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Survey on Prediction of Terrorism Activities Using Supervised Machine Learning Methods

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ABSTRACT: The main objective of this work is to predict the region and country of a terrorist attack using machine learning techniques. The work has been mainly carried out upon the Global Terrorism Database (GTD), which is an open-source database that consists of a list of terrorist activities from the year 1970 to 2017. Six machine learning algorithms have been used. From the dataset selected set of features are taken to achieve an accuracy of up to 82%. If certain parameters are known, the results are used to train machine learning models to predict the region and country of the terrorist attack. It is postulated that the work can be used for enhancing defense and security against future terrorist attacks in the world.

KEYWORDS: Terrorism; prediction; machine learning; accuracy

I. INTRODUCTION

Terrorist attacks are expanding at a great pace over the world. As per the United Nations definition of Terrorism, "any action with a political goal that is intended to cause death or serious bodily harm to civilians" [1]. In the last year, around 22 thousand incidents occurred globally, causing over 18 thousand casualties [2]. The factors leading to terrorism change over time since they are reliant upon multiple political and social causes.

Apart from predicting the reason behind the attack, identification of the responsible agencies is also difficult. There has been a lack of information regarding patterns of extensive terrorist behavior. The existing analyses are either case studies or the use of quantitative methods such as regression analysis. The former of these is specific to certain cases, while the latter strategy is restricted to interviews of civilians struck by the attack. Supervised machine learning techniques are blended with terrorism specific domain knowledge to extract macro-level inferences about the pattern of terrorist behavior [3]. The challenge of predictive modeling is to build models that have good performance making predictions upon new hidden data [4]. The problems related to conflict or terrorism, employing the tools of applied game theory or experimental economics to inform their analyses [6].

This paper implements an approach to analyzing terrorism region and country with the machine learning techniques and terrorism specific knowledge to retrieve conclusions about terrorist behavior patterns. A thorough analysis of events using GTD for supervised machine learning models. Uncountable losses of lives and assets happen every year all around the globe. The interesting thing to note is seldom some organizations claims their hand behind or involvement in its execution while sometimes nobody takes the blame of the attack. The purpose of this work is getting a more precise idea, by analyzing all the incidents to build an intelligent model that can be engaged in institutive predictions. It has been noted that terrorists sometimes don't claim responsibility for attacks and from the statistics states that terrorist teams claim credit for less than one out of seven attacks.

The contemporary research is centered on obtaining the relationship between terrorism and its causal factors. Existent efforts have not been good enough for prediction. Machine learning approaches can notice in predicting the possibility of a terrorist attack, given the required data. The outcomes of this work can help security agencies and policymakers to exterminate terrorism by taking relevant and effective measures.

This paper implements an approach to analyzing terrorism region and country with the machine learning techniques and terrorism specific knowledge to retrieve conclusions about terrorist behavior patterns. Through analysis of events



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exploitation GTD, six supervised machine learning models (Gaussian Naïve Bayes, Linear Discriminant Analysis, k-Nearest Neighbours, Support Vector Machines, call Tree, and supply Regression) were developed and evaluated on their performances.

The rest of the paper is organized is as follows: Literature survey is presented in Section II.

II. LITERATURE SURVEY

A huge number of events makes it challenging to predict the terrorist group responsible for some terrorist activity. The work in [1] has examined machine learning methods for classifying and analyzing global terrorist activity. The authors have examined supervised machine learning approaches to analyze terrorist activity and then developed a model to classify past events in the Global Terrorism Database.

An evaluation of terrorist acts that occurred in 2016 is shown in [2]. In this paper, the authors have taken into consideration the data of terrorist attacks that occurred in Turkey in 2016. They have used data mining techniques to recognize the most useful machine learning algorithm.

Terrorist attacks in Turkey: An evaluate of terrorist acts that occurred in 2016[2018]

The lowest accuracy came out for KNN although it was good in other measures [4]. Terrorist attacks are the most vital challenging for humankind across the world, which requires the whole attention. To predict the terrorist group which is liable for results and activities utilizing historical info is a tedious task because of the lack of specific terrorist data. Consequently, this paper based on foretelling terrorist organizations involved for attacks in TURKEY terrorist acts that occurred in 2016 by using data mining techniques in analyzing the various beneficial and accessible algorithms used by the machine learning methods. The typical analysis of particular datasets including algorithms is done on the Weka tool depends upon real info drawn through Global Terrorism Database (GTD) from the national consortium for the study of terrorism and responses of terrorism (START). The conclusions of the paper show which algorithm is more suitable for a particular dataset. Tests are conducted on real-life data by using Weka and also the final analysis and inference based on five performance steps which showed that J48, is more accurate than Bayes Net, SVM, and NB but KNN has the lowest classification accuracy although it performs great in other measures. [4]

Predicting terrorism: a machine learning approach. [2018]

The work in [5] has used machine learning approaches for the prediction of terrorist attacks. Through their approach, the policymakers would be able to predict terrorist attacks and how to prevent them and will also help to allocate efficient terrorism combat resources [5]. This paper highlights how machine learning can help resolve terrorism. We perceive that even though machine learning has a reputation for black-box prediction, in fact, it can provide deeply nuanced interpretations of terrorism. Moreover, machine learning is not susceptible to the seldom heroic statistical hypotheses necessary when parametric econometrics is applied to the study of terrorism. This enhances the authenticity of explanations while combining contextual nuance that captures the quality of individualized case analysis. Nevertheless, this method also gives us a sense of the replicability of effects. We, therefore, suggest that it further expands the role of science in terrorism research.

Strategic and experimental analyses of conflict and terrorism. Public Choice [2019]

A group of studies related to this area, describing the connections between them is listed in [6]. An unexpected relation between conservative religious commitment and terrorist activism is depicted in [7]. Conceptual Understanding the root causes of conflict and terrorism eventually will allow policymakers to enact measures to reduce violence's associated costs. This particular concern on "Strategic and Experimental Approaches to the Study of Conflict and Terrorism" consists of articles that analyze issues associated with conflict or terrorism using the tools of applied game theory or experimental economics. This introductory article provides a summary of and describes the relationships between, the studies involved in the specific issue. Conceptual Understanding the root causes of conflict and terrorism ultimately will allow policymakers to formulate measures to diminish violence's associated costs. This special issue on "Strategic and Experimental Approaches to the Study of Conflict and Terrorism" consists of papers that analyze issues related to conflict or terrorism employing the tools of applied game theory or experimental economics. This introductory article provides an overview of and explains the relationships between, the studies included in the special issue. [6]



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International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 11, November 2019

Terrorism's effect on Europe's center-and far-right parties [2019]

Terrorist attacks in Egypt are adversely affecting its economy and also affecting its foreign trade. The impact of terrorism on Europe's center- and far-right parties is explored in [9]. European far-right parties have experienced mixed success in the past few years. The principal elements in many of these parties' policy platforms center on security, terrorism, and foreign persons. Generally, these platforms are designed to draw electoral support that these actors can parlay into administering positions. Our study proposes an important test to determine how voters respond to terrorist attacks concerning center- and far-right parties. We contend that far-right parties are to likely benefit from terrorist attacks more than center-right parties. The results from more than 30 European countries, traversing 1975–2013, assert our hypothesis. The connections for partisanship, governance, and terrorism are explored in this paper as well [9]

Major incidents that shaped aviation security [2019]

The work in [10] operates around the significant incidents that resulted in public aviation, and due to which the security systems of aviation have changed over time. This article is giving a summary of major events in public aviation, that have formed the aviation security policies with time. It commences with industry menaces and security ruptures (hijackings and terrorism), the countermeasures and policy decisions are giving an example of improving aviation security. The study continues by analyzing the impact of 9/11, but also the prevailing threats to public aviation and international efforts in contending them. The purpose is to analyze the consequence of the incidents on the progression of aviation security and find out whether the industry has been reactive or proactive to aviation threat mitigation. This article infers that the security methods are reactively executed, and a proactive approach of the stakeholders has to maintain its course towards the aviation security, as we believe the aviation will have a booming part in the future of transportation.[10]

An Experimental Study of Classification Algorithms for coercion Prediction [2015]

Terrorist attacks are the biggest challenging problem for humankind across the world, which demands the whole consideration of the researchers, practitioners to cope with deliberately. To predict the terrorist group which is liable for attacks and activities utilizing historical data is a complex task due to the scarcity of detailed terrorist data.

This research-based on foretelling terrorist organizations accountable of attacks in Egypt from year 1970 up to 2013 by implementing data processing classification technique to check 5 base classifiers namely; Naïve Bayes (NB), K-Nearest Neighbour (KNN), Tree Induction (C4.5), Iterative Dichotomiser (ID3), and Support Vector Machine (SVM) depend on real data described by Global terrorism Database (GTD) from National Consortium for the study of terrorism and Responses of Terrorism (START). This research intends to present two distinct ways to supervise the missing data as well as provide a comprehensive related study of the used classification algorithms and estimate the obtained results via two distinct test options. Tests are conducted on real-life data with the aid of WEKA and the ultimate evaluation and outcome based on four performance measures which showed that SVM, is more stable than NB and KNN in mode imputation approach, ID3 has the most profound classification accuracy although it appears great in other measures, and Likewise deletion approach; KNN defeated the other classifiers in its accuracy, but the overall performance of SVM is satisfactory than other classifiers. [11]

Evolving data processing Algorithms on the Prevailing Crime Trend – Associate in Nursing Intelligent Crime Prediction Model. [2011].

Crime is a behavior variation from the regular activity of the standards giving people losses and harms. Crimes are a social annoyance and cost our society greatly in numerous ways. In this paper, we look at the use of missing value and clustering algorithms for crime data using data mining. We will look at the MV algorithm and Apriori algorithm with some improvements to assist in the process of filling the missing value and identification of crime patterns. We implemented these techniques to real crime data. Crime prevention is a vital issue that people are dealing with for centuries. We also use a semi-supervised learning technique in this paper for knowledge discovery from the criminal records and to help improve the predictive accuracy [12]



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TGPM: Terrorist group prediction model of counter-terrorism. [2012]

Prediction of the terrorist group using archival data of attacks has been less investigated due to the shortage of specific terrorist data that hold the terrorist group's attacks and activities. The reasons may be its confidentiality & sensitivity. In this article, we have noted a terrorist group prediction model (TGPM) to predict the terrorist group involved in a given attack. This model originally learns similarities of terrorist incidents from various terrorist attacks to predict the engaged group. The model has been verified with the experimental results. The overall performance of the model shows an appropriate degree of accuracy. [13]

Performance analysis of Lazy And call Tree Classifier: a knowledge Mining Approach for world Celebrity's Death Analysis. [2018]

In the present world, data is a precious asset. The best utilization of this asset using technology gives an upper hand to an organization. Technologies like machine learning, data mining, and artificial intelligence are no exemption to this either. Celebrities influence common people's behaviors through biological, psychological and social means to a vast extent. Concurrently there is an immense inequality amongst their demise over the cause, region, and age. Hence, it is a challenging and interesting endorsement to work upon. The purpose of this work is to come up with a comprehensive conclusion to understand celebrity deaths by examining the incidence that happened over the decade. The database for training is built from the public and open-access databases for years 2006–2016 containing 11, 200 reported deaths over the globe. Conclusions of the work are year by year extraction of death, the reason behind it, age, gender, and place. Lazy and decision tree classifier model of data mining is being used for the analysis based on the service as an evaluation class. [14]

Web data processing Technologies and Their Applications in Business Intelligence and Counter-terrorism. [2003]

The report of Web-based data has created a demand amongst executives and technologists for ways to identify, collect, interpret, and use data that may be of importance to corporations and organizations. The growth of data mining and the larger field of Web mining has trades failed within a complicated puzzle of mechanisms and procedures for obtaining and handling crucial intelligence.[15].Web data processing and Applications in Business Intelligence and Counter-Terrorism reacts by conferring a transparent and thorough summary of internet mining, with emphasis on CRM and, for the first time, security and counter-terrorism applications.The tools Associate in Nursindg strategies of internet mining ar disclosed in an easy-to-understand vogue, featuring the importance of practical, hands-on experience in the formulation of successful e-business solutions. [15]

The author, a program director for information and Applications Security at the National Science Foundations, options however each opportunity and threats the online may be recognized and managed.Provided with the knowledge contained in this work, businesses can collect and analyze Web-based data to help improve customer relationships, increase sales, and identify existing and potential threats.Organizations will implement these same net mining techniques to battle the important and gift crisis of terrorist acts, showing net mining's vital role within the intelligence arsenal. [15]

Training linear SVM in linear time. [2006].

Linear Support Vector Machines (SVMs) became one all told the leading outstanding machine learning techniques for superior dimensional distributed knowledge usually found in applications like text classification, word-sense elucidation, and drug vogue.

III. CONCLUSION

Examining the variable parameters like a month, Target_type, attack_type, our trained models predict the region of attack and terrorist behavior patterns. Six supervised machine learning algorithms are being used namely Gaussian Naïve Bayes, Logistic Regression, and Linear Discriminant Analysis, Support Vector Machines, K-Nearest Neighbours and decision trees. By applying the above algorithms, we concentrate on getting the highest accuracy possible for predicting terrorist activities. The outcomes of the presented work can be adopted for enhancing defense against terrorist attacks in future times.



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Vol. 6, Issue 11, November 2019

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