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Recognition of Serious Issue Haunting the Social Media Platforms to Detect Fake Accounts Using Machine Learning

B. Swetha

Assistant Professor, Department of Electronics and Communication Engineering, Malla Reddy College of Engineering for Women, Hyderabad -500100, Telangana, India

Abstract - Social media is presently a significant piece of our daily life. Currently more than the half of the world is an active user of the social media platforms. The ever -increasing popularity of these platforms has also given rise to a major issue which is the presence of fake accounts on them. These fake accounts serve the purpose of impersonating or cat-fishing other people. They have become an easy way to sell fake products and services to the customers. Also, the personal data of billions of people are at stake. These threats have made it essential to detect and deactivate the dummy accounts before any harm gets done. By the virtue of Machine learning it has become easy to automatically detect millions of such accounts in a matter of seconds. In this project, we explore a deep learning model that can be used to classify a given account as real or fake, especially in Instagram. In the proposed work accuracy of the model is 93.63 percent.

Key Words: Social media, Instagram, Deep Neural Network, Artificial Neural Network, Fake account

1. INTRODUCTION

Throughout the human history people have worked on developing better ways of communication. One such attempt led to the birth of social networking sites in the 1990s. Though it took sometime for people to catch on with these sites but by the early 2000s the social media platform began to flourish [1]. At least 3 social networking site were launched every year. The world witnessed one of the biggest revolution of all time. Currently everyone feels the need to have an online presence. The social media has become the number 1 activity on the internet [2]. In 2010 the number of active users of social media was 970 Million, within a decade this number rose upto 3.6 Billion in 2020. In the coming 5 years it is expected that the social media will continue to bloom, eventually attracting more than 4.41 Billion users by the year 2025.

The social media platforms have also seen an increase in the number of accounts which provide services or products in exchange of money. But most of these accounts are fake, as a result thousands of people are sold fake products and are promised fake services by these accounts. Sometimes these fake accounts are used by companies to build hype for their bad products and services [4]. Another big issue associated with the fake accounts is the amount of data overload that they are resulting in. With such a large number of users the social media platforms create a lot of data. It is estimated that by the year 2025 even Google data centres will suffer from data overload. According to a survey 500 Million women have Facebook account but the population of women in the world is only 300 Million [5]. The survey also reveals similar case for other social media platforms as well. The growing threats of these fake accounts has made it necessary to take them down. With the number of fake accounts being in millions it has become impossible to manually detect them. Luckily the advancement in digital technology can benefit a lot in this situation. Methods like Machine Learning can help in making the stratification process a lot easier and accurate.

This project involves use of deep learning model to classify social media accounts as genuine or fake. An Artificial Neural Network (ANN) model is used to support the stratification process. The upshot of the model is analysed using confusion matrix and graphs.

2. LITERATURE SURVEY

Researchers around the globe have worked on a lot of methodologies to detect phantom profiles. These method involve extracting some features from the target account and feeding them to a trained Machine Learning classifier. This classifier looks for patterns in the given data and eventually based on the discovered pattern labels a given account as legitimate or fake.

For instance Samala Durga Prasad Reddy (2019) [6] used a random forest classifier to detect fake accounts with 95% accuracy. Profile features like id, name, status count, followers count, friends count, location, date of creation of the id, numbers of shares done by the account, gender and language used by the account holder were used as features for the classification process.

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S. P. Maniraj, Harie Krishnan G, Surya T, Pranav R (2019)[8] have defined a profile as phoney on the off chance that it doesn't coordinate with the characterised commitment rate or has actorly activity or is involved in spamming. They have utilised gradient boosting alongside decision tree for the purpose.

The researches done so far make use of traditional machine learning algorithms like random forest, naive bayes, SVM, and decision tree. These methods are incapable of doing feature selection on their own. Thus the researcher has to study relation between the features and target variable in order to decide which features are to be considered and which can be rejected. Another drawback being their inability to adapt with the changing patterns in the input dataset which can make them insufficient at times. Hence these methods require constant monitoring. The changing patterns in the input can cause them to give incorrect results thus reducing the accuracy. Also one major issue with them is that they do not perform well if the dataset is too large or is unstructured. This makes traditional methods highly unsuitable for real life scenarios as in such cases the data is mostly unstructured and often too large.

Owing to the drawbacks of the traditional methods it has become necessary to explore advance algorithms like deep neural network. Deep neural network is a highly efficient method which can be used to replace the traditional machine learning methods. It works very well on unstructured data and perfectly deals with large datasets. The major drawback of feature engineering which existed in case of traditional machine learning algorithms is eliminated in case of deep neural network. It does not require the researcher to specify the features to be used instead it itself decides which features are important and which do not affect the result. This makes deep learning effective and accurate.

3. PROPOSED SOLUTION

Each social media profile has a lot of data associated with it like the user name, account holder's name, number of friends of the user, date of birth of the user, phone number of the user, etc. We can make use of the associated data to comment on the genuineness of the account. In this research we have used deep neural network to recognise fake Instagram accounts. A six layered ANN model is used for the purpose. The designed model uses features like username, number of followers, profile description length, number of accounts followed by the user, number of posts etc to declare a given account as genuine or fake. Nowadays for security reasons the social media companies have started providing the facility of making account private to the users but if this method is deployed then they can even access the information of private accounts for examination without any violation of privacy [6].

3.1 Dataset Used

The dataset used for this case study is an open dataset which is available on Kaggle. It was collected using a crawler by Bardiya Bakhshandeh [9]. The dataset has details of 696 Instagram accounts. These 696 data entries are divided into 2 folders train set and test set. The train set has data of 576 accounts and the test set has data of 120 accounts. Both train and test set are balanced meaning they have a ratio of 1:1 between real and fake accounts, i.e., the train set has 288 real and 288 fake account details and test set has 60 real and 60 fake account entires. The target variable which expresses whether the given account is real or fake can take up 2 values 0 and 1. The value being 1 if the account is fake and 0 if the account is genuine. Other than the target variable the dataset has 10 features out of which 4 take binary value and the rest take integer value. Before the dataset can be used for the estimation process it is essential to process it. The dataset was checked in order to eliminate any missing values. Fig-1 shows the dataset used for the training purpose.

profile pic	nums/length username	fullname words	nums/length fullname	name==username	description length	external URL	private	#posts	#followers	#follows	fake
1	0.27	0	0	0	53	0	0	32	1000	955	0
1	0	2	0	0	44	0	0	286	2740	533	0
1	0.1	2	0	0	0	0	1	13	159	98	0
1	0	1	0	0	82	0	0	679	414	651	0
1	0	2	0	0	0	0	1	6	151	126	0
1	0	4	0	0	81	1	0	344	669987	150	0
1	0	2	0	0	50	0	0	16	122	177	0
1	0	2	0	0	0	0	0	33	1078	76	0
1	0	0	0	0	71	0	0	72	1824	2713	0
1	0	2	0	0	40	1	0	213	12945	813	0

Fig -1: Training dataset

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3.2 Artificial Neural Network

ANNs are computational models that are designed to emulate the human brain. The working of the brain is used as a basis by the ANN for development of complex algorithms that can be used to solve a given problem. Like the human brain ANN can decipher and arrive to a conclusion from a given vague information. ANN is made up of thousands of artificial neurons which are simply called units or nodes. These nodes are like the natural neurons both in structure and working [10].These nodes are connected to each other to form layers and the interconnection of these layers produces a web like structure which is called a network.

A fundamental ANN comprises of input, hidden and output layers. The input layer accepts input from the outside world. The nodes present in the input layer are passive in nature, this means that they are incapable of making any changes in the data provided to them. The input provided to this layer can be in form of a pattern or a vector in case of visual data. This accepted input is then transformed into something meaningful by the hidden layers. The hidden layers refine the features of the input before passing them on to the output layer. Finally the output layer responds to the given information and produces output for the system. Based on the number of hidden layers an ANN can either be shallow neural network or deep neural network. An ANN becomes shallow if it has a single hidden layer between the input and the output layer and it becomes deep it has at least 2 hidden layers in between the layers taking information and the layer giving yield. Since deep network has more than a single hidden layer learning becomes faster. Fig-2 depicts this difference. The number of hidden layers in an ANN model should be decided in such a way that it avoid both over-fitting and under-fitting.

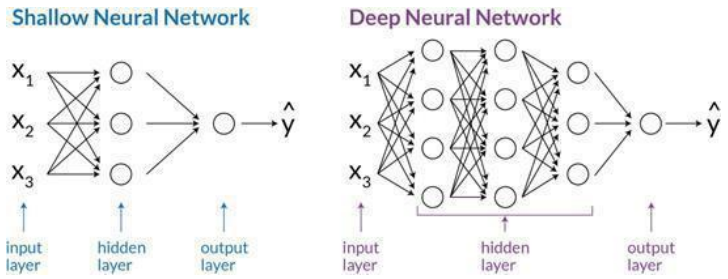

Fig -2: Shallow and deep neural network architecture

Apart from the number of hidden layers we can also use the direction of flow of information to classify an ANN. Based on this criteria an ANN can be feed forward or feed backward. In a feed forward network the information can only flow in forward direction, i.e., it is unidirectional and has no feedback loops. On the contrary feedback network allows the existence of feedback loops in its structure. Fig-3 shows feed forward and feedback network [17]. Each neuron is connected to all the neurons in the previous and the next layer. Thus the neurons are said to be interconnected to each other. Each interconnection between the neurons has weight associated to it. This associated weight can be positive, negative or even zero. The output of a neuron gets multiplied to the weight associated with the interconnection through which it travels to the next neuron as input. Thus the strength of an information signal gets altered after it is multiplied with the weight. The signal might become weaker or stronger depending on the weight [11]. The strength of a signal might even become zero if the associated weight is zero. The model tries out a number of combinations of weights during the training process to find a combination which gives the most accurate prediction [12]. All the inputs arriving at a neuron are multiplied with their corresponding weights and then added. This weighted sum is then added to a bias to scale up the response of the system or to make the weighted sum non zero incase it takes value as zero. After addition of bias to the weighted sum it is passed through an activation function. An activation function is a transfer function which is used to get desired output from the weighted sum.

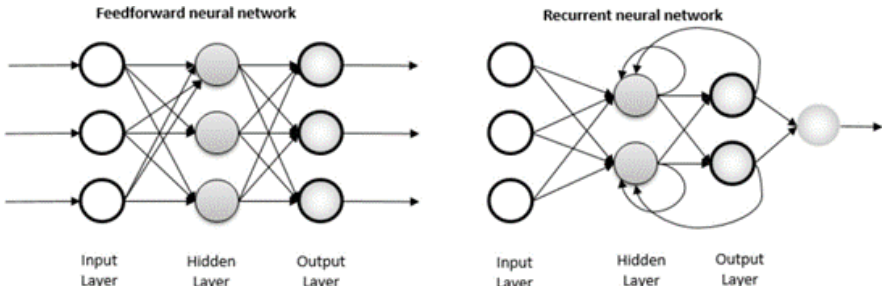

Fig -3: Feed forward and feedback network

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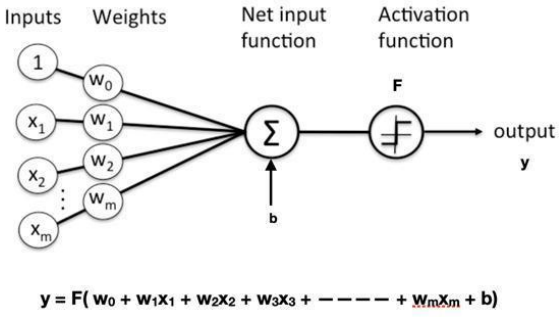

Fig -4: Working of a single node

An ANN has to go through a training phase before it can actually start making predictions. During the training ANN works on recognising the various patterns present in the data, these patterns can be visual, textual or even vocal. In case of unsupervised learning ANN simply learns to group the given data in clusters depending on the similarity shown by them. In case of supervised learning the ANN model checks the output predicted during the training with the actual output while adjusting the weights to obtain the most accurate structure. Another type of learning is reinforcement learning where the model interacts with the environment to get its state and then chooses an appropriate action to change its state. This chosen action gets sent to a simulator which gives feedback to the model in form of a numerical reward that can take positive or negative value. Based on the review received from the simulator the model changes or keeps its action. The model uses trail and error approach to find the most suitable action [18]

4. RESULT AND DISCUSSION

The proposed model gives an accuracy of 93.63 percent with 0.18 percent loss. To further study the performance of the model we can use confusion matrix and learning curves.

4.1 Confusion Matrix

Using confusion matrix we can describe the performance of the classification model [13]. Fig. 6 shows the confusion matrix for the deep learning ANN model proposed in this project. It can be further used to find out precision [14] and recall [14] of the model.

Precision is the ratio of true positives to the values predicted correctly. It is defined in Eq.3, given as follows :-

$$precision = \frac{true\ positives}{true\ positives + false\ positives}$$

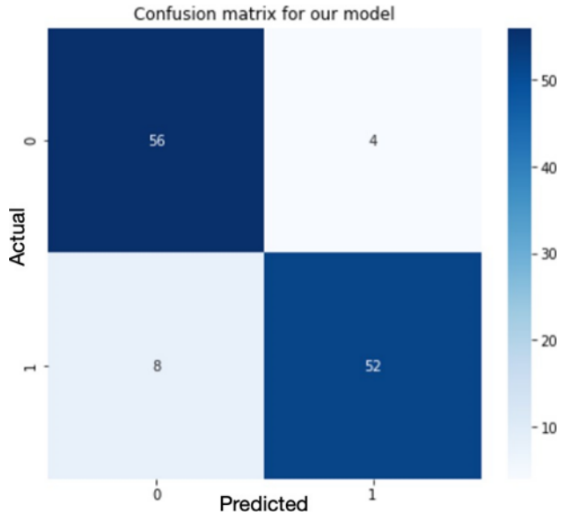

Fig -6: Confusion matrix for the model

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4.2 Accuracy and loss of the model

Graphical outputs of the model can be used to check if it is over-fitted, under-fitted or perfectly fitted [15]. Fig-7 depicts the loss as the training process advances.

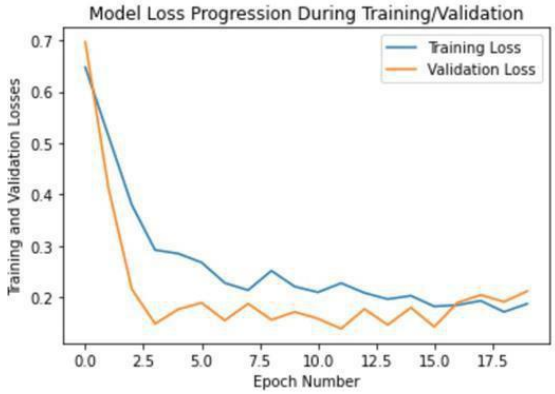

Fig -7: Graphical representation of losses wrt epochs

It can be observed that the training loss decrements with increment in epochs, same can be said for validation loss. Fig-8 represents the accuracies of the model which increments with epochs. In order for the model to be efficient the training and validation loss as well as accuracy should be comparable.

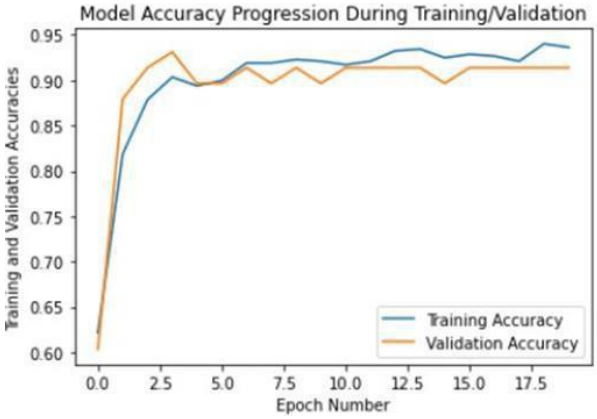

Fig -8: Graphical representation of accuracies wrt epochs

5. CONCLUSIONS

In this research we have recognized a serious issue haunting the social media platforms which is the ever increasing number of fake accounts on them. To overcome this problem we have proposed a deep learning model which can be used to identify the dummy accounts in matter of seconds which can be then removed before they cause any serious harm to the people. The suggestion of a deep learning has been done in this project keeping in mind the drawbacks of the currently existing methods. The model used studies the data associated with the accounts to derive a relation between it and the genuineness of the account. To represent the performance of the model we have used confusion matrix and learning curves along with the accuracy of the model. The model has shown good performance in case of both training and testing set. Currently only the data available for Instagram profiles has been used for the training and testing purpose but in future we can also train the model to identify fake accounts on other popular platforms like Facebook, LinkedIn, Twitter and many more by providing an efficient dataset for them.

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