International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 4, May-June 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Amazon Product Review Sentiment Analysis with Machine Learning

Ravi Kumar Singh[1], Dr. Kamalraj Ramalingam[2]

[1]Student, [2]Associate Professor,
[1,2]Department of Master of Computer Applications, School of CS,
Jain Deemed to be University, Bangalore, Karnataka, India

ABSTRACT

Users of Amazon's online shopping service are allowed to leave feedback for the items they buy. Amazon makes no effort to monitor or limit the scope of these reviews. Although the amount of reviews for various items varies, the reviews provide easily accessible and abundant data for a variety of applications. This paper aims to apply and expand existing natural language processing and sentiment analysis research to data obtained from Amazon. The number of stars given to a product by a user is used as training data for supervised machine learning. Since more people are dependent on online products these days, the value of a review is increasing. Before making a purchase, a buyer must read thousands of reviews to fully comprehend a product. In this day and age of machine learning, however, sorting through thousands of comments and learning from them would be much easier if a model was used to polarize and learn from them. We used supervised learning to polarize a massive Amazon dataset and achieve satisfactory accuracy.

KEYWORDS: *Sentiment analysis, machine learning, Amazon customer reviews, Logistic Regression Classifier, Decision Tree Classifier, SVM*

How to cite this paper: Ravi Kumar Singh | Dr. Kamalraj Ramalingam "Amazon Product Review Sentiment Analysis with Machine Learning" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-4, June 2021, pp.720-723, URL: www.ijtsrd.com/papers/ijtsrd42372.pdf

IJTSRD42372

INTRODUCTION

As online marketplaces have grown in popularity over the years, online retailers and vendors have encouraged their customers to share their thoughts on the items they've purchased. Thousands of reviews are written every day on the Internet about a wide range of products, programmes, and locations. As a result, the Internet has surpassed all other sources for collecting information and opinions on a product or service.

The Internet has revolutionized the way we purchase products. Wherever product testing is not feasible in the retail e-commerce environment of online marketplace. Furthermore, in today's retail sale environment, a large number of new products are introduced on a regular basis. As a result, consumers can rely heavily on product feedback to shape their opinions in preparation for a more complex cognitive process during the purchasing process. Users, on the other hand, always find looking out and comparing text reviews to be challenging. As a result, we want a higher numerical rating system that is backed up by feedback, so that consumers can easily make a buying decision.

Clients can require the use of a score device at some point during their decision-making process in order to locate useful feedback as quickly as possible. As a result, models that can predict a person's score based on a textual content assessment are critical. Obtaining a common sense of a textual evaluation may want to enhance customer service. It can also help businesses increase sales and develop their products by gaining a better understanding of what their customers want.

The Amazon electronic product evaluation dataset was taken into accounts. The evaluations and ratings provided by customers to exceptional products, as well as reviews about the customer's product(s), were also taken into accounts.

LITERATURE SURVEY

Sentiment analysis has gotten a lot of attention in recent years thanks to the abundance of online reviews. As a result, numerous studies have been conducted in this area. Some of the most relevant research works to this thesis are discussed in this section.

SVM was tested for text classification by Joachims (1998), who found that it performed well in all experiments with lower error levels than other classification methods.

With the assistance of SVM and Naive Bayes and maximum entropy classification, Pang, Lee, and Vaithyanathan (2002) attempted supervised learning for classifying movie reviews into two groups, positive and negative. In terms of precision, all three methods performed admirably. In this analysis, they experimented with different features and discovered that when a bag of words was used as a feature in the classifiers, the machine learning algorithms performed better.

Three supervised machine learning algorithms, Naive Bayes, SVM, and N-gram model, were tested on online feedback about various travel destinations around the world in a

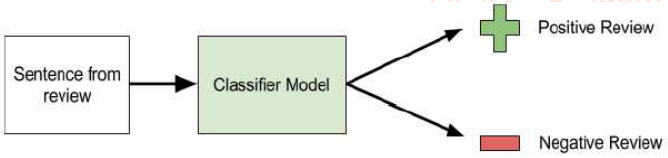
recent survey conducted by Ye et al. (2009). They discovered in this study that well-trained machine learning algorithms work exceptionally well for classification of travel destination reviews in terms of accuracy. They also showed that the SVM and N-gram models outperformed the Naive Bayes system. However, increasing the number of training data sets decreased the gap between the algorithms significantly.

Chaovalit and Zhou (2005) compared a supervised machine learning algorithm to an unsupervised approach to movie review called Semantic orientation, and found that the supervised approach was more efficient than the unsupervised form.

Naive Bayes and SVM are two of the most widely used methods in sentiment classification issues, according to several studies (Joachims 1998; Pang et al. 2002; Ye et al. 2009). As a result, this study attempts to apply supervised machine learning algorithms such as Naive Bayes and SVM to Amazon's beauty product reviews.

PROPOSED SYSTEM

The method entails gathering product-based datasets from various E-commerce sites such as amazon.com, epinion.com, and others. The feedback is received on items such as phones, iPods, and other electronic devices. The aim of this project is to use algorithms like random forest, decision tree, and SVM to evaluate and forecast product reviews by classifying them as positive, negative, or neutral. We conduct pre-processing, extract features on which comments are made, measure polarity of feedback, and plot a graph for the result since the input is about unstructured product reviews. Dealing with negation is also covered in the results. For instance, "the Nokia phone is not bad" is a positive review despite the negative word "not." The approach flow diagram as shown below, and the subsections are explained in detail in the following subsections.



Sentiment Classification Algorithm:

Sentiment analysis, also known as opinion mining, is a problem in natural language processing (NLP) that entails recognizing and extracting subjective knowledge from text sources. The aim of sentiment classification is to interpret user feedback and categorize them as positive or negative, without requiring the system to fully comprehend the semantics of each phrase or text.

Sentiment analysis is becoming a powerful method for monitoring and analyzing consumer sentiment as people share their thoughts and feelings more freely than ever before. Brands can learn what makes consumers happy or sad by automatically analyzing consumer reviews such as survey responses and social media interactions. This allows them to tailor goods and services to their customers' specific requirements.

Different areas, such as movie reviews, travel destination reviews, and product reviews, have been attempted by sentiment classification.

Random forest Classifier (RFC)

Random Forest is a concept for putting together decision trees that can be obtained by combining multiple decision trees. We can run into issues like outlier data or noisy data while using single tree classifiers, such as decision tree classifiers, which can affect the performance of the classifier function, while Random Forest as a classifier provides randomness and is therefore highly resistant to noise and outliers. This classifier produces two different forms of randomness: data randomness and function randomness. This classifier has a number of hyper parameters because it's used to combine multiple Decision Trees, such as:

- How many trees should be built in the Decision Forest?
- What is the maximum number of features that can be selected at random?
- The maximum height of each tree.

Since it uses the concepts of bootstrapping and bagging, Random Forest is thought to be a reliable and accurate classifier.

Support vector machine (SVM)

Support vector machines (SVMs) are a type of supervised learning system that can be used to solve sentiment classification problems (Cristianini & ShaweTaylor 2000). This approach positions marked training data on a decision plane, then uses an algorithm to create an optimal hyperplane that divides the data into groups or classes. As shown in Figure 1, the best hyperplane is the one that separates the groups by the largest margin. This is done by choosing a hyperplane that is the furthest away from the nearest data on each class (Berk 2016). "The groups are not separated in H1. H2 has a slight advantage, but only by a small margin. H3 divides them by the greatest possible margin." Weinberg, Zack (2012).

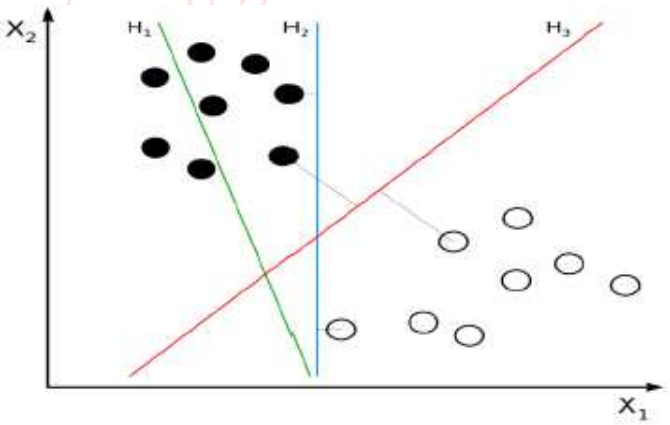


Fig1: Support Vector Machine

Logistic Regression Classifier (LRC)

The likelihood of an outcome with only two possible values is predicted using logistic regression (i.e. a dichotomy). One or more predictors are used to make the prediction (numerical and categorical). For two reasons, linear regression is ineffective for predicting the value of a binary variable:

Values outside the appropriate range would be predicted by a linear regression (e.g. predicting probabilities outside the range 0 to 1)

The residuals would not necessarily spread around the expected axis since dichotomous experiments could only have one of two potential values for each experiment.

A logistic regression, on the other hand, yields a logistic curve with values ranging from 0 to 1. In logistic regression, rather than using the probability, the usual logarithm of the target variable's "odds" is used to construct the curve. Furthermore, the predictors do not have to be normally distributed or have the same variance in and category to be efficient.

Decision Tree Classifier (DTC)

A hierarchical tree structure with attributes represented by decision nodes and attribute values represented by edges. The creation of decision rules for classifying new data instances is made possible by this tree-like representation.

A decision tree is a tool for making decisions that uses a tree-like model of decisions and their possible outcomes, such as chance event outcomes, resource costs, and utility. It's one way of displaying an algorithm that is completely made up of conditional control statements.

Result and Discussion

The predictive accuracy of the models is calculated after testing and training the dataset to decide which model is the best classifier for classifying feedback. The SVM model, as seen in the table, has the best predictive accuracy of the four models, whereas the Decision Tree model has the worst predictive accuracy.

Model Name	Accuracy
Logistic Regression Classifier	93.92%
Support Vector Machine	93.94%
Random Forest Classifier	93.50%
Decision Tree Classifier	90.10%

- After a few arbitrary feedbacks, it seems that our features are working properly with Positive, Neutral, and Negative outcome.
- We can also see that our Support Vector Machine Classifier has improved to a level of 94.08 percent accuracy after running the grid quest.

```
from sklearn.metrics import classification_report
from sklearn.metrics import accuracy_score

print(classification_report(X_test_targetSentiment, predictedGS_clf_LinearSVC_pipe))
print('Accuracy: {}'. format(accuracy_score(X_test_targetSentiment, predictedGS_clf_LinearSVC_pipe)))
```

```
              precision    recall  f1-score   support

          -1       0.00      0.00      0.00         5
    Negative       0.67      0.25      0.36       156
     Neutral       0.47      0.11      0.18       292
    Positive       0.95      1.00      0.97      6473

    accuracy                           0.94      6926
   macro avg       0.52      0.34      0.38      6926
weighted avg       0.92      0.94      0.92      6926

Accuracy: 0.9408027721628646
```

Conclusion and Future Work

Sentiment analysis is the process of recognizing and aggregating user sentiment or opinions. The method of deciding whether the polarity of text in a document or sentence is positive, negative, or neutral is known as sentiment analysis. We can see that four approaches have been compared, and a result has been calculated for approaches on the product review dataset. The accuracy of Logistic Regression is found to be 93.92 %, SVM is found to be 93.94 %, Decision Tree is found to be 90.10 %, and Random Forest is found to be 93.50 %. Among the four models, the SVM model has the highest predictive accuracy. We can see that text files that are too big take a long time to process. Automatic sentimental analysis is a powerful tool for detecting and forecasting current and future patterns. While opinions at the feature level have been sought, there are still many limitations that can be explored further. The potential for future development –

- Providing product reviews in a variety of languages.
- Addressing the issue of slang mapping.
- Dealing with sarcastically expressed views.
- Identifying comparative views and determining which of the two products under consideration is the best.
- Dealing with anaphora resolution, which is what the opinion is really about.

In the future, the work could be expanded to conduct multiclass classification of reviews, which would give consumers a clearer picture of the review's essence, allowing them to make better product decisions. It can also be used to predict a product's ranking based on the review. This would provide consumers with a trustworthy rating because the product's rating and the sentiment of the review will often contradict each other. The proposed job extension would be extremely beneficial to the e-commerce industry by increasing customer loyalty and confidence.

ACKNOWLEDGEMENT:

I do acknowledge the support and encouragement of all people who helped me throughout the completion of this project.

I would wish to give thanks **Dr. Dinesh Nilkhant,** Director - JGI, Knowledge Campus, Bangalore, Karnataka for proving the facilities to try to analysis work. His leadership and management skills are continuously a supply of inspiration.

I conjointly wish to give thanks **Dr. M. N Nachappa,** Dean, School of Computer Science & IT, Jain deemed to be university, Knowledge campus, Bangalore, Karnataka for his support and cordial cooperation.

I would wish to give thanks to our MCA & program coordinator, **Dr. Bhuvana J,** Mentor and Associate Professor, Department of Master of Computer Application for providing for providing the support and steerage to try to analysis work. Her timely direction and motivation helped me to stay my patience throughout this journey.

Moving further, I would wish to give thanks my sincere gratitude to project coordinators Members, **Dr. Lakshmi JVN and Dr. Gangotri,** Assistant Professor, Department of Master of Computer Application for sharing their experience which helped me in completing my thesis in the best possible way. In addition, they also helped in critically reviewing and proof reading my work and my project thesis.

References

[1] S. Brownfield and J. Zhou, "Sentiment Analysis of Amazon Product Reviews," in *Proceedings of the Computational Methods in Systems and Software*, Springer, 2020, pp. 739--750.

[2] T. Haque, N. Saber and F. Shah, "Sentiment analysis on large scale Amazon product reviews," in *2018 IEEE international conference on innovative research and development (ICIRD)*, IEEE, 2018, pp. 1--6.

[3] R. Jagdale, V. Shirsat and S. Deshmukh, "Sentiment analysis on product reviews using machine learning techniques," in *Cognitive Informatics and Soft Computing*, Springer, 2019, pp. 639--647.

[4] N. Nandal, R. Tanwar and J. Pruthi, "Machine learning based aspect level sentiment analysis for Amazon products," *Spatial Information Research,* vol. 28, pp. 601--607, 2020.

[5] A. Rathor, A. Agarwal and P. Dimri, "Comparative study of machine learning approaches for amazon reviews," *Procedia computer science,* vol. 132, pp. 1552--1561, 2018.

[6] A. Ravi, A. Khettry and S. Sethumadhavachar, "Amazon Reviews as Corpus for Sentiment Analysis Using Machine Learning," in *International Conference on Advances in Computing and Data Sciences*, Springer, 2019, pp. 403--411.

[7] J. Sing, G. Singh and R. Singh, "Optimization of sentiment analysis using machine learning classifiers," *Human-centric Computing and information Sciences,* vol. 7, pp. 1--12, 2017.

[8] Z. Singla, S. Randhawa and S. Jain, "Sentiment analysis of customer product reviews using machine learning," in *2017 international conference on intelligent computing and control (I2C2)*, IEEE, 2017, pp. 1--5.

[9] K. Srujan, S. Nikhil, H. Rao and K. Karthik, "Classification of amazon book reviews based on sentiment analysis," in *Information Systems Design and Intelligent Applications*, Springer, 2018, pp. 401--411.

[10] W. Tan, X. Wang and X. Xu, "Sentiment analysis for Amazon reviews," in *International Conference*, 2018, pp. 1--5.

[11] S. Wassan, X. Chen, T. Shen and M. Waqar, "Amazon Product Sentiment Analysis using Machine Learning Techniques," *Revista Argentina de Cl{\'\i}nica Psicol{\'o}gica,* vol. 30, p. 695, 2021.

[12] S. Dey, S. Wasif, D. Tonmoy and S. Sultana, "A Comparative Study of Support Vector Machine and Naive Bayes Classifier for Sentiment Analysis on Amazon Product Reviews," in *2020 International Conference on Contemporary Computing and Applications (IC3A)*, IEEE, 2020, pp. 217--220.