EXPLORING OF MACHINE LEARNING ALGORITHMS FOR PERSONALITY PREDICTION OVER SOCIAL MEDIA

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ABSTRACT

Social Media is the best example of the advancement of technology. Personality prediction is used to define the personalities of users on the basis of their online activities. These strategies may vary with machine learning techniques, various data source materials, and multiple data sets. This paper aims to identify and to predict the characteristics of social media users depending on the various features and measures of 5 personality models. The results are predicted based on analyzing the various frameworks of online communities and grammatical structures like tweets, posts, and profile information and status related to personality interactions. This can be predicted firstly, by analyzing and understanding the relationship between users and behavior interactions between them. Secondly, identify the higher potential network feature by different machine learning algorithms and define the relationship between the different dictionaries and feature sets and data sets. With the help of numerous machine learning algorithms such as Regression Analysis, Gradient Boosting, Support Vector Machine, and Neural Networks algorithms and distinct machine learning approaches, analyze the correlation and similarity across each data set and personality traits. Therefore the outcome of the accurate personality prediction shows that the different personalities under the data set have been tested. The best performance will be achieved by understanding the specific Social Network Analysis (SNA) and SPLICE, LIWC proposed in the feature extraction, which helps to predict high-precision personalities

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KEYWORDS

Behavior, OCEAN Model, Personality Prediction, Social Networking.

INTRODUCTION

Personality is the way where the person responds to a particular situation. It is the combination of different characteristics that make a person unique. In recent times, the rapid growth in social networking sites like Facebook, Twitter, YouTube, and LinkedIn is now the most popular destination for Netizens [1]. The user's different activities that are performing on the different social networking sites provide a unique and best platform for different researchers and scholars to analyze and helps to understand the different personalities and behaviors of each individual. Different users with different personalities and interactions between the personalities on social media with different social relations such as status and profiles help us to predict the user's personalities. Normally by creating an account on social media sites like Facebook, Twitter, YouTube, and LinkedIn people are giving the right to others to collect their information. So, different attributes of these social media sites are useful for estimating the personalities of every individual.[1]-[2]. Based on social behavior and information towards friends and relatives groups are more helpful to successfully predict someone's personality[1]. This study of paper predicts personalities based on a user's social behavior and the language used by the user and habits and status on Social media platforms [1]. Firstly it will identify the most similar features of each user. Next, it proposes a method for a better understanding of the Social Network Analysis (SNA).

The SNA is categorized into two different categories. They are[5]:

- Linguistic Inquiry and Word Count (LIWC).
- Structured Programming for Linguistic Cue Extraction (SPLICE).

These two features will be understood based on the dataset. Here it will define the relationships between each of the features in the dataset and with personality traits [1].

Study of Social Media

Social media or social networking sites are giving people a platform to interact with each other either personally or professionally [1]. The popularity of social media sites like Facebook, Twitter, YouTube, and LinkedIn has developed incredibly in recent years. The social media experiences user's ability to perform the following actions [2]: Social account of each individual helps in posting self-information on their profile page and status page and interaction between friend's, followers and relatives. Expansion of individual networks will be done by increasing connections with people. There is also a feature available that provide notifications of people that whether accepting their friend request or blocking their

request. Social media can be analyzed based on two types of analysis[2]. They are:

- Content-based
- Linkage based

Content-Based Analysis:

Social Media sites like Facebook, Twitter, YouTube, and LinkedIn have a massive amount of content in either text, image audio, and video type. This type of analysis is called content-based analysis [2].

Linkage Data-based Analysis:

Different social networking sites can be analyzed based on mapping, and the relationships between various entities. Here the linkage will be represented based on different types of nodes & edges [2].

Personality Assessment Fundamentals:

Mostly there are two important fundamentals are available on which most of the researchers work on personality assessment with social media data. The two most used methods are Personality Models and the prediction Algorithm which are used to calculate the personality [2]-[5].

Personality Models:

There are famous personality tests that are accessible for anyone to check the components of their identities are represented with the name of the BIG 5 MODEL [1]. In the beginning, the big 5 models were defined as Assurgency, Agreeableness, Conscientiousness, Emotional. Later by some famous scholars, this big 5 model has become the OCEAN model. And the OCEAN is viewed as Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism [1].

Table- I: OCEAN PERSONALITY MODEL

Personality Trait	Description
Openness	Curios, original, intellectual, creative.
Conscientiousness	Organized, systematic, punctual, and achievement-oriented.
Extraversion	People think less and act more, talkative, sociable, and connect with others easily.
Agreeableness	Tolerant, sensitive, trusting, kind.
Neuroticism	Anxious, irritable, temperamental, and moody.

Big 5 Personality Model:

This is a 5-factor model which is popularly known as the BIG 5 MODEL developed on characteristics of the personality in the field of psychology. The big 5 model consists of elements explained in table1.1 OCEAN PERSONALITY MODEL[1]. Description of the Big-5 Model as follows [3]:

Openness:

Openness is closely related to the open mind personality, which describes as curiosity creative ideas, balanced discussion with others. They are always like and willing to learn new things that others can't do normally [3].

Conscientiousness:

Conscientiousness is mostly related to the people who have a developed nature of behavior and discipline and liked to complete their work in time in a planned manner. They are more effective and most perfect to be a leader and clear-minded with clarity of thoughts [3].

Extroversion:

An extrovert is a person who has ability to connect with others better in the outer world. The extroverts think less and act more. Introverts are those who think most and often all the changing inventions were done by them. Extraverts often act on their instincts [3].

Agreeableness

Agreeableness mostly relates to a direct attitude and being humble, generous, and full of compliance and trust in others. Most people with these characteristics are good team players.[3].

Neuroticism

Neuroticism is mostly related to negative attitudes such as anger, depression, anxiety, inferiority complex. People with these characters are not best fit to employable or work under pressure [3].

Why Study Social Media?

There are three reasons why social media i.e. Facebook, Twitter, YouTube is relevant to social scientists for analyzing different personalities [1]-[2]. Activities performed on social accounts are considered huge data sets. And the content and the interconnections and linkage o data available on the social account used for various analyses. Online social networking sites and social accounts have both benefits and dangers which are needed to be analyzed and understand carefully. The popularity of Social Networking sites also helps the researchers to study more and to predict the results with high accuracy [1]-[2].

MACHINE LEARNING ALGORITHMS

Machine Learning:

Machine learning is the new field in analyzing psychology. Broadly the machine learning is classified into two main categories[4].

- Supervised Learning
- Unsupervised Learning

Supervised Machine learning:

Supervised classification will also provide the basic information from the user end. The information provided by the user may be in different forms[4]. The supervised machine learning is helped in learning different cases from the data input and to predict the values from the different inputs. Naïve Bayes algorithm or method is the best example to understand

the supervised learning algorithm. The supervised learning algorithm is categorized into two different categories[4]:

- Regression Technique
- Classification Technique

Unsupervised Learning:

Unsupervised learning in machine learning predicts the values by itself with some algorithms without user-provided information. The most used unsupervised learning algorithm is clustering[4]. Clustering is a technique in which the distance formulas helps for finding distances and plays a major role in finding the cluster head. Different cluster heads form a region [4]. The algorithms that are used for predicting the personalities of the user's on the social media platform are the Naïve Bayes algorithm, XGBoost algorithm, and Neural Network algorithms [8]. Choosing the best and suited algorithm plays a major role in developing different models to define the personalities. The algorithms used are:

- Naïve Bayes Algorithm
- XGBoost Algorithm
- Neural Network Algorithm
- Logistic Regression
- Gradient Boosting
- Support Vector Machine

Naïve Bayes Algorithm:

Naïve Bayes Algorithm is one of the classification methods that will work on Bayes' theorem based on the idea of different independence predictors. Naïve Bayes assumes a particular feature of a class that is unrelated to the occurrence of any other features[8]. The assumed features are statistically independent. The theorem completely works on the assumption of the input parameters that are distinct from one another, i.e. there would be nothing to know about some other factors that are given in other classifiers [11].

XGBoost Algorithm:

XGBoost algorithm is abbreviated as e**x**treme **G**radient **B**oosting. It is a tree-structure based decision-making ensemble algorithm that uses gradient-boosting technique[8]. Values and classes that predict include unstructured data, i.e. images and text, etc.,[8].

Neural Networks Algorithm:

The neural network algorithm is a set of algorithms that helps to analyze and to understand the different relationships in the dataset through a process in the human brain operators. It adapts to changing the inputs so that the neural network can generate the best result without reconstructing the output[8]. The basic neuron collects input and processes some mathematical calculations and generates output. The activation function helps to unbind the input to output into a predictable form. The most used activation function is a sigmoid function[8]. Neural networks can be formed with three main levels of neurons. The layers are input, hidden layer & output. The hidden layer consists of multiple neurons that are connected between the input layer and the output layer. The neuron's weights and strengths are fine-tuned and allow the different networks to calculate the accurate prediction results [8].

Logistic Regression:

Regression Analysis is a supervised learning model that is used to anticipate the accuracy of the target variable. The possible existence of so many targets or predictor variables is dualistic means which will only take place in mainly two classes[8]. This can be analyzed based on the concept of probability. The sigmoid function helps in mapping the prediction values. The function maps the values in between 0&1[8].

Gradient Boosting:

Boosting is a way of transferring a weak classifier into a strong classifier. Gradient Boosting is an **Ensemble Learner**[8] i.e., it will create the final optimized model from different individual models. Combining such different weak models in an ensemble helps an overall improvement of the results and efficiency. The most commonly used weak models are decision trees and that is parallel to Random Forest [8].

Support Vector machine:

Support Vector Machines (SVMs) seem to be the most powerful and flexible supervised machine optimization models and most frequently used for both classification and regression techniques. In particular, they are being used to solve classification problems[8]. The goal of the SVM is to find the hyperplane that classifies the different data points[11]. To separate the two different classes many possible hyperplanes can be chosen but finding the plane which has the maximum margin and the maximum distance between the classes is important [8].

RELATED WORK

The study [1] identified that a Neural Network machine learning approach is the best-suited way to predict the personalities using the Big 5 Model. Social networking sites and digital networks account like Twitter, Facebook, LinkedIn and YouTube are the different and major sources for human interaction where multiple users allowed sharing their opinions and feeling with others. The social networking sites with massive information helps the researchers to analyze and to predict the different personalities. The personality prediction helps and makes it possible to understand the users based on their interests and needs. The prediction can also be applied to various domains like marketing, sociology, psychology, and business intelligence. The individual's personality traits can be obtained based on the linguistic information collected from the Big 5 personality model. Several applications can predict the personalities they help identify the sentiments in the hidden message. determining the characteristics based on the Big-5 model shall be considered as "Multi-Label Classification". In the big 5 models, the personalities are categorized namely Openness, Conscientiousness, Extroversion, Agreeableness, Neuroticism (OCEAN). This personality prediction work has introduced that this system will work with a group of people with more tweets rather than a single person with a single text. This system consists of 3 modules. First to collect metadata from different social networking sites, second to transfer the metadata into big 5 model classification, finally predicting the data by applying the neural network algorithm.

The personality prediction system consists of majorly 4 modules:

- Data collection
- Data Preprocessing
- Data Transformation
- Data Classification

So, this study facilitates the analysis of user behavior and interests and trends. And the big 5 model helps in identifying the personalities through linguistic information with 35% accuracy.

The study [2] states that Natural Language Processing (NLP) helps in understanding the user's language on social platforms and which leads to predict the user's personality with high accuracy. Stated that semantic features rather than syntactical features help to judge a human's personality. This can be achieved by joining the personality dataset with the user's like's data set which will be a mapping from dataset like id. This allows us to study and to analyze the metadata and along with relations among the metadata and helps in predicting the user's personality. Here two sampling techniques are used, they are Random Sampling which is used to collect the selected element from the dataset, and Stratified Sampling which is used to partition the overlapping and non-overlapping data which leads to equal distribution of data. To find the optimal value different machine learning algorithms are used. Random Forest algorithm is used to create a decision tree and to map with each dimension of data in the user's likes dataset. Linear Regression algorithm which is used to maintain the relationship between each feature in the dataset. The Root Mean Squared Error (RMS) and Mean Squared Error(MSE) both methods are used to predict the target value. The study has achieved 40% of prediction and predicted 15% of the target value from different optimal personalities.

The study[4] defined that the personality will be predicted by setting several classification techniques with a large number of dimensions and by constructing a large number of questionnaires to measure the users. The text, audio, and video information that uploads by the user play a key role in the definition of personality. The data sets with metadata are inserted into a multi-layer perceptron (MLP). The theme of using MLP is to predict the data from multiple inputs. The Convolution Neural Network (CNN) helps in identifying the monogram, diagram, n-gram features of a single piece of text and helps in removing the neutral sentences and to mark the important text. Recurrent Neural Network (RNN) helps in identifying the linguistic information from the different feature sets. The identified stylish data is categorized into two groups they are N-grams and POS N-grams. The Support vector machine, the Hidden Markov Model are used in detecting the true personalities from each text. And CERT (Computer Expression Recognition Toolbox) is the technique that is used to determine the Facial Expressions. The facial expressions and emotions also help and very useful in predicting the personalities. New architectures with more features are helpful in mapping very complex functions and increased 2% accuracy from the previous results.

The study[5] defines that the traditional approach of personality measurement requires that the users have to answer a number of questions that assist in identifying their behavior and preferences. The aim of the study is to determine whether character prediction should be viewed as a multi-label predictive model or should be handled differently? What type of predictive features works well in online platforms? What is the value of accuracy in predicting the values? Human-Computer Interactions (HCI) are more important in identifying the user's personality traits. Considered the different varieties of both linguistic features and emotional features from Twitter, YouTube, and Facebook. Regression is the only technique in predicting the continuous and real values to predict the data from different sets. The results will be evaluated focused on two methods Root Mean Squared Error (RMSE) and Co-efficient Determination both will measure the difference between the values predicted and the values observed and the correlation analysis helps in analyzing the relation between the selected features and behavioral ratings. The univariate and multivariate regression model helps in computing the personality scores.

The study[7] stated that developed different techniques for modeling the documents focused on the extractor of the Convolution Neural Network(CNN) feature and Support Vector Machine(SVM) algorithm are applied to predict the personalities from the extracted features. Different features that are extracted from the data set linguistic features are LIWC, MRC, Speech, Videos, Sentiments, and others, and non-linguistic features are structural, behavioral, and temporal data. Support Vector Machine, Logistic Regression, and Gradient Boosting. The XGBoost classifier helps in filtering the outliers to choose the most acceptable data set.

PROCEDURE

Since it became trendy in using different languages in social sites for analyzing and predicting personalities. There is an increasing amount of methodologies that mostly use both linguistic features and social network features of profiles, status, and information updates to infer and to identify the personalities[1]-[6]. The personality prediction method consists of 4 elements.

- Data Pre-processing
- Feature Extraction
- Feature Selection
- Implementation of Machine Learning Algorithm.

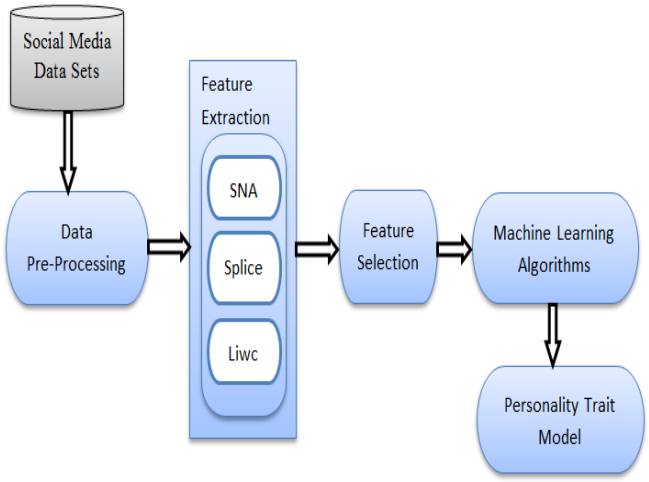

Fig: Personality Prediction Model

Data Pre-Processing:

Data set should be Pre-processed before being processed, selection of features and feature extraction on the training data set. In Data processing firstly, separate the words of each sentence via an aggregation of the same phrases[1]. The words will be gathered based on LIWC and SPLICE language skills on the same feature sets. The relationship between both the personalities and the words have to be negatively affected. It is impossible to determine the relationship between the same tenses [1] [5].

Feature Extraction:

The behaviour of the user on social networks is affected by personal behavior with other users. Here, the information in the dataset is classified into two categories. The very first group is composed of a font feature set that is extracted from the user's Facebook language and habits. To analyze the contents from the Facebook status, profile, and text two dictionaries are used [1]-[5]. They are namely LIWC and SPLICE. The second group analyzes social interactions and behaviors that include the size of the user, density, and transitivity of the network. This information helps in understanding the Facebook behavior of the user. LIWC is mostly used in psychology studies. In the present study the data set with different text formats are categorized into five subcategories they are Word count, psychological process, personal information, financial issues, and relativity or other linguistic information with different dimensions[1]-[6]. LIWC seeks to be flexible and simple in its operations and allows the user to explore more about words used in multiple ways. SPLICE is a new dictionary that has been developed recently and is still in the process of updating[1]. This analysis the social structure and the relationships among the people in the network of the user and with nodes. This is an approach for examining the pattern of relationship among the interaction between the social entities i.e., especially individual persons. The theme is to understand the indirect relation between social groups[1]. Distinct clusters of happy as well as unhappy people studying network services. The happiness of a person is associated with friends, their relatives, and a close circle of them.

Feature Selection:

Mainly there are two reasons why the selection of features is important to build a model. First, it reduces the high dimensionality of the data set by erasing the different characteristics that are not essential for training improving the generalization of a model, and reducing training time[1]. Second, the model receives a better understanding of the characteristics and their relationship between the features. And this also increased the efficiency of the classification algorithm and decreases the application requirements. To measure the relationship between the two variables and to determine the characteristics that are more important for personality prediction, Pearson's correlation Measure is often used to quantify the association between the independent variables and to predict the relationship between individual scores and the extracted characteristics [1].

PERSONALITY PREDICTION RESULTS

In this study, initially, evaluation of the Pearson correlation analysis between the character sets and the personality ratings will be done. In order to determine and understand the significance of each factor [1] depends on the outcomes of the correlation between the SPLICE and the Big 5 personality model. The neurotic users are possessively correlated with self-image words and portrayed positively in the text [1]. Users with very open-minded are highly correlated with images that truly indicate that they will be usually seen as imaginative. People with individual curiosity, open-mindedness, and desire to experiment with new ideas [14]. Extravert users are less likely to share their opinions and express their feelings. Conscious users are inversely correlated with the agreement ratio and indicate that such users aren't exploited by someone else and would like to sustain their action plan [1]. Based on the reliability outcomes of the social media network features, the extraversion was identified as the highest correlated characteristics. As well as the extraverts also have a friendly connection with internet users, who always try to find fresh and amazing experiences [2]. And, basically, neurotic users don't know about anyone because they belong to various kinds of people. Neuroticism had such a strong correlation with transitivity, which is correlated with a range of nodes associated with the most common neighbors with the same experience[1]. The experimental evaluation shall be conducted on the basis of the methods used in the XGBoost model as a primary classifier. The principle of this assessment is to evaluate the predictive capability of methods using a data set that usually contains more aspects of a feature set consisting of both personal and combined datasets. The result of the personality prediction is based on the XGBoost technique as the main classifier[1]. It is relatively higher to predict correct results effectively in an efficient and scalable machine learning model with a great pairing of all attributes, the values are anticipated to be of high accuracy.

Table 2: Comparison of Features with Algorithms of OCEAN Model

Feature	Algorithm	O	C	E	A	N
SNA	XGB	High	Medium	High	Low	Medium
	LR	High	Low	Low	Low	Medium
	GB	High	Low	High	Medium	Medium
	SVM	Medium	Medium	High	Low	Low
LIWC	XGB	High	Low	Medium	Medium	High
	LR	High	Low	Medium	Low	Medium
	GB	High	Medium	High	Medium	Medium
	SVM	High	Medium	High	Low	High
SPLICE	XGB	High	Medium	Low	High	Medium
	LR	High	Medium	Medium	Medium	Medium
	GB	High	Low	Medium	Low	High
	SVM	Medium	Medium	High	High	High
SNA+LIWC+SPLICE	XGB	High	Medium	High	Low	Medium
	LR	High	Medium	High	Low	High
	GB	High	Low	High	Low	Medium
	SVM	High	Medium	High	Low	Medium

CONCLUSION

Many applications are developed to predict personalities automatically. However, Machine learning algorithms are more useful based on data sets like Facebook, Twitter, YouTube that are used to train different models. This study identified that the literature on the users of social media frameworks or social networking sites is the behavioral feature for exploring the relationships between the user's personalities and their behavior on social media[1][2]. Consideration of the sample group plays an important role in the evaluation of the unique characters valid data will be derived from the study of social and linguistic characteristics. This study found that using different dictionaries helps to improve increase the results of correlations. By computing the Pearson coefficient value between both the data source and each personality dimension observed that various personality traits linked distinct characteristics[1]. This approach has been developed with five different models proposed methods such as Data Pre-Processing, Feature Extraction, and Feature Selection followed by machine learning techniques for each individual identity model. The maximum personality score is determined only with the XGboost machine learning technique with the use of individual selected features. After data processing from both the Big-5 personality model, small correlation results

of each particular measure will also be recognized from different data sets. From the calculated individual correlation, results identify the feature set which gives the highest prediction result called Pearson Correlation helps in achieving high accuracy. From the above Personality, Prediction results concluded that users with openness and neuroticism post less information, and the users having agreeableness and conscientiousness personality post more photos and express their feelings easily to others. The personality types of internet users not only made us learn the online user's behavior and have also provided us all with guidance about how to improve personalized services in the

future. This report points out that various individual behaviors can also help the various areas of business intelligence, marketing information technology, and psychology to stimulate economic growth and efficiency [2]-[4].

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