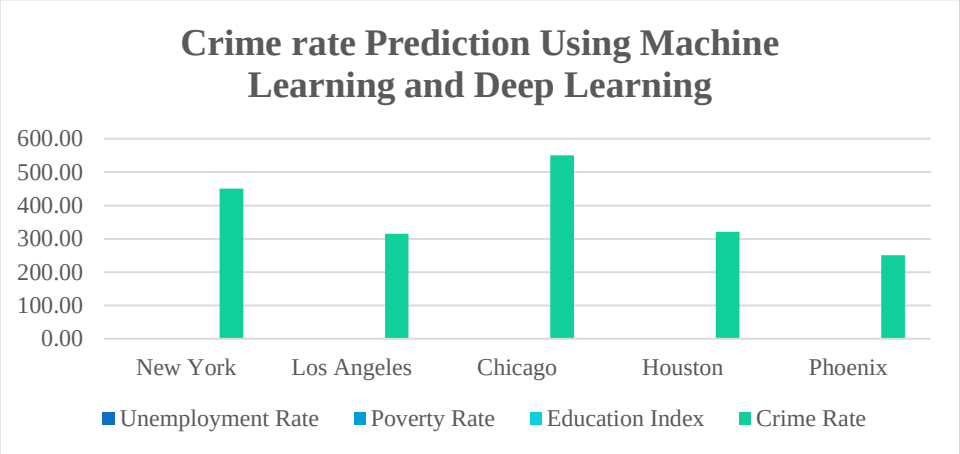

FIGURE 1. Crime rate Prediction Using Machine Learning and Deep Learning

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TABLE 2. Normalized Data

	Unemployment Rate	**Poverty Rate**	**Education Index**	**Crime Rate**
New York	0.0370	0.7308	0.0000	0.3329
Los Angeles	0.5926	0.2051	0.4118	0.7850
Chicago	1.0000	1.0000	0.7647	0.0000
Houston	0.0000	0.3846	0.5882	0.7666
Phoenix	0.1852	0.0000	1.0000	1.0000

Table 2 shows the Normalized data forCrime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix. Unemployment Rate in Chicago (1.0000) is Showing the Maximum Value and Houston (0.0000) is Showing the Minimum Value. Poverty Rate in New York (0.7308) is Showing the Maximum Value and Phoenix (0.0000) is Showing the Minimum Value. Education Index in Phoenix (1.0000) is Showing the Maximum Value and New York (0.0000) is Showing the Minimum Value. Crime Rate in Phoenix (1.0000) is Showing the Maximum Value and Chicago (0.0000) is Showing the Minimum Value.

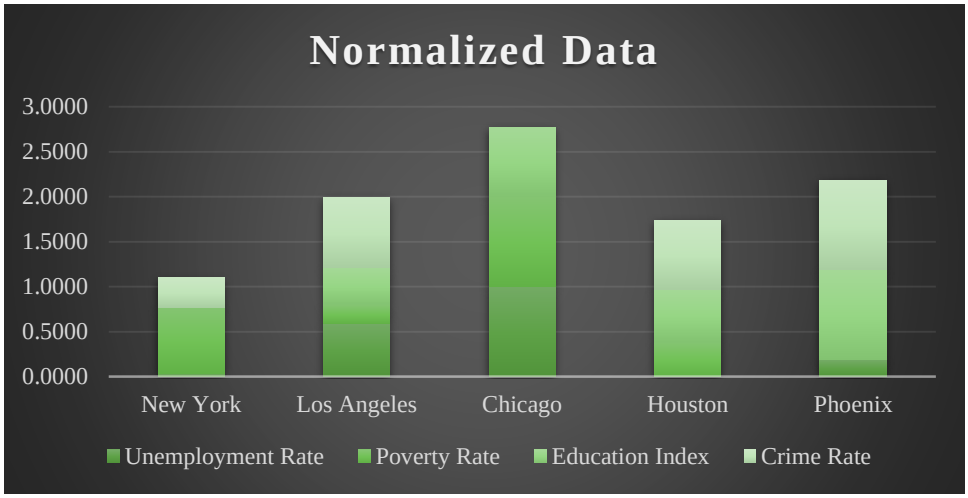

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TABLE 3. Deviation sequence

	Unemployment Rate	**Poverty Rate**	**Education Index**	**Crime Rate**
New York	0.9630	0.2692	1.0000	0.6671
Los Angeles	0.4074	0.7949	0.5882	0.2150
Chicago	0.0000	0.0000	0.2353	1.0000
Houston	1.0000	0.6154	0.4118	0.2334
Phoenix	0.8148	1.0000	0.0000	0.0000

Table 3 shows the Deviation sequence for Crime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix it is also the Maximum or Deviation sequence value.

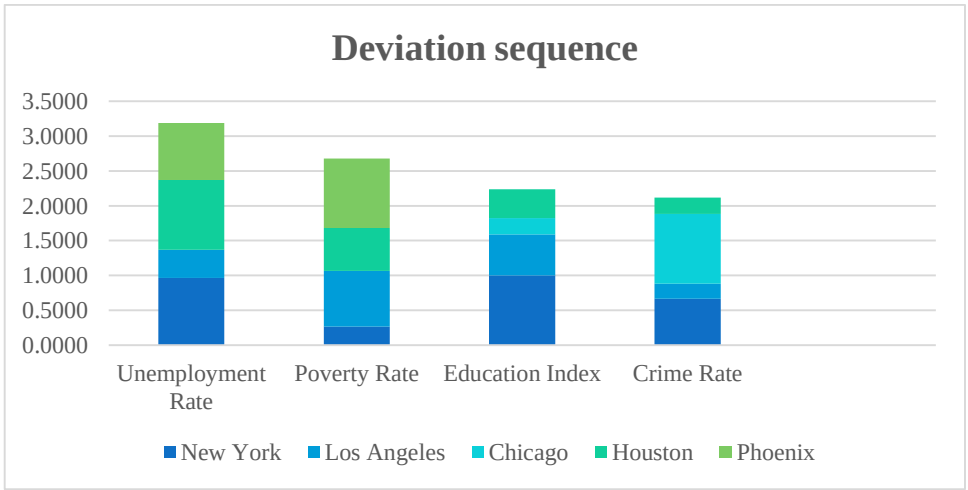

FIGURE 3. Deviation sequence

Figure3 shows the Deviation sequence for Crime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix it is also the Maximum or Deviation sequence value.

TABLE 4. Grey Relation Coefficient

	Unemployment Rate	**Poverty Rate**	**Education Index**	**Crime Rate**
New York	0.3418	0.6500	0.3333	0.4284
Los Angeles	0.5510	0.3861	0.4595	0.6993
Chicago	1.0000	1.0000	0.6800	0.3333
Houston	0.3333	0.4483	0.5484	0.6818
Phoenix	0.3803	0.3333	1.0000	1.0000

Table 4 shows the grey relation coefficient forCrime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix. It is Unemployment Rate in Chicago (1.0000)is Showing the Maximum Value and Houston (0.3333)is Showing the Minimum Value. Poverty Rate in Maximum: New York (0.6500)is Showing the Maximum Value andPhoenix (0.3333)is Showing the Minimum Value. Education Index in Phoenix (1.0000)is Showing the Maximum Value andNew York (0.3333)is Showing the Minimum Value. Crime Rate in Phoenix (1.0000)is Showing the Maximum Value andNew York (0.3333)is Showing the Minimum Value.

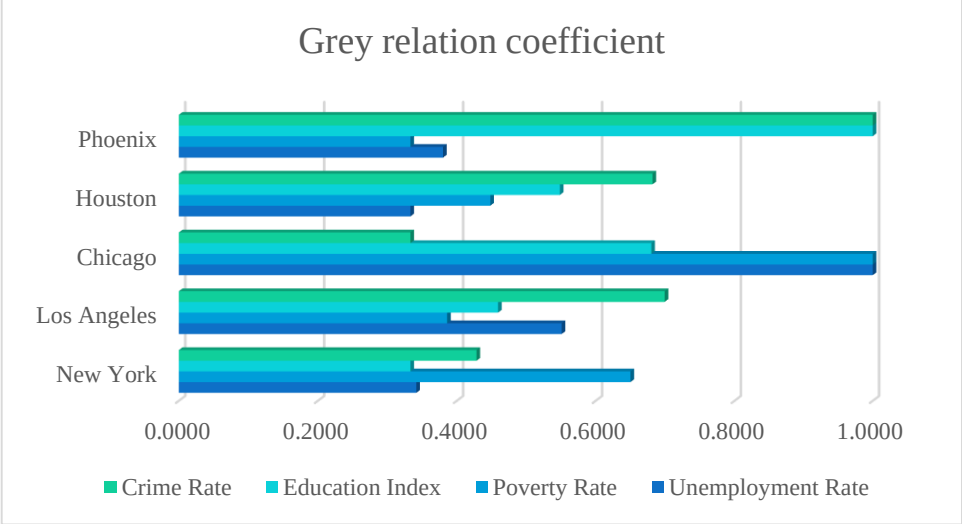

FIGURE 4. Grey relation coefficient

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TABLE 5. Result of final GRG Rank

	GRG	**Rank**
New York	0.4384	5
Los Angeles	0.5240	3
Chicago	0.7533	1
Houston	0.5029	4
Phoenix	0.6784	2

Table 5 shows the Result of final GRG Rank of GRA Crime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix. Chicago is showing the highest value for GRG and New York is showing the lowest value.

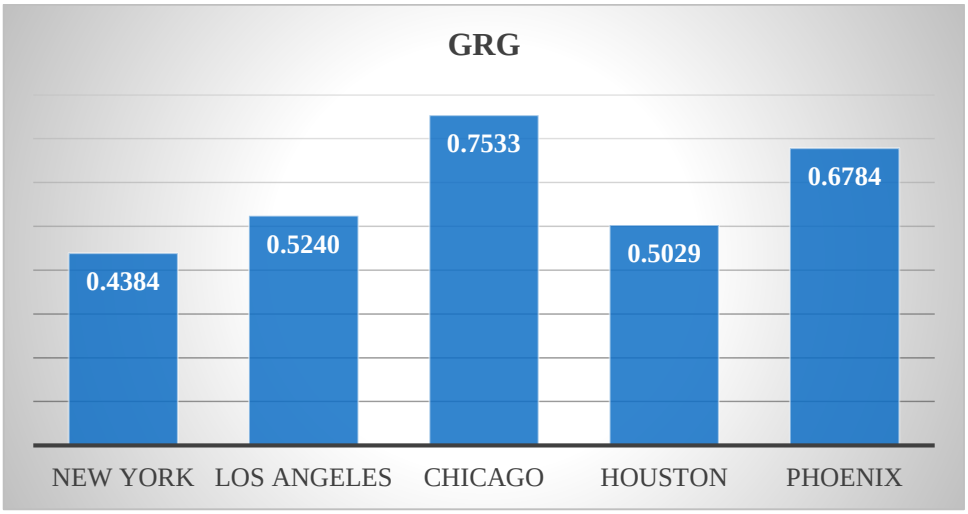

FIGURE 5. GRG

Figure 5 shows the Result of final GRG Rank of GRA Crime rate Prediction Using Machine Learning and Deep Learning Unemployment Rate, Poverty Rate, Education Index and Crime Rate New York Los Angeles, Chicago, Houston and Phoenix. Chicago is showing the highest value for GRG and New York is showing the lowest value.

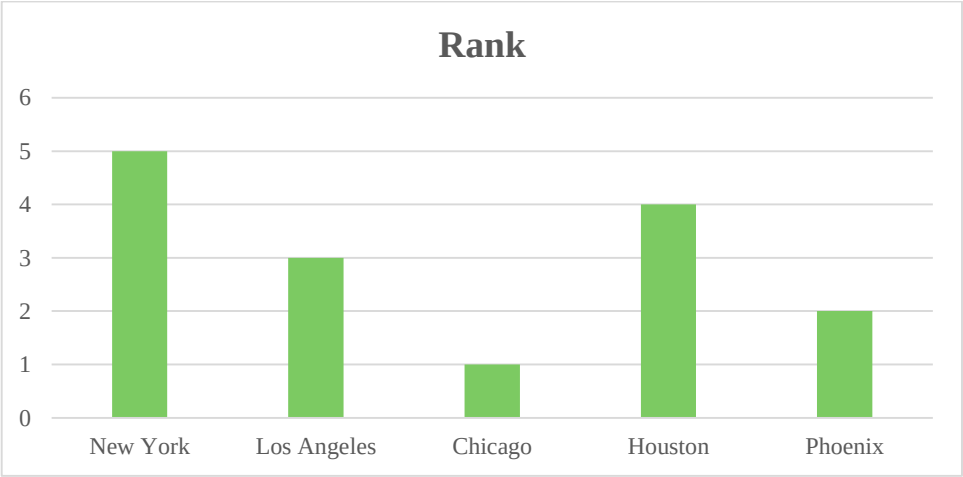

FIGURE 6. Rank

Figure 6 shows the Result of final GRG Rank of GRA Crime rate Prediction Using Machine Learning and Deep Learning Chicago is got the first rank whereas is the and New York is having the Lowest rank

4. CONCLUSION

Predicting crime rates using machine learning and deep learning techniques Various factors analysing an inclusive one a complex task. can influence criminal activity. Here's a general outline of how you could approach this problem:Data Collection:Gather historical crime data from reliable sources such as government databases, law enforcement agencies, and crime statistics repositories. This data should include information about Preparing crime data for analysis involves various stepsViolence against women is a prevalent issue, particularly pronounced in our country. Numerous nations are grappling with the challenge of curbing such

crimes, making prevention a crucial endeavour. The government of India has recently shown considerable concern for addressing offenses against women. Efforts to rectify this issue are being met with increased attention from society as well. As the frequency of these crimes continues to rise, substantial amounts of data are collected each year based on reports. This data holds immense predictive value and aids in assessing and to some extent preventing these offenses. Analysing this data to extract valuable insights involves a process of data analysis, which includes tasks like data cleaning, conversion, and modelling. By utilizing GRA, problems within the MCTM framework can be effectively addressed and rectified. GRA serves as an evaluative model that aids in analyzing and assessing data collections and records. This analysis involves studying the communication or geometric relationships that exist between different data sets. Derived from the concept of gray systems, Gray Correlation Analysis (GRA) serves as a method that quantitatively utilizes information continuity to establish connections between various elements. The principal tenet of GRA revolves around the idea that the intimacy of communication styles is determined inversely by the addition of size to series curves. This might involve experimenting with different features, models, or data manipulation techniques. Deployment: After achieving satisfactory model performance, you can apply it to make predictions on new data. This process can be facilitated through a user-friendly interface, whether it involves creating a new system or integrating the model into an existing one, in cities like New York, Los Angeles, Chicago, Houston, and Phoenix. Unemployment Rate, Poverty Rate, Education Index and Crime Rate. the Result of final GRG Rank of GRA Crime rate Prediction Using Machine Learning and Deep Learning Chicago is got the first rank whereas is the and New York is having the Lowest rank.

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