Real-Time Sentiment Analysis of Movie Reviews on Social Media Platforms

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Abstract

Sentiment Analysis interpolates the concepts of natural language processing, computational linguistics, text analysis and an effective way to analyze subjective information. It is the combination of a body of theory with a variety of technical tools, Natural Language Processing (NLP) provides a computational approach to text interpretation. This is a dynamic area of research and development; as a result, no single definition can claim to satisfy everyone. Nonetheless, there are a number of factors that any reasonable person would take into account when forming their own definition. One crucial area of natural language processing is known as sentiment analysis, also called opinion mining. Social media analytics, which entails simply forming people's opinions on social media based on an analysis of their sentiments or ideas as expressed in text, is one of the many domains in which sentiment analysis finds use. It's a good model for analysing user reactions and comments. One of the most common uses for sentiment analysis is in real-time applications, which we hope to address in this paper. To evaluate user feedback in real time, artificial intelligence has developed real-time sentiment analysis, which uses an ML model that has already been trained. This paper evaluates the sentiments of people's reviews about movies on social media using machine learning models algorithms like the Nave Bayesian classifier, Neural networks, and VADER on a dataset of 1600000 tweets containing 6 different attributes. The purpose of this paper is to discuss the methods and machine learning algorithms used to evaluate the efficiency of such models.

Keywords: Machine Learning Algorithms, Naïve Bayesian classifier, Neutral Networks Sentiment Analysis VADER.

1. Introduction

To a large extent, our daily lives now revolve around our smartphones. In these trying times, smart phones aid us in every aspect of our lives, from health to finances to education. Simply put, our hands hold the key to happiness. One thing, however, remains beyond the capabilities of our mobile devices. What are our current emotions? Siri: "Hey, how are you today?" Google: "Ok, Siri. Inquire of my feelings: "How am I feeling today?" The question is beyond the capabilities of your mobile device. Have you ever thought, "I am quite happy today!" Someone would give this sentence a perfect score of 10 on the joy scale if asked to rate it. They wouldn't give it a perfect 10 if we took the word "quite" out of the previous sentence. Instead, he'll probably give it a score close to 7. The day was the worst. It's clear that whoever said this is having a bad day and will rate it as a zero. Just think of the possibilities if AI could read your mind and react appropriately. The term "sentiment analysis" refers to the practise of gathering and analysing information about a subject based on that subject's subjective emotions, opinions, and observations. This technique is commonly referred to as "opinion mining" because it extracts the most important aspects of people's opinions [1-3].
Several different machine learning (ML) statistical models are utilised during the process of carrying out sentiment analysis [4-5]. In addition, natural language processing (NLP) is utilised to extract features from large datasets in order to investigate the information that is subjectively contained within each expression. Sentiment analysis has a variety of applications, one of which is social media analytics, which, to put it in more layman's terms, is the capability to collect and find meaning in data gathered from social channels in order to support business decisions and measure the performance of actions based on those decisions through social media. Sentiment analysis is just one of the many applications that sentiment analysis has. Monitoring customer reviews is yet another way that sentiment analysis can be put to use.

This is accomplished by first locating comments from unhappy customers and then attempting to understand the factors that led to their dissatisfaction regarding the product. You will be able to quickly resolve these issues with the help of sentiment analysis, which will prevent the customer from abandoning you altogether. Real-time sentiment analysis is a solution that is powered by AI (as shown in Fig 1) and is used to analyse the feelings that are attached to the data that is provided by a user with the assistance of a Machine Learning Model. Our objective is to simplify the process of analysis on large amounts of sequential data and to visualise the opinions mined with the assistance of visualising libraries.

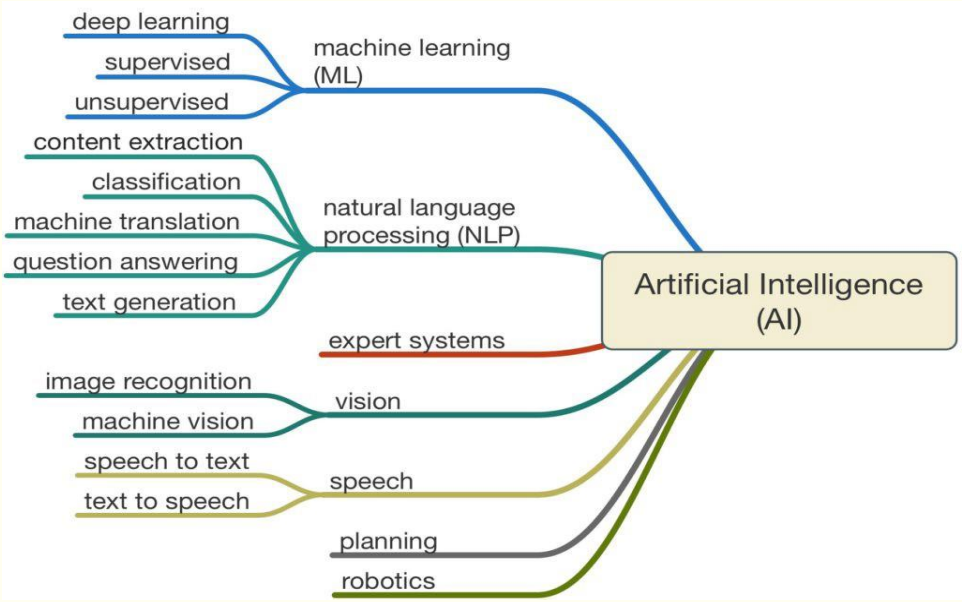

Figure 1. Role of AI and NLP

2. Literature Review

Numerous research projects are completed by analysing the overall polarity of a document or sentence in order to determine whether it is a positive or negative review of something [6-7]. The first people to start working on sentimental analysis were Pang et al. [8]. Their initial objective was to determine the overarching feeling conveyed by a text. an example of this would be assigning a positive or negative sentiment to a review of a movie. They used machine learning algorithms on review databases, which resulted in them using Naive-Bayes, maximum entropy, and support vector machines as their go-to algorithms. They also came to the conclusion, after analysing a variety of factors, that classification of emotion is a very difficult task. They demonstrate that supervised machine learning algorithms form the foundation of sentiment analysis. To determine the average semantic orientation of the phrases from the review that contained adjectives or adverbs, Turney et al. used a simple unsupervised learning algorithm [7]. Dave and his colleagues trained a classifier on a self-tagged corpus of reviews taken from various websites as part of system [9]. Analysis of sentiment at the phrase level is covered in [10], which identifies the contextual polarity for a sizable portion of different expressions of sentiment. They demonstrated in their research that the polarity of a phrase within its context can be distinct from the polarities of the words that appear within that phrase. A discussion a few common methods of sentiment analysis, including using a subjective lexicon, N-Gram modelling, and machine learning in also also covered in some papers [11].

Learning the opinions of others is crucial. As with many other things, the popularity of websites and social media has skyrocketed over the past decade. The use of social media

sites like Twitter, Facebook, and Tumblr has skyrocketed recently. Which website currently holds the title of "most visited" online? Twitter has a global user base. Statistically speaking, the microblogging service Twitter has approximately 6,000 tweets sent per second. Daily tweet volumes range between 200 and 500 million. Individuals can share their thoughts and feelings on Twitter.
Managing a large dataset can be challenging, but by utilising NLTK and Text Blob, they were able to easily classify their data and provide more accurate results by employing multiple classifiers.

3. Requirement Analysis

3.1 Python

This is a high-level, general-purpose programming language that is interpreted and places a premium on making its code easy to read by making extensive use of indentation. Its language features and object-oriented approach are meant to aid developers in producing readable, well-structured code for applications of all sizes. Python is a deterministic programming language with a garbage collector. It's compatible with a wide variety of programming styles, such as structured (especially procedural) code, as well as OO and functional code. It is often described as a "batteries included" language due to the extensive standard library that comes with it. By the late 1980s, Guido van Rossum had teamed up with others to create Python as a replacement for ABC, and by 1991, Python 0.9.0 had been released. In 2000, Python 2.0 was released with new features like list comprehensions and a garbage pickup mechanism that can identify loops (in addition to reference counting). When Python 3.0 was first released in 2008, it represented a major, non-backwards-compatible change to the language. As of version 2.7.18 in 2020, Python 2 will no longer be supported [12].

3. 2 Data Learning

Deep learning is a type of machine learning that aims to simulate the way a human brain's neural network works by breaking down complex problems into their component parts. These neural networks are an attempt to make the model "learn" from massive amounts of data, but they are far from perfect. Although a single hidden layer can produce approximative predictions, additional hidden layers help the model optimise and improve prediction accuracy [13]. Deep learning is used in a wide variety of artificial intelligence (AI) apps and services to further automate processes, both analytical and physical, that would otherwise require human intervention. Deep learning is used in everything from digital assistants and voice-enabled TV remotes to the detection of fraud committed using Mastercard credit cards and in the development of brand new products (such as self-driving cars).

3.3 Neural Network

As the name suggests, a neural network is an artificial network where the links between the nodes do not close in on themselves. The deep learning algorithms we've developed rely on neural networks like these. Siri, voice search, and Google Translate are just a few examples of apps that use deep learning algorithms for tasks with ordinal or temporal

dependencies, such as language translation, NLP, speech recognition, and picture captioning. Similar to feedforward and convolutional neural networks (CNNs), recurrent networks acquire knowledge from experience.

In contrast to conventional deep neural networks, whose output is assumed to be completely unrelated to its input, recurrent neural networks depend on earlier elements of a sequence to produce a meaningful one. Unidirectional recurrent neural networks cannot take into account future occurrences, despite their potential usefulness in defining a sequence's output. A further distinction of recurrent networks is that their parameters are shared between all network layers. However, in a recurrent neural network, the weight parameter is constant across all layers, whereas in a feed forward network, it varies across nodes. Reinforcement learning is only possible because these weights can be updated using backpropagation and gradient descent.

3.4 Machine Learning

As a result of automating data analysis, machine learning makes analytical model building a mechanical process. Machine learning is a subfield of AI that aims to automate as much of the learning, pattern recognition, and decision-making process as possible. Interest in machine learning is on the rise again thanks to the same factors that have made data mining and Bayesian analysis so successful in recent years. Attributes like, cheaper and more powerful computing, and cheap data storage are all contributing factors. All of this paves the way for the rapid and automatic development of models that can assess more and more complex data and provide faster, more accurate answers, even on a massive scale. Building accurate models increases a company's chances of seizing lucrative opportunities and protecting itself from unanticipated threats.

4. Research Methodology

To achieve our objective mentioned above, we have used the following methodology:

- Exploring the various methods currently used for sentiment analysis.
- Gathering of Sequential Information from Twitter, Facebook, and Amazon.
- Performing feature engineering of collected data.
- Developing a classifier using a variety of supervised machine learning techniques as the foundation.
- Training and testing on built models using pre- processed data.
- Evaluating and Hyperparameter Tuning on Classifiers.
- Computing the results of each classifier.
- Saving and shifting model to web-based UI.
- Further:
- Analyze the input data from the user.

- Web Scrape thread data from Twitter to mine real-time opinion and analyze the sentiment trend.

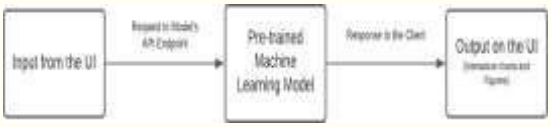

Figure 2. Level Data Flow Diagram

5. Algorithm and Techniques Used

5.1 Decision Tree

One well-known method of data mining employs a tree-like structure to map inputs to outputs. Like a flowchart, it has nodes at its edges that represent the result and blocks in the middle that represent attributes from the dataset. Unlike other approaches, this one can handle irregular and absent information. There isn't a lot of computing time spent on the classifications either. The diagram displays the range of outcomes possible given a set of two alternatives. Commonly, it will begin with a single block and progress to various possible outputs. Each of the blocks connects to others, opening up new branches [14].

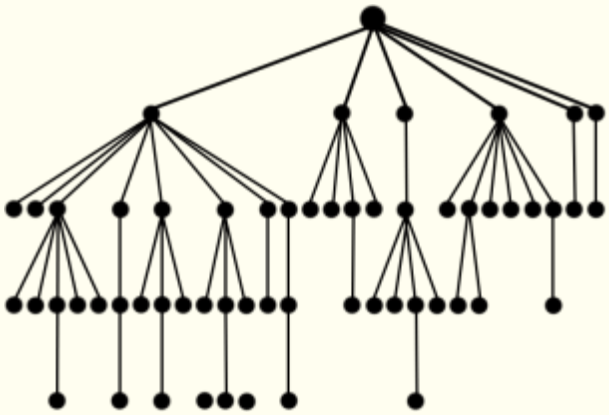

Figure 3. A Decision Tree

5.2 Fuzzy Membership Functions

It's possible that Text Blob is a Natural Language Processing library written in Python (NLP). Text Blob completes its objectives with the assistance of NLTK
Users are able to figure out categorization, classification, and a wide variety of other tasks with the assistance of NLTK, which provides easy access to a large number of lexical resources. Text Blob might be a straightforward library, but it enables complex operations and analyses to be performed on textual data.

Approaches that rely on lexicons define a sentiment according to its semantic orientation and, as a result, the degree of intensity that each word in the sentence carries. For this purpose, a pre-defined dictionary that separates words into positive and negative categories is required. In most cases, a text message is represented as a bag of words or a sparse vector. [Case in point:] [Case in point:] After giving each of the words its own score, the ultimate sentiment is determined by performing some kind of pooling operation, such as calculating the mean of all of the ratings given to the words [15].
Text Blob is responsible for determining the polarity as well as the subjectivity of a statement. The polarity scale runs from -1 to 1, with -1 indicating an unfavourable feeling and 1 indicating a favourable outlook. The polarity of a sentence can be altered by the use of words that are negative. The semantic labels in Text Blob are helpful for performing fine-grained analysis. Examples of this include emoticons, exclamation marks, and emojis. There is subjectivity between [0 and 1]. Subjectivity refers to the combination of personal opinion and information that is contained in a piece of writing. Because of the increased subjectivity of the text, it offers readers more personal opinions than it does factual information.

5.3 VADER

A rule-based/lexicon model, VADER is applied to text sentiment analysis to determine the polarity (positive/negative) and intensity (strong) of emotion. This feature is already present in the NLTK package and can be applied to raw text data without any additional preprocessing [16].
Sentiment analysis in VADER is based on rules in a lexicon that relate words to ratings of how strongly they make the speaker feel. The overall sentiment of a piece of writing can be determined by tallying up the weight of each word. Terms like "love," "enjoy," "glad," and "like" all convey positive emotions. Furthermore, VADER is able to understand the negative connotation of phrases like "did not love," for example. Wonderful, for example, is capitalised because of the value placed on that particular word.

5.4 Naïve Bayes

One method of multinomial classification is the Naive Bayes Algorithm. It is based on Bayes' theorem, which states the principle of conditional probability. The Naive Bayes Algorithm is widely applied in text classification.

5.5 Convolution Neural Network

This method offers a wide range of tools for dealing with tabular data. For sentiment analysis, we use text data, so Neural networks, a subset of Machine Learning, are essential. They use a hierarchical structure for data processing that's reminiscent of how neurons in the brain do their thing.
The ability of deep learning to mimic the human brain makes it especially useful when applied to the task of reading human text.

5.6 Data Collection

5.6.1 Tweepy

Python is a dynamic, object-oriented, interactive programming language that uses modules and data types and classes that can change on the fly. This makes collecting data from Twitter using Python easy and straightforward. Tweepy is a free and public Twitter API client written in Python. Using a Python programme to communicate with the API can be useful. In addition to Twython and SNScrape, there are other packages you can use to harvest Twitter information. The current situation calls for the use of tweepy, the official and best-suited library approved by Twitter for accessing their content safely. However, tweepy isn't perfect; it can only store 32K tweets at a time and only provides data from the previous week.

5.6.2 Twitter Data

We will go over the fundamentals of building a Twitter App, including user authentication and requesting basic API resources. To begin, let's sign up for Twitter at https://dev.twitter.com/apps. When the registration process is complete, we will start receiving applications. The following keys are available in the application details tab.

- API KEY
- API KEY SECRET
- ACCESS LEVEL
- OWNER
- OWNER ID (Optional)

5.6.3 Data Pre-Processing

The numpy and pandas modules in Python have been used for data preparation and analysis. The steps used by numpy and pandas are as follows:

- After loading the datasets,the process of analysing them and then removing any stop words that we find.
- In addition, in order to prevent unnecessary repetition, we have lowered the case of our text.
- Eliminating URLs in order to prevent needless traffic in the data. Python includes a module for regular expressions, which is used to accomplish this goal.
- In addition, we are getting rid of any slang and abbreviations that don't add any meaningful context to our findings.
- Getting rid of smileys and emoticons. Both of the steps mentioned can be done using modules that you can either find already created or create yourself
- Eliminating any unnecessary background noise, such as Twitter handles, punctuation, unnecessary spaces, numbers, and special characters

- The next step in the process involves normalizing the text through the use of two different methods, namely stemming and lemmatizing.
- Transform the text into numerical form. In other words, we are converting our training data into a sparse matrix.
- Converting text into a format that can be read by a computer as a matrix will allow it to perform analysis on the data and produce some insightful results.
- Model is constructed, after which, depending on the model, we either transform the data into tensors or sparse matrices.

6. Results and Analysis

Table 1. Comparison between original and predicted values

Input	Prediction	Actual	Accuracy
This film...terrible	0.002	0	100%
This film...great!	0.993	1	99.4%
They are...nicely.	0.945	1	94.6%
I had a great day!	0.948	1	94.8%
We...not...away.	0.339	0	66.1%

Our model achieves an accuracy of 88.08% when applied to test data. For the sake of simplicity, we tested our model with five additional sentences to determine its real-time accuracy. The results showed that it had an accuracy of 90.98%, which was slightly higher than our test accuracy.

7. Conclusion

The paper evaluates the accuracy rate of movie reviews using decision tree model, fuzzy membership functions, VADER which is a rule based lexicon and Naive Base Algorithm. Initially we eliminate all the emoticons, slangs, smileys on social media and try to extract information which is relevant to analyze using NLTK package in python. Secondly, we have implemented decision tree and Naïve base algorithm to analyze the sentiments of the people. We have a massive amount of opinionated data that is freely available in digital formats on the internet. With Real-time Sentiment Analysis model developed here can actually solve a problem to know the opinions of the customers/people and what their audience wants. Our model can provide the detailed accuracy by analyzing the comments/ feedback of the people on social media platform. Our Machine Learning Model will give them rich insight into their customer's feedback.

8. Conflict of Interest

There is no conflict of interest in this work.

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