IJCSN - International Journal of Computer Science and Network, Volume 8, Issue 3, June 2019
ISSN (Online) : 2277-5420
www.IJCSN.org
Impact Factor: 1.5

Airline Passenger Profiling Based on Long Short-Term Memory

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Abstract-The threat of terrorism has an important topic on airport security measures .While passengers face ever-longer lists of prohibited items, security experts increasingly argue that it is passengers themselves, not the contents of their bags, that need to be scrutinized. If passenger profiling works, it would be an effective way to prevent terrorists from attacking and save time and money for everyone else. Passenger profiling play an important role in aviation security. Some of the methods used for this is not efficient because of complication of data. Here proposed a new system that first normalizes the time related data, so that each attribute represent the data in the same data space. After normalization the dimension of data will be reduced using Principal Component Analysis. The dimensionality reduced time related data is termed as LSTM (Long Term Short Memory)to find the pattern that can distinguish between a normal passenger and risky passenger. The LSTM provides much more accuracy than a traditional neural network as it is more capable to detect the pattern in a time related data .The test data is evaluated against the trained model and predicts the result more accurate than traditional ones.

Keywords-Principal Component Analysis, Long Term Short Memory, Normal Passenger, Risky Passenger

1. Introduction

Profiling may be an inevitable response to the dangers evident at airports. Every month, over 40 million people travel by air in this country. It is simply practically impossible to closely scrutinize every passenger while maintaining a functionality for airline security based travel system. The use of profiling is to recognize airplane passengers who threatens and know about the safety of the flight, based on appearance, behavior, and personal information. Airline passenger profiling raises important constitutional considerations that should not be dismissed simply because more security is needed at the nation's airports. Terrorists may go undetected by behavior pattern recognition profiling, despite that the technique's success in capturing other criminals. Terrorists may be trained for long periods in how to control suspicious behaviors. And there are no existing profile templates for how terrorists behave, so it would be difficult to come up with a profile that predicts their specific ways of behaving. This paper proposes a machine learning approach to passenger profiling using a recurrent neural network called Long Short Term Memory (LSTM) which is processing a time seriesed data and usually detected predictive problems. The passenger is assigned to be in several classes each of this is corresponds to a particular level of risk values. We construct a neural network and train the input data using LSTM, which classified the passenger into two classes based on risk values ie, normal passenger and risky passenger.

2. Related Work

Huseyin Cavusoglu, Byungwan Koh, Srinivasan Raghunathan [1] proposes Transportation Security Administration (TSA) manually inspects all those passengers classified as attackers and sends others through a screening system, as it did called the Computer Assisted Passenger Prescreening System (CAPPS), then it is superior to no profiling on all four performance measures if and only if the quality of the profiler of the screening system is high. If the quality of the screening device is very high, profiling could be detected by all four performance measures. On the other hand, when the TSA deploys two screening devices along with the profiler, each screening device optimally configured among each of the two groups of passengers then

profiling improves the reliability of screening device signals minimize the inconvenience caused to normal passengers, and improves the social welfare when quality of the screening device is high. One of the implementation of finding the security architecture used by the TSA when it deployed CAPPS could provide a strong support to the arguments by some against the use of profiling, if the TSA deploys a two-screening device architecture, it might not affect the criticism that profiling is discriminatory but also benefit normal passengers and all over the society economical.

Samidh Chakrabarti and Aaron Strauss [2] proposes Carnival Booth: An Algorithm for Defeating the Computer-Assisted Passenger Screening System. CAPS uses profiles to select passengers for growing scrutiny, then it is actually less secure than systems that provides random searches. Carnival Booth is defined how a terrorist cell can defeat the CAPS system. Using a combination of statistical analysis and computer simulation, evaluate the efficiency of Carnival Booth and demonstrate that CAPS is an ineffective security measure. Using computer simulation how a terrorist cell can increasing their chance of mounting a successful attack under CAPS system as opposed to a security system that uses only random searches. A CAPS strengthens security by introducing gaping security hole easily exploitable by terrorist cell.

John E. Kobza [3] introduces Multilevel Allocation Problem (MAP), which models the screening of passengers and baggage in a multilevel aviation security system. A passenger is screened by one of several classes, using security screening devices, where passengers are classified by their perceived risk levels. This paper describes a systematic approach for designing an enhanced passenger screening system using discrete optimization models and algorithms, by formulating a problem that models multilevel passenger prescreening strategies. A set of N passengers, each of which is characterized by an assessed threat valueAT1, AT2……. ATN with 0 < ATi · 1; i = 1, 2…..N, a set of M classes. Passenger assignments for the N passengers to the M classes by A1,A2…..AM,N represents the subset of passengers who are assigned to class i, and define the risk level Ri of class i = 1, 2……M as the proportion of assessed threat values of the passengers assigned to class i.

Yu-Jun Zheng, Wei-Guo Sheng, Xing-Ming Sun, and Sheng-Yong Chen, [4] introduces a deep learning approach for passenger profiling. Develop a deep neural network (DNN) for classifying normal passengers and potential attackers, and further develop an integrated DNN for finding group attackers whose individual features are insufficient to reveal the abnormality.

3. Design & Implementation

The proposed architecture is shown in Fig 1.We proposed a long short term memory model for airline passenger profiling. First normalize the input data set to provide a common data format and then extract the features through dimensionality reduction using principal component analysis technique. In this passengers are classified into two groups that is normal passenger and risky passenger based on their risk values. The passenger with higher risk value is categorized in risky passenger class and lower risk or with no risk value is categorized into normal passenger class based on the appropriate risk values.

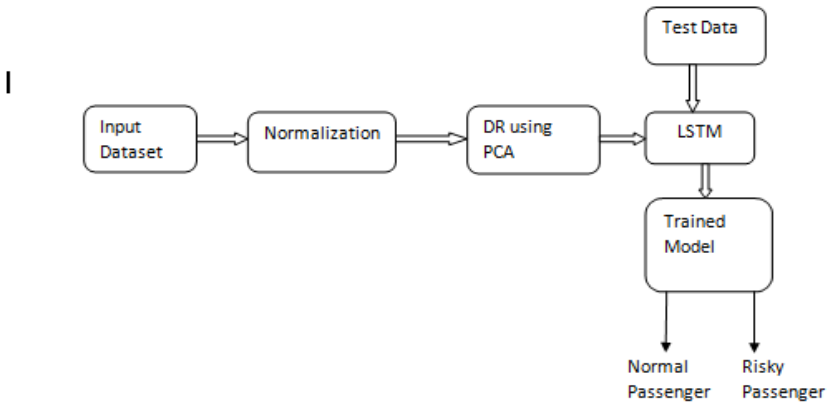

Fig 1:Proposed System

3.1 Artificial Neural Network

Artificial Neural Networks (ANN) have many different coefficients, which it can optimize. Hence, it can handle much more variability as compared to traditional model .ANN is rarely used for predictive modeling. The reason being that Artificial Neural Networks (ANN) usually tries to over fitting the relationship.

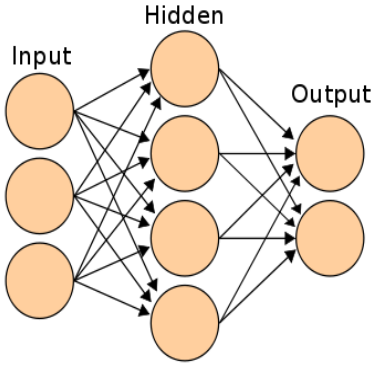

Fig2: Artificial Neural Network

3.2 Principal Component Analysis

The main idea of principal component analysis (PCA) is to reduce the dimensionality of a data set consisting of many variables correlated with each other, either heavily or lightly, while retaining the variation present in the dataset, up to the maximum extent. The same is done by transforming the variables to a new set of variables, which are known as the principal components (or simply, the PCs) and are orthogonal, ordered such that the retention of variation present in the original variables decreases as we move down in the order. So, in this way, the 1st principal component retains maximum variation that was present in the original components. The principal components are the eigenvectors of a covariance matrix, and hence they are orthogonal.

3.3 Recurrent Neural Networks

Recurrent Neural Network (RNN) are a type of Neural Network where the output from previous step are fed as input to the current step. In traditional neural networks, all the inputs and outputs are independent of each other, but in cases like when it is required to predict the next word of a sentence, the previous words are required and hence there is a need to remember the previous words. Thus RNN came into existence, which solved this issue with the help of a Hidden Layer. The main and most important feature of RNN is Hidden state, which remembers some information about a sequence. Suppose there is a deeper network with one input layer, three hidden layers and one output layer. Then like other neural networks, each hidden layer will have its own set of weights and biases, let's say, for hidden layer 1 the weights and biases are (w1, b1), (w2, b2) for second hidden layer and (w3, b3) for third hidden layer. This means that each of these layers are independent of each other, i.e. they do not memorize the previous outputs.

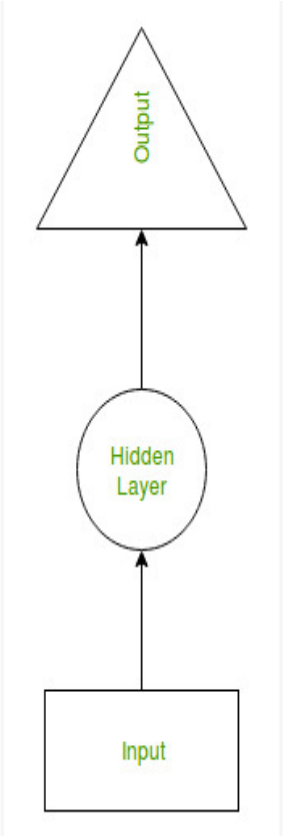

Fig3:Recurrent Neural Network

3.4 LSTM Networks

Long Short Term Memory networks – usually just called "LSTMs" – are a special kind of RNN, capable of learning long-term dependencies. LSTMs are explicitly designed to avoid the long-term dependency problem. Remembering information for long periods of time is practically their default behavior, not something they struggle to learn. All recurrent neural networks have the form of a chain of repeating modules of neural network. One drawback to standard RNNs is the vanishing gradient problem, in which performance of the neural network suffers because it can't be trained properly. This happens with deeply layered neural networks, which are used to process

complex data. Standard RNNs that use a gradient-based learning method degrade the bigger and more complex they get. Tuning the parameters effectively at the earliest layers becomes too time consuming and computationally expensive. One solution to the problem is called Long Short-Term Memory (LSTM)

4. Result Analysis and Discussion

An RNN remembers each and every information through time. It is useful in time series prediction only because of the feature to remember previous inputs as well. This is called Long Short Term Memory. Recurrent neural network are even used with convolutional layers to extend the effective pixel neighborhood. LSTM are explicitly designed to avoid the long-term dependency problem. It is more efficient than Traditional Algorithms. It is a Processing Time serized data that is more accurate than previous methods.

Tabe1:Result Analysis

ALGORITHM	ACCURACY(%)
LSTM	94.56
Naïve Bayes	84.71
ANN	82.06

5. Conclusion

This paper introduces a Machine Learning approach for Passenger Profiling. DR using PCA is for normalizing the input data set and preprocessing the unwanted features. LSTM method is used to train the input dataset and this is an efficient method used for time sequence processing. The proposed method provides the airline profiling more secure and it is less time consuming and avoid manual interaction.

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