

# A Survey of Sentiment Analysis Based on Customer Reviews in Deep Learning

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**Abstract:** *Online reviews have gained popularity as they help people make decisions. In this context, the goal of this project is to develop a deep learning platform that can be used to classify customer feedback as positive or negative. This process is known as sentiment analysis. It is based on a supervised learning mechanism where a classifier is built on knowledge of the training data and then used to classify the test data. A prototype application is being built to demonstrate proof of concept. The success of deep learning largely depends on the availability of large-scale training data. A new deep learning framework for review classification using public ratings as weak observation signals. To this end, an algorithm called Deep Learning Sentiment Analysis (DLSA) is proposed and implemented. An application prototype was created to demonstrate this concept, and an empirical study of showed that the proposed system outperforms the current system.*

**Keywords:** *Sentiment analysis, deep learning, supervised learning, classification*

## 1. INTRODUCTION

Deep learning is a subfield of machine learning that deals with algorithms inspired by the structure and function of the brain called artificial neural networks. Deep learning empowers many artificial intelligence (AI) applications and services that enhance automation by performing analytics and physical operations without human intervention. Deep learning technologies are at the heart of everyday products and services (such as digital assistants, voice-activated remote controls, credit card fraud detection tools) and emerging technologies (such as autonomous vehicles).

With the rapid development of various Internet technologies, more and more electronic business platforms, social platforms, news platforms, film and television platforms have emerged. Users simply use the Internet to get a lot of up-to-date information and to post their opinions, reviews, feelings, relationships online, so while people were enjoying this lifestyle,

a lot of reviews started coming out along with users' emotions and had a huge impact on events, products, services, subjects, organizations, and more.

Andrew L. Maas et al. [5] presented a model using combinations of Unsupervised and Supervised Learning to distinguish words with similar vector representations but opposite sentiment polarity and to improve the performance of sentiment classification tasks. Duyu Tan et al. [6] proposed for combining the context model and the emotion model. Zhang Wei et al.[7] presented to use unsupervised methods to obtain word vectors, use supervised methods to obtain emotional information. Wang and Yu [8] applied a fuzzy clustering algorithm and unsupervised learning to propose a sentiment semantic query model used to perform queries on sentiment and image databases based on semantic color descriptions. Esuli and Sebastiani [9] developed a SentiWordNet dictionary with containing the power of opinion for each term. SentiWordNet is used to classify reviews and define aspects of reviews [10].

## 2. RELATED WORK

This section provides an overview of the relevant literature. The performance of algorithms involved in machine learning actually depends on the representation of the data, concluding that different interpretations will interact with the data and obscure other insights into the variance behind the data.[3] Conceptual results indicate that deep architectures may be required to learn complex functions that can represent high-level abstractions, such as vision, language, and other AI-level tasks. Deep architectures typically consist of multiple layers of nonlinear activity, such as neural networks with multiple hidden layers or complex propositional formulas that reuse many sub-formulas. It is difficult to find the parameter space of deep architecture. However, learning algorithms such as Deep Belief Networks have been introduced in to solve this problem and have achieved significant results, surpassing the latest in some areas [4].

### **Sentiment Analysis Techniques:**

1. CNN: Convolutional neural networks (CNNs) form the basis of many modern computer vision systems. Image classification, object detection, semantic segmentation - all of these tasks are successfully handled by CNNs. At first glance, it seems counterintuitive to use the same technology for separate tasks like natural language processing.

A CNN model is trained on 50% of the data set and tested on the remaining 50% of the data set. For the customer feedback data set, we compare the results obtained with the CNN model to the conventional ML algorithm and compare the results obtained. It has

been observed that our model can provide better performance than conventional ML approaches and achieves 95% accuracy.

2. SVM: Support Vector Machine, or SVM, is one of the most popular supervised learning algorithms used for both classification and regression problems. However, it is mainly used for classification problems in machine learning.

The goal of the SVM algorithm is to generate the best decision lines or boundaries that can divide an n-dimensional space into classes, so that in the future new data points can be easily placed into the correct categories. This best solution boundary is called the hyperplane. SVM picks endpoints/vectors that help create the hyperplane. The algorithm is called a support vector machine.

### 3. LITERATURE SURVEY

1. **Paper Name** : Deep Learning for Sentiment Analysis Based on Customer Reviews

**Author** : B. Seetharamulu , B. Naresh Kumar Reddy and K. Bramha Naidu

**Description** : Online reviews have grown in popularity as people make decisions through them.

In this context, the goal of this project is to develop a deep learning framework that can be used to classify customer feedback as positive or negative. This process is known as sentiment analysis. It is based on a supervised learning mechanism where a classifier is built on the training data and then used to classify the test data. The prototype app was created to demonstrate a proof of concept. The success of deep learning relies heavily on the availability of large-scale training data. A new deep learning framework for review sentiment classification uses widely available ratings as weak observation signals. To achieve this goal, an algorithm called Deep Learning Sentiment Analysis (DLSA) is proposed and implemented. A deep learning framework has been proposed and implemented. The prototype app was created to demonstrate a proof of concept. Empirical study showed that the proposed system is superior to the existing system.

2. **Paper Name** : Sentiment Analysis of Customer Product Reviews Using Machine Learning

**Author** : Zeenia Singla, Sukhchandan Randhawa, Sushma Jain

**Description**: Today, digital reviews play a key role in improving global communication among consumers and influencing consumer buying patterns. E-commerce giants such as Amazon, Flipkart, etc. provide a platform for consumers to share experiences, while gives

future buyers a real-world view of product performance. To extract valuable information from many reviews, we need to classify reviews into positive and negative sentiment. Sentiment Analysis is a computer-aided study for extracting subjective information from text. In the proposed work, more than 4,000,00 reviews were classified into positive and negative emotions through sentiment analysis, and Naive Bayes, SVM (Support Vector Machine) and decision trees among various classification models were used reviews were classified. Models are evaluated using 10-fold cross-validation.

**3. Paper name :** A Hierarchical Model of Reviews for Aspect-based Sentiment Analysis

**Author Name :** Sebastian Ruder, Parsa Ghaffari , and John G. Breslin

**Description :** Opinion research based on customer feedback has become common in recent years. However, although the sentences of a review form part of the polemical structure of the review, they are usually classified independently. Intuitively, the sentences in the review build and develop each other. Therefore, knowledge of the structure of the review and the context of the proposals should contribute to the classification of each proposal. We demonstrate this hypothesis for the aspect-based sentiment analysis problem by using hierarchical bidirectional LSTMs to model the interdependence of sentences in a review.

**4. Paper Name :** Sentiment Analysis Based on Deep Learning : A Comparative Study

**Author Name :** Nhan Cach Dang, Maria N. Moreno-Garcia and Fernando De la Prieta

**Description :** A study of public opinion can give us valuable information. In social networks such as Twitter and Facebook, sentiment analysis has become a powerful tool for studying user opinion and has a wide range of applications. However, problems with natural language processing (NLP) limit the effectiveness and accuracy of sentiment analysis. In recent years, deep learning models have proven promising solutions to NLP problems. This article reviews a recent study using deep learning to solve sentiment analysis problems such as sentiment polarity. A model using frequency-inverse document frequency (TFIDF) and word embedding's was applied to multiple data sets. Finally, experimental results obtained for various models and introduced functions were comparatively studied.

#### 4. PROPOSED SYSTEM

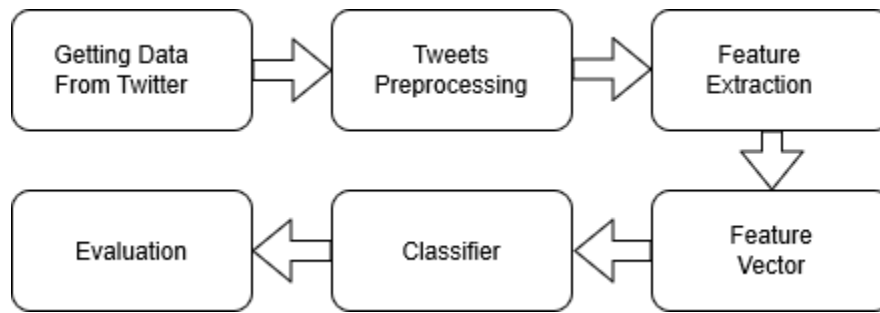


Fig 1 Sentiment Analysis

#### SVM (Support Vector Machine) Classification Algorithm

The Support Vector Machine can be described as a binary classifier. It attempts to find a hyperplane that can separate two classes of data by the largest margin. There are 2 types of separation in SVM the one is Linear & the other is Non-Linear. The Non-Linear classification can be done with the help of the kernel trick. Kernel plays an important role in the separation of data as in nonlinear margin cannot be drawn in 2-D it has to be lifted in a higher dimension where the data can be separated that is a 3-D plane, as it can be observed that two different classes indicating circle & square are used, SVM creates a hyperplane that divides the two classes with the maximum margins.

#### Naïve Bayes Classification Algorithm

Naïve Bayes is also a classification algorithm that is based on the principle of Bayes Theorem. Naïve Bayes is not a single algorithm but a collection of algorithms that gives the probability of an event occurring. The principle that is followed by this algorithm is that every pair of features that have been classified is independent of each other. The probability of the features is considered with the probability of an individual feature occurring divided by the probability of the remaining feature. This states the Bayes' Theorem on which Naïve Bayes' is made. As the features are considered independent, the algorithm will give individual results of each variable to perform differently from other algorithms.

#### 5. TECHNIQUES & ALGORITHM

##### Support Vector Machine:

**Input:** Input (X, Y) to Customer Feedback Dataset

**Output:** Sentiment Analysis (Class 1, 2, 3, 4, 5)

### **Pseudo Code:**

X: Independent features

Y: Dependent Features

Split X,Y into Training and testing dataset

X train, X test, Y train, Y test

SVM Classifier: Using hyperplane for prediction. Divides the data into two classes and gives more accurate results.

End

Returns the class label.

## **6. CONCLUSION AND FUTURE WORK**

Sentiment Analysis, or Opinion Mining, is a field of study that analyzes emotions, attitudes, or emotions of people towards a specific object. This article addresses the fundamental problem of sentiment analysis i.e., the classification of sentiment polarity. Online reviews gained popularity as people made decisions based on of them. In this context, the goal of this project is to develop a structure that can be used to classify customer feedback as positive or negative. This process is known as sentiment analysis. It is based on the SVM algorithm, and the classifier is built from the training data and then uses to classify the test data.

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