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# Aspect-Based Sentiment Analysis Using Machine Learning: A Review

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**ABSTRACT:** In the digital era, e-marketing is turning into another pattern to ease things in the real world. Nowadays buying product online is apparent task for people. It is important for the company or organization to know whether their customers like the product or service. For that we need to analyse customers and one of the attributes of analyzing customer is to analyze the sentiments of them. This is where the sentiment analysis comes into picture. Aspect-based sentiment analysis concentrates on important feature of the product which can be valuable for customer while purchasing it online. For extracting those features, firstly we have to collect opinions or sentiments on product. This will be collected from different sources like as surveys, NPS, online reviews etc. After that machine learning algorithms will be applied for analysing aspect-based sentiments.

**KEYWORDS:** Sentiment Analysis, Aspect, Customer, Reviews, Classification, Extraction.

## I. INTRODUCTION

From the past decade the use of internet has been increased. With the internet the use of social media and e-commerce has increased enormously. Users do express their opinions about the product online. The opinions about the product can be positive, negative or neutral. In case of company or an organization the customers are not one or two, they are in millions. So in that case industry really need to know whether customer like the product or not. The customer's opinion about the product called as customer feedback. For the improvement of industry it is required to analyse customer's feedback. Thus it becomes a matter of interest for researchers to develop a framework or model in order to analyse user generated opinions. One such model for analysing user's sentiments known as **sentiment analysis**. Sentiment analysis is the process of computationally identifying and category opinions from the piece of text and predicting its polarity from writer's attitude towards product, service or brand as positive or negative. In this paper we will focus on aspect based sentiment analysis. Finding polarity of customer's feedback about some aspects or features is known as **aspect based sentiment analysis**. Here aspect meant that attribute or components of product or service.

With aspect based sentiment analysis the result will be more accurate, interesting and detailed. For example suppose we want to buy the product. So for any product the aspects are ease of use, cost, design etc. The following figure shows sample of aspects or features of any product.

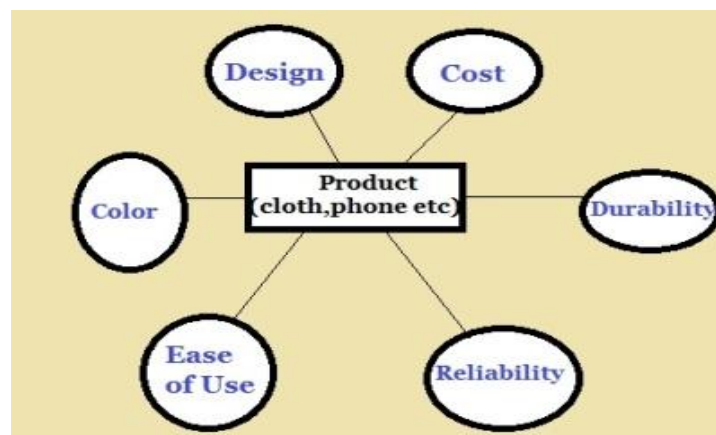


Figure-1. Product and its Aspects

The above figure-1 shows some aspects of any product i.e. ease of use, reliability, colour, cost, design and durability. There can be other aspects valuable for customer according to the product while purchasing. For example, while purchasing mobile the aspects should be like as colour, cost, camera, design, RAM, memory, processor etc. After looking user's review about the particular feature of the product, it becomes easy for customer to choose a product. Aspect level sentiment analysis can be divided into three levels:

- 1) Text level analysis
- 2) Sentence level analysis
- 3) Document level analysis

In text level analysis focuses is on particular text. In the sentence level analysis focuses is on sentences and in the document level analysis focuses is on complete document of data.

## II. LITERATURE REVIEW

The research in the field of sentiment analysis are discussed here.

Bo Pang et.al. (2008)[1] Presented a survey on opinion mining and sentiment analysis. In this paper various approaches and techniques are discussed related to sentiment analysis. The evaluation techniques, resources and discussion of datasets are available in this paper.

A. Gural Vural et.al.(2012)[2] focussed on working of web crawling. Sentiment based web crawling presented in this paper. The tools and strategies used for crawling also presented in this paper. The framework has been developed which has collect URL's of web pages and after that crawling is applied on those we pages. The comparison of various crawling based strategies are also discussed in this paper.

Kumar Ravi et.al. (2015)[3] Focussed on survey of opinion mining and sentiment analysis. The researcher presented opinion and sentiment analysis approaches and techniques. This paper covers views presentation in more than 100 articles. The literature related to sentiment analysis from the year 2002-2015 is covered in this paper and available in tabular format.

Devika M D et.al. (2016)[4] They covered the comparative analysis of various approaches and techniques used in sentiment analysis and provided summary in tabular format.

Shubham Goyal(2017)[5] Represented work on sentiment analysis. The text mining was used for data collection. The data collected from tweets. The lassification algorithm are used for analysis of sentiments. The classification algorithms Naive Bayes and KNN was used.

Mr. S.M. Vohra et.al (2018)[6] presented work on analysis of sentiments. In this paper the researcher discussed about the tools used for analysis. The various techniques and approaches are also discussed in the paper in tabular format.

Neha Nandal, Jyoti Pruthi, Amit Choudhary(2019)[7] presented comparative survey of aspect based sentiment analysis.

## III. ASPECT BASED SENTIMENT ANALYSIS

The main aim of Aspect Based Sentiment Analysis is to analyze sentiment which has been expressed from each aspect. The following figure shows steps used in aspect based sentiment analysis.

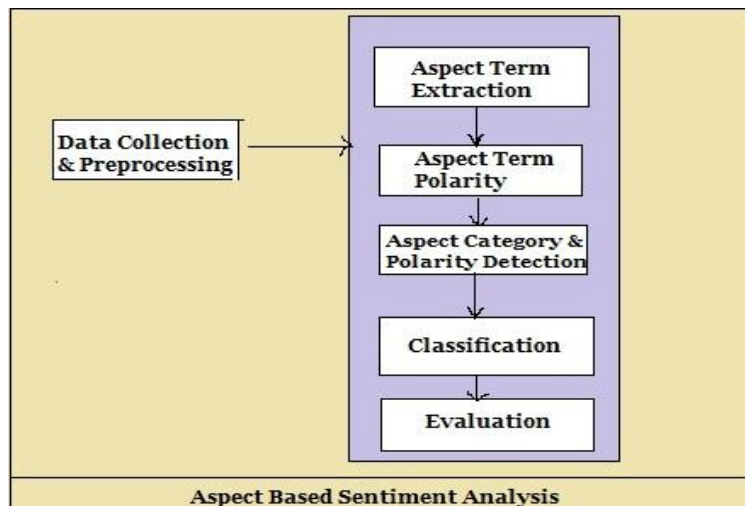


Figure-2. Aspect Based Sentiment Analysis

#### A. Data Collection and Pre-processing

The researchers have collected data or dataset for analysis from different resources. E.g. NPS, customer satisfaction surveys, online reviews, social media, and amazon.com etc. Before applying the main task of aspect based sentiment analysis the pre-processing of data is required. The pre-processing means tokenization, removing stop words, normalization of data etc.

#### B. Aspect Term Extraction

Aspect term extraction is used to identify aspect term presented in customer reviews. For extracting aspect terms researchers used features like as Head word, POS tagging, Casting, Word N-grams, Name List, Punctuation marks and Relations [8]. The machine learning techniques used in extracting aspects terms are support vector machine, Random forest and random trees. The following methods proposed by researcher for extracting aspect term i.e. H&L method, FREQ baseline, FREQ+W2V method, H&L+W2V method.

#### C. Aspect Term Polarity

After extracting aspect term from customer review now we have to identify polarity of term. Polarity can be positive, negative and neutral. The aspect term polarity has been extracted by using various features like polarity of neighbouring adjectives, relations, neighbouring POS tags, word N-grams, and parse dependencies.

#### D. Aspect Category Detection

Aspect category detection is used to identify the categories present in the review's sentence. The co-occurrence based algorithm used for category detection.

#### E. Aspect category Polarity

Aspect category polarity takes information from the previous stage i.e. aspect category detection and identify polarity (positive, negative, neutral) of customer review's sentence[9]. The polarity can be identified by calculating the distance between the corresponding aspect and n-gram. The category polarity has been detected using bigram and unigram features.

#### F. Classification and Evaluation

For classification, the machine learning algorithms has been used. Machine learning algorithms divided into two types.

1. Supervised Learning
2. Unsupervised Learning

The machine learning algorithms under supervised learning are support vector machine, naive bayes, nearest neighbour, neural networks etc.

The machine learning algorithms under unsupervised learning are Gaussian mixture, K-means, K-medoids, and Fuzzy C-means etc.

The performance of subtasks (aspect term extraction, aspect term polarity, aspect category detection, aspect category polarity) used in sentiment analysis has been evaluated. The performance can be evaluated with precision (P), recall(R),F-score(F) depending upon the subtasks is as follows:

$$P = \frac{TP}{TP+FP} \quad R = \frac{TP}{TP+FN} \quad F = \frac{2.P.R}{P+R}$$

Where TP=True Positive, TN=True Negative, FP=False Positive and FN=False Negative.

## IV. CONCLUSION AND FUTURE SCOPE

Sentiment analysis is the technique used for identifying sentiments of people about product, service or brand in terms of polarities. The aspect level sentiment analysis is used to find polarities of customer about specific feature or aspect of the product. With aspect based sentiment analysis the result will be accurate, interesting and detailed. This helps the



customer to buy any product very easily. In this paper the technique used for aspect based sentiment analysis is discussed. In the future the deep learning can be used for aspect based sentiment analysis.

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