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Notice for the PhD Viva Voce Examination

Ms Sujatha A K (Reg. No. 1447102), PhD scholar at CHRIST (Deemed to be University), will defend her PhD thesis at the public viva voce examination on Thursday, 06 May, 2021 at 3.00 pm. The defense will be conducted online on the Webex Meeting platform.

Title of the Thesis	:	**Anomaly Detection in Online Social Media**
Discipline	:	**Engineering (Computer Science and Engineering)**
External Examiner (Outside Karnataka)	:	**Dr Poovammal E** Professor and Director Department of Computer Science and Engineering Kattankulathur Campus SRM Institute of Science and Technology SRM Nagar, Kattankulathur Tamil Nadu - 603203
External Examiner (Within Karnataka)	:	**Dr N Guruprasad** Professor Department of Computer Science and Engineering Global Academy of Technology Ideal Homes Township Mysore Road, Aditya Layout, RR Nagar Bengaluru - 560098 Karnataka
Supervisor	:	**Dr Balachandran K** Professor Department of Computer Science and Engineering School of Engineering and Technology CHRIST (Deemed to be University) Bangalore Kengeri Campus Bengaluru - 560074

The faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva.

Registrar

Place: Bengaluru
Date: 03 May 2021

ABSTRACT

Online Social Media (OSM) is a platform where users post opinions, discussions, product reviews, random thoughts, advertisements, comment exchanges and status updates. These platforms help in text mining applications such as prediction of election results, studying global mood trends, public perception of a national concern or an issue, mining of public health knowledge, detecting epidemics and business analytics. These applications also present some research challenges like personal data stealing, community phishing, hate speeches, spreading misconceptions, cyber bullying and terror attack planning. Some of these challenges are anomalies or outliers which don't conform with the majority ones. The anomalies focused in this research work are behavioral and content anomalies. Data preprocessing for textual data from OSM plays an important role for creation of the Vector Space Model (VSM) which is used as an input for behavioral and content anomaly models. The contents posted by the public in OSM is written using natural language and sometimes may not follow the formal communication mode. It has lexical, semantic and syntactic ambiguities and becomes a challenging task to extract accurate information and discover logical patterns during the text mining process. Some of the commonly used methods for text mining are, Bag of Words (BoW), N-grams and Term Frequency-Inverse Document Frequency (TF-IDF). Few limitations of these techniques are, high dimensional sparse feature vectors, missing contextual meaning, presence of weak features and Part of Speech ambiguity. In this research study, an improvised Feature Engineering model is proposed which is a combination of Forward Scan Trigrams and weighted TF-IDF to address the creation of an efficient Vector Space Model (VSM). This proposed model is used with an improvised Feature Hashing technique to address the removal of weak features. The developed model is applied for the identification of misconceptions about coronavirus outbreak in Twitter® dataset and the model showed an improved classification performance in terms of its accuracy and F-measure. Detection of behavioral anomalies is addressed in the research using the following two methods: Self-Supervised machine learning and an Ensemble model. Using supervised machine learning has limitations as the textual dataset for a particular case study taken from OSM is unstructured and unlabeled. Besides this, it is expensive and time consuming to create a dataset with labels. Unsupervised machine learning on this dataset results in inaccurate clustering as the dataset has less diversified topics. In this study, a Self-Supervised machine learning model is proposed to address the labeling for each sample based on the correlations present in the data objects. Once the dataset is labeled, behavioral anomaly detection is viewed as a classification problem, for classifying the input labeled text dataset into anomalous and non-anomalous based on user behaviors.

Standalone classifiers have limitations including noise, variance and bias factor. In this research study, a Stacked Weighted Ensemble (SWE) model is proposed where three levels of ensembling is used to minimize limitations. Self-Supervised model is used to identify behavioral anomalies for a Twitter® dataset on user's opinions for a case study of demonetization policy implemented in India. In combination with improvised Feature Engineering (FE) Process, the proposed model's performance resulted in an improvement in terms of its accuracy in comparison with a clustering model (K-means). SWE is used for identifying Hate Speeches in a Twitter® dataset and observed a performance enhancement in terms of accuracy, precision, recall and F-measure. The third part of the research study focuses on detection of content anomalies which is carried out through topic modeling. Topic models like Latent Dirichlet Allocation (LDA), Latent Semantic Analysis (LSA) and Hierarchical Dirichlet Process (HDP) have limitations of dense representations, overlapping of words distribution to the topics and non-consideration of mutual position of words in the text. In order to address these issues, a Batchwise Latent Dirichlet Allocation using Stochastic Variational Inference (BLDA-SVI) model is proposed in this research study to model for the identification of hidden and relevant topics in terms of their optimized posterior distribution. This proposed model is tested for two case studies, (1) Analyzing user's reviews based on their hotel accommodation listed in booking.com website and (2) Root cause analysis for spike in new COVID-19 cases in Indian context using the Twitter® dataset. When the proposed model is combined with Feature Engineering preprocessing, it has shown an improved performance.

Keywords: Self-Supervised, Ensemble, Latent Dirichlet Allocation, Stochastic Variational Inference, Latent Semantic Analysis, Hierarchical Dirichlet Process, K-Means, Support Vector Machines, Random Forest, Naive Bayes, Decision Trees, Rocchio, Linear Regression, Logistic Regression, Feature Engineering, Feature Hashing, Trigrams, Term Frequency-Inverse Document Frequency, Twitter®