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Deep Learning Models for Sentiment Analysis

Saba Tahir

Department of Computer Application, GDC Kulgam (Contractual), J & K, India

Abstract: ***Deep Learning Models Based Sentiment Analysis Application of multiple layers of artificial neural networks for the learning tasks is called deep learning. In the research field, deep learning is a powerful machine learning technique. It has the ability to learn multiple levels of representations and abstractions from data, which can solve both supervised and unsupervised learning tasks. Deep learning uses multiple layers of non-linear processing units for feature extraction and classification. Sentiment analysis is one of the active research areas in Natural Language Processing. There exist numerous techniques to perform sentiment analysis task, which include both supervised and unsupervised methods. Types of supervised machine learning method include Support Vector Machines (SVM), Maximum Entropy, Naïve Bayes, etc. Types of unsupervised machine learning methods include sentiment lexicons, grammatical analysis, and syntactic patterns. Application of deep learning to sentiment analysis has been very popular now a days. The reason to choose deep learning models, as it provides improved performance and accurate results over learning tasks. Deep neural network methods will perform both feature extraction and classification for document and short text. The application of different deep learning models on sentiment analysis. Sentiment Analysis Sentiment analysis is a technique that comes under the field of natural language processing. The process of identifying human emotions and thinking is termed as sentiment analysis, which is also known as opinion mining. It classifies whether the given text is positive or negative or sometimes neutral also, based on the classification level on a given document or sentence. There exist several approaches to accomplish the sentiment analysis task. This task is achieved by identifying the sentiment or opinion of the subjective element within a text. The approaches that are used to classify a piece of text are according to the opinions expressed in it, i.e. either positive or negative or neutral. The analyzing piece of text can be sentence or document or anything. The sentiment analysis is accomplished by classifying the methods into machine learning and lexicon-based approach. Again the machine learning approach is classified into supervised and unsupervised machine learning techniques. Under supervised learning there exists mainly Support Vector Machine (SVM), Neural Networks (NN), Naïve Bayes (NB), Maximum Entropy (ME) approaches.***

Keywords: deep learning, sentiment analysis, Artificial intelligence

1.Introduction

Sentiment analysis refers to the management of sentiments, opinions, and subjective text [1]. Sentiment analysis provide the comprehension information related to public views, as it analyze different tweets and reviews. It is a verified tool for the prediction of many significant events such as box office performance of movies and general elections [2]. Public reviews are used to evaluate a certain entity, i. e., person, product or location and might be found on different websites like Amazon and Yelp. The opinions can be categorized into negative, positive or neutral. The purpose of sentiment analysis is to automatically determine the expressive direction of user reviews [3]. The demand of sentiment analysis is raised due to increase requirement of analyzing and structuring hidden information which comes from the social media in the form of unstructured data.

Features of Sentiment Analysis

Sentiments contain a variety of featured values like tri-grams and bi-grams by means of polarities and combinations. So sentiments are being assessed both as negative and positive aspects through the numerous support vector machines, by using training algorithms. The neural networks are implemented in sentiment analysis to compute belongingness of labels. To help out data extraction at context level the conditional dependencies among several edges and nodes of acyclic graph operated by Bayesian networks are used. By optimizing words and sentences, learning and data accuracy can be attained on social media platform. At word root level, data tokenization is used to produce negative and positive aspects of data. Techniques are being used to decrease the errors in sentiment analysis to attain higher level of precision in data for social media.

Sentiment Analysis as multidisciplinary Field: The sentiment analysis is multidisciplinary field, because it includes numerous fields such as computational linguistics, information retrieval, semantics, natural language processing, artificial intelligence and machine learning

The classification for the approaches of sentiment analysis can be done in three extraction levels a) feature or aspect level; b) document level; and c) sentence level learning.

Techniques for Sentiment Analysis: Sentiment analysis relies on two types of techniques, i. e., lexicon based and machine learning based techniques a) Machine learning based techniques: This type of techniques are implemented by extracting the sentences and aspect levels. The features consist of Parts of Speech (POS) tags, n-grams, bi-grams, uni-grams and bag-of-words. Machine learning contains three flavors at sentence and aspect, i. e., Nave Bayes, Support Vector Machine (SVM) and Maximum Entropy. b) Lexicon based or corpus based techniques: These techniques are based on decision trees such as k-Nearest Neighbors (k-NN), Conditional Random Field (CRF), Hidden Markov Model (HMM), Single Dimensional Classification (SDC) and Sequential Minimal Optimization (SMO), related to methodologies of sentiment classification. Machine learning approach has three categories: i) supervised; ii) semi supervised; and iii) unsupervised.

Deep Learning Models:

Deep learning is the application of multiple layers of artificial neural networks for the learning task. The deep learning neural networks are inspired by the functioning of the human brain. Deep learning models have a large number of processing units called neurons. These neurons perform various tasks such as classification and text representation. Recently deep learning models are showing impressive performance in natural language processing tasks such as sentiment classification tasks including document and sentence classification. Deep learning models are also used to learn sophisticated features from the dataset. In sentiment analysis task, text or feature representation plays an important role that reflects the original information conveyed by words or sentences in a document. There exist two techniques to represent or generate text representation in natural language processing

Support Vector Machines (SVM): It is a linear classifier i.e. a non-probabilistic classifier. It is a supervised machine learning technique so it requires a large amount of training data. It classifies the training data by a hyper-plane, which acts as a boundary to separate the training data based on categories. Based on boundaries the original objects or test data is mapped to the classified training data, which is called transformation. After the transformation, the mapped objects are linearly separable.
Neural Networks (NN): It also comes under linear classifier, which mainly comes under a supervised machine learning technique. The linear classifier under this technique is logistic regression, which can be viewed as a single layer neural network, used to train the predictive model.

Naïve Bayes (NB): This classifier is a popular probabilistic classifier. It uses conditional probability to classify words into their respective categories. The advantage of Naïve Bayes classifier is, it needs small dataset for training.

Maximum Entropy (ME): It is also a probabilistic classifier which is also called exponential classifier or log-linear classifier. This classifier extracts some set of features from the input, combining them linearly and using this sum as an exponent.

Application of Deep Learning Models on Sentiment Analysis.

Deep Learning Models Based Sentiment Analysis Application of multiple layers of artificial neural networks for the learning tasks is called deep learning In the research field, deep learning is a powerful machine learning technique. It has the ability to learn multiple levels of representations and abstractions from data, which can solve both supervised and unsupervised learning tasks [24] [25]. Deep learning uses multiple layers of non-linear processing units for feature extraction and classification. Sentiment analysis is one of the active research areas in Natural Language Processing. There exist numerous techniques to perform sentiment analysis task, which include both supervised and unsupervised methods. Types of supervised machine learning method include Support Vector Machines (SVM), Maximum Entropy, Naïve Bayes, etc. Types of unsupervised machine learning methods include sentiment lexicons, grammatical analysis, and syntactic patterns. Application of deep learning to sentiment analysis has been very popular now a days. The reason to choose deep learning models, as it provides improved performance and accurate results over learning tasks.

Challenges: The major challenges of sentiment analysis based recommender system on the cloud are discussed below.

Sentiment Analysis on Social networking sites: Sentiment analysis was performed on micro-blogs or short texts like single sentences and reviews available on social networking sites. Such task was a challenging task because of limited contextual information.

Basedon opinions on reviews available on social networking sites, developing a recommender system on the cloud are a challenging task [13]. Feature Extraction: It is always a challenge to recognize the features of objects. Feature extraction plays an important role in sentiment prediction of a sentence, document or short text. Feature extraction is based on different approaches such as noun; verb-based approaches are being used.

2.Conclusion

This study proposes a framework based on different deep learning models for sentiment analysis with a recommender system. The proposed deep learning models are based on supervised and unsupervised learning technique.

For evaluation DLSARS framework was proposed, that apply sentiment analysis on micro-blog textual data using dummy variable approach by using multilayer perceptron model that uses wide learning component, which can be viewed as a generalized linear model called logistic regression. The evaluation of DLSARS framework on different domains and different amount of data provides convincing results.

Feature Extraction: It is always a challenge to recognize the features of objects. Feature extraction plays an important role in sentiment prediction of a sentence, document or short text. Feature extraction is based on different approaches such as noun; verb-based approaches are being used.

Improving the Accuracy of the Algorithm: The accuracy of the algorithm is estimated by opinion detection of a sentence or short text or document. The algorithm which reduces human effort and improves accuracy is very essential.

The Demand of Automation for Real-time Opinion Mining: Enormous growth in the use of social networking sites such as Twitter, Facebook, etc., where people express

their opinions. Companies, media, analysts mine twitter for information about the particular item or service. There is a necessity to have an automated system for collecting and analyzing tweets or reviews in near real-time environment. The demand for automation is a need to decrease the human effort to analyze reviews or content in social media. Sentiment at different Text Granularities: Sentiment was determined at various levels such as sentiment in product reviews, blog posts, whole documents; the sentiment of sentences, SMS messages, chat messages and tweets. The challenge is to explore sentiment problems that include detecting sentiment at various levels of text granularities such as terms, sentences, paragraphs. Also the determination of sentiment of phrases that may include negators, degree adverbs, and intensifiers.

Parallel Computing for Massive Unstructured Data: Execution of processes or tasks simultaneously called parallel computing, which is used to improve the execution speed. It is necessary to implement parallel computing in sentiment analysis for massive data of social media, where massive instant messages are published every day so that we can utilize the computing power.

3.Future Scope

The framework based on deep learning models for sentiment analysis with recommender system was evaluated on the text. In future, the research work is focused on developing a framework based on deep learning models for sentiment analysis with recommender system evaluated on images and video.

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