2. **Literature Review**

# **Introduction**

Sentiment analysis is a field that allows interaction between human beings and computers using natural language. This field allows listening to the Voice of Customers. It is being applied in different fields like politics, marketing and also learning. Sentiment analysis is the process of analysing opinions expressed in form of text computationally with normally a goal of obtaining the attitude of someone towards a certain topic / subject. The main aim is to analyse the affective text. This chapter describes sentiment analysis and the fields that are currently using it, effort that was directed towards using this and technologies that are currently being used to cater for Voice of Customers in businesses. Research unveiled that different algorithms have been in use for the use of sentiment analysis in different fields and the algorithms are discussed in this chapter.

# **Sentiment Analysis Definitions**

Different and multiple efforts were put in place with the aim of giving the best definition that brings out all the elements covered by sentiment analysis in a single line. The term itself has got different names that are used to means the same with it that suit best with the subject of application at a particular period of time. Authors are using the different names in accordance to the subject. It is sometimes called opinion mining (Pang and Lee, 2008) and also polarity detection (Sharma, Nigam and Jain, 2014).

Esuli and Sebastiani (2006) defined opinion mining/sentiment analysis as a recent discipline at the crossroads of information retrieval and computational linguistics which is concerned not with the topic a document is about, but with the opinion it expresses. This definition is far much too broad and it put focus on document level sentiment analysis. Document level sentiment analysis is normally not appropriate as it take the whole document as a single entity. Therefore, the definition is not specific enough to define sentiment/ opinion mining in library terms.

Priya and Dinakaran, (2016) defined “Sentiment analysis is the process of analysing the affective text into positive, negative or neutral emotions.” This definition misses out the techniques that are used that is Natural Language Processing, computational analysis and linguistic and textual analysis. Adding the techniques to the definition, a new definition which states that Sentiment analysis is a data mining type that looks for inclination from people’s opinions using natural language processing, text analysis and computational linguistics, which their use is to extract and analyse subject related information from different sources. This definition suits best sentiment analysis for a library system.

In accordance to the field in which sentiment analysis is being applied that is Libraries, a specific definition of sentiment analysis can be derived. Sentiment analysis is the process of extracting library content viewers’ comments to see their feelings towards the content in the library (i.e. videos).

# **Algorithms that are used in Sentiment analysis classification.**

Sentiment analysis uses different algorithms to perform the analysis and classification of the data points in the data sets. These algorithms are placed into categories. The categories include Machine learning approach, Lexicon based approach and hybrid approach. For machine learning, algorithms that are used to analyse and classify the sentiments include Naïve Bayes Classification Algorithm, K-Nearest Neighbour, Support Vector Machine Algorithm, Linear Regression, Decision making tree, random forest algorithms, Maximum entropy rule , Probability latent semantic and Latent Dirichlet Allocation (Singh Jandail, 2014).

From the category of Lexicon based algorithm, there is Dictionary based approach, Novel Machine Learning Approach, Corpus based approach and Ensemble Approaches. Lexicon based approach uses sentiment dictionary that contains a number of opinion words and compare them with the data available and determine the polarity. Three strategies for constructing a lexicon of sentiment include methods based on corpus, manual construction, and methods based on dictionaries. Manual construction is a very difficult task and a very time-consuming task. Corpus-based methods have got relatively high accuracy when it is producing opinion words. Finally, in the dictionary based techniques, the idea is to collect a small and understandable set of opinion words in person / manually first with known orientations, and then to grow this set by searching in the WordNet dictionary for their synonyms and antonyms.

Finally, in the hybrid approach, that is the combination of the machine learning and lexicon based approaches has potential to improve sentiment classification performance. The main advantages of hybrid approaches are the lexicon/learning symbiosis, the detection and measurement of sentiment at the concept level and the lesser sensitivity to changes in topic domain. While the main limitation is that reviews are with a lot of noise (irrelevant words for the subject of the review) are often assigned a neutral score because the method fails to detect any sentiment.

Some researchers have been researching the implementation of machine learning technique since the beginning of this century to collect feelings from online reviews using this method, many researchers have viewed opinion mining as a question of text classifications (Singh Jandail, 2014). This approach usually involves creating a model using statistical techniques such as Support Vector Machine (SVM) and Naïve Bayes (NB).

Choice of algorithms varies from application. Some situations require parametric machine learning algorithms and some situations requires non-parametric machine learning algorithms. Parametric machine learning algorithms these are algorithms that simplify the functions used to the known form and then use a number of assumptions. Non-parametric algorithms these are algorithms that do away with the use of string assumptions about the mapping functions form. Non-parametric algorithms are free to learn any functional form from the data used for training the model.

Discussing the mainly used classification algorithms

* + 1. **Naïve Bayes Machine Classification Algorithms.**

This is one of the powerful machine learning classification algorithms. This is a method of classification based on the theorem of Bayes with strong (naive) assumptions of independence between features. A Naive Bayes Machine Learning classifier expects that the proximity of a specific feature (element) in a class isn’t connected to the proximity of some other elements.

This algorithm uses the likeliness of elements and as a result this brings a number of errors in the output that this classification algorithm outputs. For example, if an organic fruit that looks like an apple is entered in the system it will be classified as an apple. This applies the same to sentiments, understanding the difference between spam sentiments, conditional statements and positive and negative sentiments takes a very big amount of time.

Naïve Bayes doesn’t require a very large amount of data to train it. Very small datasets can be used to train it unlike SVM which requires a very large dataset.

Most we use it in textual classification operations like spam filtering. It attaches probability values to every word that belongs or that is associated with spams, in accordance to the topic or the company that is sending the email. The Naive Bayes is commonly used to classify texts into multiple classes and has recently been used for classification of sentiment analysis.

* + 1. **Support Vector Machine Classification (SVM) Algorithms.**

Support Vector Machines is a type of supervised machine learning algorithm which provides classification and regression data analysis. SVM is mostly used for classification while they can be used for regression. Supervised learning algorithms these are algorithms that operate with labelled data. If a new data point is received the system compares the data point with the current data in the dataset that was used to train the model/ system, then conclusion is reached basing with the information used to train the system at first. SVM can solve linear and non-linear problems and it works well for a number of practical issues. SVM's idea is simple: the algorithm generates a line or hyperplane that divides the data into groups. **A hyperplane in a Euclidean n-dimensional space is a flat, n-1-dimensional subset of the space dividing the space into two disconnected sections.**

Support Vector Machine Algorithms are known to perform well in sentiments analysis classification (Abirami and Gayathri, 2017). SVM investigates data, characterizes selection limits and uses the components performed in the input space for calculation (Harb *et al.*, 2008). The important information is presented in arrangements of two vectors, where each vector is of size *m.* After, the machine tries to identify the boundary that’s separating the two classes that is far from any place in the training samples (Pang, Lee and Vaithyanathan, 2002). The separate characterizes the edge of grouping, increasing ambivalent choices by extending the rim. According to Cherian and Murukezhan, (2013) the SVM has been proven to perform more effectively than the Naïve Bayes classifier in various text classification problems.

# **Advantages and Disadvantages of Sentiment Analysis.**

Examining the metrics of the market one by one is not the best way to measure marketing performance. A more holistic approach, which requires combining different marketing metrics, will yield more detailed and insightful results. Sentiment analysis is one of the metrics providing the context needed to evaluate your marketing performance.

Having a lot of likes and comments under a video library posts might seem like a success. After all, people are interacting with the content, so the video library plan may seem like it’s working. To kill small bad comments while they haven’t spread any far there is need for sentiment analysis. The advantages of sentiment analysis are discussed below.

# Advantages

### 1. Sentiment analysis helps in developing a more insightful, data-based marketing strategy

Beating a strategy based of data is really impossible to archive. Sentiment analysis is one of the indicators that will advance marketing strategies since it has an effect on the online presence of many different aspects of the brand. Analysing the emotions around the brand helps understand the motivations behind the purchasing decisions of consumers and the motives behind their searches.

Sentiment analysis helps in getting data base on which it can bring the marketing strategy to the next level. In addition, sentiment analysis provides strategic information when it comes to assessing the rivals. Marketing strategy components should be present which help in distinguishing competitors. That's one of the benefits of analysing sentiments–it allows you to discover and leverage the unique parts of the videos offered.

The impact of marketing campaigns on the sentiments about the brand can be seen. Analysis of sentiments helps to identify audience groups that respond to content most positively. This will help deliver more personalized messages to the product's most targeted audience.

2. Understand your customers

It's difficult to succeed in business without an audience full understanding. The more accurate the message is, the higher the response rate. Analysis of sentiments can be the secret weapon, not only in targeting the right demographics, but also in monitoring the overall tone of the talk. The application of sentiment analysis to the marketing portfolio would help to get the most out of the posted content.

### 3. Take a look at brand perception

Sentiment analysis helps and ensure that the messages shared are relevant and targets the right audience. One of the greatest advantages brand owners have is a strong understanding of a brand, by monitoring sentiments around the industry, they can see how people feel about some subjects and change the content accordingly.

### 4. Give extra boost to your customer service

Once a crisis hits, there is need to take action so fast, before its escalation. Sentiment analysis helps to contain crisis around the brand, or even turn the tables around and use the crisis as an advantage. The key is acting fast and spotting negative comments early. This help to nip the critical situations in the bud.

**Disadvantages**

While an analysis of sentiments is useful, there is no believing that it is a complete replacement for reading survey responses, as the comments themselves often contain useful nuances. Where sentiment analysis can further help by identifying which of these comments should be read, allowing, for example, to focus on the most negative comments.

# **2.5 Existing related systems.**

1. **YouTube**

YouTube is a video sharing library. It’s much of a video sharing library. It allows users to create channels and upload videos in to their channels for people to see. It allows users to visit the channels like videos and comment and let the owner of the channels seeing all these comments. It caters for adult and children. This video library pays owners of the channel for the videos they upload. The channel owners are paid according to the number of view on their channels. This makes YouTube an employment video library. According to (Bärtl, 2018) the amount of YouTubers is over 13 Million and that is 13 million people working on YouTube.

The problem that YouTube doesn’t cater for is helping YouTubers to increase their market share. It does help the YouTubers to analyse the comments from the subscribers and viewers.

1. **Facebook**

Facebook is one of the sites that can be called **social networking sites.** It make it easier for people to **connect and share** information that include videos with family and friends over the line. By 2006 anyone over 13 year old was able to join Facebook as long he or she has a valid email address. As far as social networking topic is concerned Facebook is the largest social networking according to market share, it has got **more than 1 billion users.**

**Today people are making money through monetizing Facebook web pages. This makes Facebook another employment platform. There is money people are making out of YouTube so there is need to analyse the comments and help the owner of pages to see the extent to which their content is liked by their followers. If the followers are not satisfied then the system must help the page owners to see where they are missing it by highlighting negative and positive comments.**

1. **Vidyard**

Vidyard actually offers a video library feature that are offered by the above discussed video libraries. These include **having a central hub for videos, collaborating seamlessly, reducing storage and server costs, controlling video access for customers and easily making changes. All these makes up the benefits of Vidyard. The sentiment analysis part remains uncovered just like other video libraries.**

# **Traditional ways of Capturing Voice of Customers.**

The traditional ways of capturing feedback from customers were so laborious and not effective at all than the currently being used methods. The effort that was needed to capture data from a single customer was so laborious. Examples of traditional methods that were used to capture the feedback include interviews, questionnaires, observation and focus groups.

Interviews is one of the methods that was used to allow customers to return feedback long in the days before introduction of a lot and present day found technology. Interview is a process of gathering data when people stay in a room and they have a question and answer session. Where the interviewer ask questions and the interviewee answers the question. Interviews have got a weakness of directive questions. The interviewer asks what he wants to know and doesn’t allow a customer to say out what she things is wrong within an organisation.

Questionnaires is a question containing sheet that is send to person of interest. Normally it is passed to customers after service delivery and they answer the questions saying out their feedback. Then the questionnaire is analysed and conclusion is reached out of the questionnaire. Problem with this way of gathering feedback from customers is the questions it contained maybe directive in such a way that avoids the customers from clearly saying out a view with the fear of not answering the question.

Observation is a feedback gathering technique that was being used in the past. Observation needs an observer that gathers the information from customers by observing them while they are in the place of interest. Then conclude from what the observer see from the movement of the customers and so on. The weakness with this technique is that customers can change their behaviour if they realise that they are under study. The other weakness may also come from the observer as the observer can be biased in the study and conclude in a way that satisfies him or herself.

Lastly focus groups was one the techniques that were used for gathering information from customers. Listening the voice of customers with focus groups calls for a meeting between the customers and a number of stakeholders of the firm or organisation. This technique has got a weakness of having very few stakeholders included.

Traditional customers’ feedback methods are not ideal for collecting information about customers' reactions to video and libraries. Considering that design is a visual medium, survey questions may not capture the entire reaction of a guest to the design and all in all doesn’t reduce the labour of analysing the feedback

# **Existing technologies of retrieving feedback from customers.**

Libraries are using different ways of capturing sentiments from patrons. Some of these methods include survey, review sites, suggestion boxes, emails, blogs, social media, and phone calls. All these methods are laborious and tedious to arrive at a conclusion using them. They need an extra hand or effort from top management that is of analysing the data till its making sense.

Suggestion box is one of the methods that is used to capture written sentiments from patrons. Suggestion box is a device used to collect comments and feedback from customers about a service that they are being offered. Traditionally this was a box and with technology it changed to be electronic suggestion boxes. Farnum, Baird and Ball, (2011) did a research about how suggestion boxes are being used in Canadian academic libraries. The research was targeted to see how often suggestion boxes used in libraries and how often do they use them. The research discovered that almost every academic library in Canada has got a suggestion box and they are still using the suggestion boxes. According to Farnum, Baird and Ball, (2011) suggestion boxes support four major aspects in service improvement. The aspects are accountability, trustworthy, decision making and anonymity. Suggestion boxes have got advantages of leaving comments anonymously. The identity of a customer isn’t exposed. Even if a patron drops a comment letter in the drop box while someone is looking it him or her no identity is exposed. Suggestion boxes solves the problem of directed comments from patrons. Patrons leave their feedback without anyone questioning them what they want to ask like what focus groups do. Then this allows patrons to express their thoughts clearly. This way of gathering feedback from patrons has got disadvantages of eliciting dissatisfaction feedback and it will portray a negative image of library while there is a positive side of it too (Shenton and Johnson, 2007).

Customer support chat is one of the methods that is used to capture voice of customers. In this technique customers will interact with a person from the organisation who is responsible for communicating with the customers. The person is normally called the Customer Support Manger. A research was done by (Torstensson and Dannehall, 2017) with the aim of gathering facts to see if it was necessary to use a live customer support chat. Live customer support brings a number of advantages to both the organisation and also to customers. Live customer support motivates customers to launch complains as they are certain that they will get immediate response in real time (Pinto, 2013). It requires very little energy for a customer to submit a complaint or a suggestion. This helps the organisation to maintain its good will as it always responds to customers need. This method of listening the voice of customers is better than emails (Elmorshidy, 2013). By using live customer support chat, companies gain economic advantage to use of really expensive customer support call centre (Elmorshidy, 2013). Torstensson and Dannehall, (2017) concluded that a support chat can be used as a way of engaging with customers either new or old customers. However, the study didn’t look in a number of issues that are important to every organisation. It didn’t consider how economic it is to use live chat. Live chats need human beings to respond to customers. For very large organisations there is need for more Customer support managers for the organisations to respond to every customer in real time. This will increase cost to the organisation as it has to employee more workers.

Phone calls is another tool that is being used to capture or listen to customer feedback (Dean, 2007). Using this tool customer calls the library when there is a complaint or if there is a query which must want to be attended. This tool has got a number of disadvantages. It is really expensive for customer to call the library. This reduces the number of customers who calls the library, at the same time reduces the number of complaints that the library receives. Reduction of complaints end up portraying a wrong image about service delivery in the library. Management end up thinking that if there is no complains the service delivery is super.

Use of social media platform such as WhastApp, Facebook, Twitter and Instagram is another method that is being used for getting feedback from patrons. Social media are websites and application that people uses to communicate, create and share information. Apart from its uses in organisation it has got its uses for entertainment purposes. WhatsApp is used for chatting with friends and at the same time share documents, music, pictures and videos. Libraries have adopted these social media platform as a way of engaging daily with patrons. The main push is to follow the patrons in the place they are in. There are 7.7 billion number of people in the world and 3.7 billion are online (Esteban Ortiz-Ospina, 2019). Gerolimos and Konsta (2011) research discovered that UK libraries use Facebook and Twitter more. Use of social media bring advantages of live communication between the patron and library staff. National University of Science and Technology (NUST) library and University of Western Cape (UWC) library are examples of libraries that uses social media to engage with patrons (Mabweazara and Zinn, 2016). Social media has got its own disadvantages to use as a way of gathering patrons’ feedback.

# **Overview of Social Media Tools**

* **Facebook**

Facebook is one of the top social media networks in terms of market share. It provides users with a platform to register and make friends of their choice by sending friend requests and accepting friends’ request. Friends are able to share ideas, photos, videos, comments, etc.

* **Twitter**

Twitter is one of the world's most popular social media platforms with less market share than Facebook. It is an application for micro blogging that allows users to post short messages of up to 140 characters and less.

* **LinkedIn**

LinkedIn is a social networking site mostly used by professionals from all disciplines to connect professionals of their interest from around the world. 2013 statistics report that LinkedIn has more than two hundred and fifty-nine million users around the world.

* **YouTube**

YouTube is an incredibly well-known platform for video sharing that is used internationally for video sharing. YouTube is a repository for various video content styles including short video clips, TV clips, music videos, lectures on education, documentaries, films, games, etc. Individuals and educational institutions, media groups are increasingly using it to distribute their promotional material.

* **Flickr**

Flickr is a website that is maintained by Yahoo! Inc. for photo sharing and video hosting, a free service that allows users to upload and share their desired digital images on the web with their groups or to the public. Flickr has an estimated 87 million registered members and over 3.5 million new images posted daily

* **Pinterest**

This is a pin board-style image-sharing website that allows users to create theme-based sets of photos such as activities, interests, and hobbies. Users can browse for images on other pin boards, "re-pin" images to their own pin boards and like pictures.

* **Orkut**

Orkut is another social platform that has Facebook features. Users can connect with their friends through this website or create new friendships. They can comment on their friends ' shared posts, send certain messages, talk with them, and also upload pictures.

* **Tagged**

Tagged is a platform for social exploration that allows its users to view other users ' profiles, play games, exchange tags and digital gifts etc. About 100 million users use this program, according to an estimate.

* **Myspace**

Myspace is another popular social networking site that mainly has a social purpose that allows people to make buddies, chat online, and divide resources among themselves.

* **Google Plus**

Google+ and Google Plus is owned and operated by Google Inc. as a social network site. It is known as the world's second-largest social networking site. According to a survey, this network contains 540 million monthly active users.

* **LiveJournal**

LiveJournal is another social networking service that allows Internet users to maintain a blog, journal or diary, and is also the name of the free and open source server software running the LiveJournal website and online community. There are about 16 million publications on various topics such as politics, culture, fashion, literature and architecture, etc. on this social networking site.

* **Photo bucket**

Photo bucket is a website that shares photos and saves footages. It is an online community dedicated to photos and videos preservation and sharing. Millions of users use this page to share with their loved ones their pictures and videos.

* **Picasa**

Picasa is a platform for photo sharing that was used to organize and edit digital images.

* **Slide share**

Slide share is a slide-hosting platform based on the internet. It provides users the ability to access documents in various file formats, such as PPT, PDF, Keynote and Open Document presentations, personal or publicly. Users can also rate, comment and share the content that has been uploaded. Slide share has been voted as one of the top ten educational and e-learning resources in the world.

* **Blogs**

This application helps users to share data at one time with a number of people. Blogs are also helpful! And used to distribute circulars of offices and latest announcements of activities in universities on a very large scale.

* **RSS**

RSS (Really Simple Syndication) is a web stream that includes full or correct text and information about changing metadata, new blog posts, news headlines, audio and videos, etc. The program helps users who want to update their favourite websites on time. Subscribing to a website's RSS service eliminates the user's need to manually check the website for new things. Alternatively, by updating the page and letting the user know about new updates, their app does this job.

Social media has proved to be a reliable source of product marketing knowledge. A unique data source provides a quick means of customer feedback used to help a number of business areas. Social media can provide immediate feedback in minutes, thereby presenting a new challenge in customer-business communication. One can use social media to evaluate consumer reaction, along with relevant information, in the form of what they like (or don't like). This can benefit other areas of an enterprise, including product development, customer service or marketing.

All of the above methods do engage with patrons in its own way. It has got disadvantages and its own advantages. In addition to the above disadvantages of each method there is a common disadvantage of not being able to analyse the sentiments / feedback that patrons pass. Thereby requiring third hand for the gathered sentiments to be useful, thus being laborious.

* 1. **Existing Sentiment Analysis Systems**

Sentiment analysis is a wide spreading concept that is penetrating almost every aspect of life. This concept has been applied in different subject areas that include politics, marketing, brand monitoring, customer support customer feedback and social media monitoring. Of late sentiment analysis applications focused on classifying film reviews or product reviews as positive or negative or distinguishing positive and negative sentences, but many recent applications include opinion mining in ways that require a more detailed analysis of the sentiment expressed in texts (Singh Jandail, 2014). One such application is to find reviews of a product to see which area of the products rated good or bad by customers. Another task which involves a more detailed analysis of sentiments is to consider where political writers fall on the political spectrum, something that can be achieved only by searching for support or opposition to specific policies. A few other uses, such as allowing politicians who want a deeper understanding of how their voters view different issues, or forecasting stock prices based on opinions people have about the businesses and assets involved in the marketplace, can also benefit from organized representations of opinion. Sentiment analysis helps management to manage customer’s feedback. There are a number of different sentiment analysis researches that were done in recent years. The aim depending from one research to another.

Different authors tried to come up with researches on sentiment analysis application in hotels. (Kasper and Vela, 2011) undertook a research for a project which was done for Saarland hotel association. The project name was BESOHOT. The aim of the research project was to improve the information value. After the research the project was implemented pilot with the aim of improving the way Saarland value the Voice of Customers. \cite{grabner2012classification} also did a research about use of sentiment analysis in the hotels. The conclusion after the research was undertaken using lexical based approach to classify customer’s feedback.

# **Proposed System**

The system that is going to be developed is going to remove the common disadvantage of the current methods that are being used to capture sentiment/ feedback from patrons. The common disadvantage is waiting for third hand to make information useful. The proposed system is going to be developed using Python programming language and Django.

# **Python**

Python is an interpreted, object oriented high level programming language that has semantic dynamic semantics. This programming language. This programming language is very easy to learn and easier to read code. This brings an advantage of easy to maintain code. It also has garbage collection features that reduces the labour of the programmer during coding. The programmer doesn't have to worry about when to and when not to release no longer being used memory.

Python is very popular open-source programming language. It offers the benefits of leaner code, shorter development cycles, compatibility with various platforms, backward compatibility, and streamlined security, administration and testing software development.

# **Django**

Django is a Python Web platform at the highest level that facilitates rapid development and clean, practical architecture. Created by seasoned developers, it takes care of much of the web development problem, so you can focus on writing your app without reinventing the wheel. It's open source and free.

# **Conclusion**

This chapter provided a brief overview of the systems that are currently being used in libraries to capture customer feedback and the definitions that are used to define sentiment analysis. The chapter was trying to shade out the advantages that sentiment analysis will bring to libraries if project undertaken.

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