Annexure-I

Restaurant Management System

A Project Report

Submitted by

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and

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Under the Guidance of

Prof. Vijayetha T. & Prof. Manisha T.

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April 2018

Annexure-II

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Annexure-III

CERTIFICATE

This is to certify that the project entitled “Restaurant Management System” is the bonafide work carried out by Hitesh M.Jeswani, Manan R.Mehta, Anmol R.Sajnani of B.Tech Integrated(Computer Engineering), MPSTME (NMIMS), Mumbai, during the VIII semester of the academic year 2017-18, in partial fulfillment of the requirements for the award of the Degree of Bachelors of Engineering as per the norms prescribed by NMIMS. The project work has been assessed and found to be satisfactory.

Prof. Vijayetha T

Prof. Manisha T

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Examiner 1 Examiner 2

_____

HOD

Dr. Pravin Srinath

Annexure IV

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Abbreviations

Abbreviation	Description
1. SA	Sentiment Analysis
2. ML	Machine Learning
3. DL	Deep Learning
4. NLP	Natural Language Processing
5. ASR	Automatic Speech Recognition
6. TTS	Text to Speech

ABSTRACT

People feel more laid-back when they are interacting with the system in Natural Language. Natural Language Processing system takes human understandable language as input and converts it into machine coherent code. This output is processed and translated back to natural language. A major problem faced by the customers in a restaurant is being served late, this is because during rush hours the availability of staff to take orders from customer decreases and this could kick one's heels eagerly waiting for their order. This overhead can be removed by implementing a restaurant management system based on techniques like NLP, Rule-based system, Database connectivity, networking, machine learning, deep-learning. The objective of this report is to provide detail understanding of how this restaurant management system works.

INTRODUCTION

1.1 Project Overview

Nowadays hustling restaurants take a lot of time to process the given order and also the time it takes to collect the order from all the tables during rush hours increases with the number of tables occupied. We came with a solution to this problem with the help of a restaurant management system deployed using NLP, ML, DL, and Rule Based System.

Focus of this project is to build a device which can help restaurants in optimizing their profits by providing following functionalities:

- A **computing device interacting with the customers**, taking order from them, asking their preferences, suggesting/recommending some of the popular dishes for them. This reduces some human labour and increases the interest of foodies in the restaurant.
- Applying **Sentiment Analysis to the customer's reviews and feedback** can provide restaurants knowledge about areas of improvement.

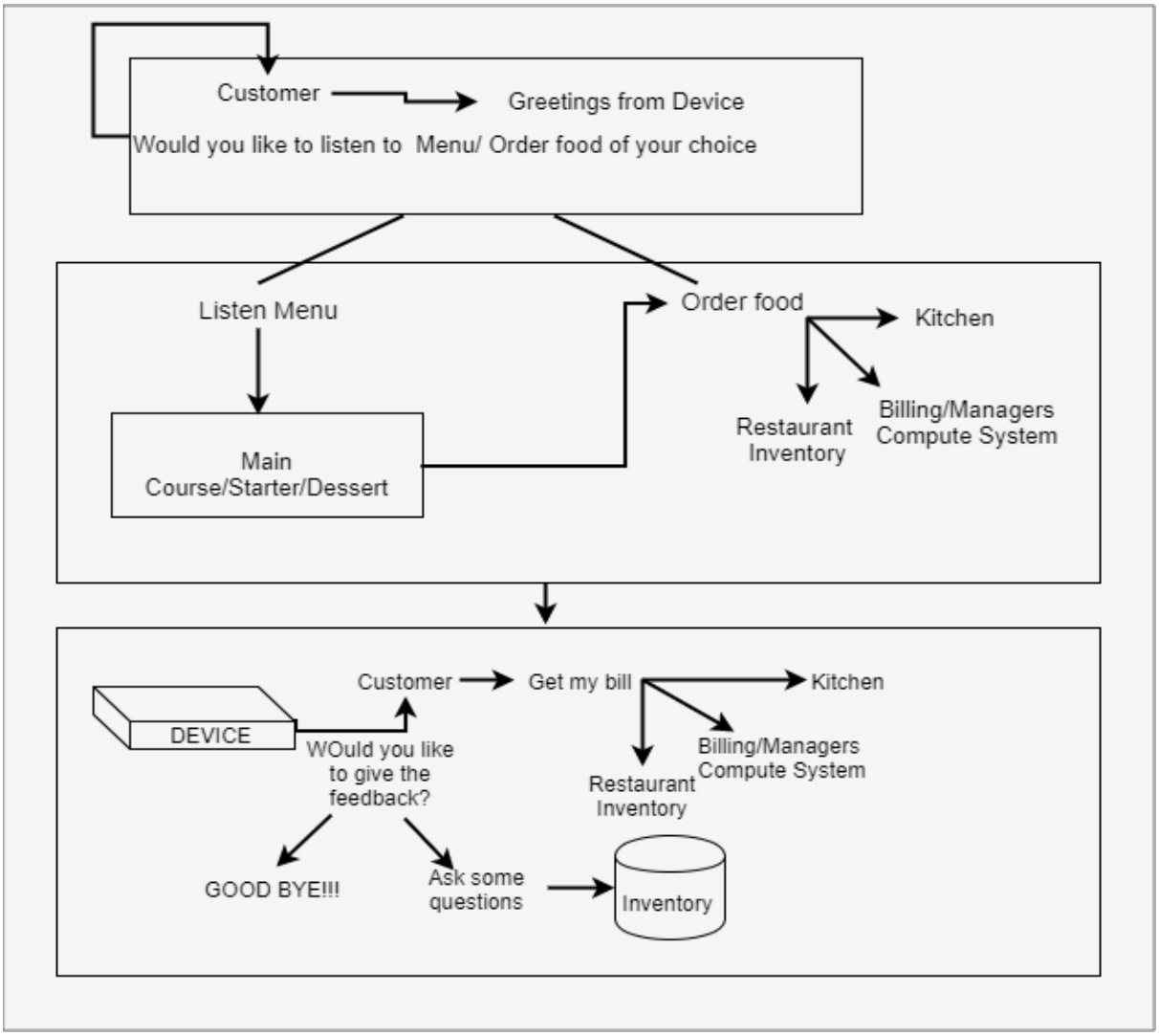


Figure 1: Flowchart for the proposed System

NLP takes order as voice commands and converts them to text, this data is stored in the DB and sent to management server where the data is processed. Order is sent to the kitchen and when it is ready, order is sent to the customer directly. Once the customer is satisfied with the food and asks for bill, bill is presented to the customer along with an option to provide feedback about the food or not. If the customer opts for providing the feedback, Sentiment Analysis algorithm is orchestrated in the background to scrutinize the feedback provided by the user. Now when sufficient feedbacks are gathered from various customers, restaurant authorities can come to know what kind of food people like, what is currently in the demand. These NLP systems are installed on all the tables and now the customers can interact with the system hands-free.

The implementation of such a system will lead to major advantages:

1) during rush hours multiple customer requests will be handled efficiently without the customer having to wait to place the order.

2) This system eliminates the overhead of waiter taking orders from the customer and the human-errors encountered in the process.

Techniques Used:

1. NLP:

NLP combines AI with computational linguistics and computer science to process human or natural languages and speech. The process can be broken down into three parts. The first task of NLP is to understand the natural language received by the computer. The computer uses a built-in statistical model to perform a speech recognition routine that converts the natural language to a programming language. It does this by breaking down a recent speech it hears into tiny units, and then compares these units to previous units from a previous speech. The output or result in text format statistically determines the words and sentences that were most likely said. This first task is called the speech-to-text process.

The next task is called the part-of-speech (POS) tagging or word-category disambiguation. This process elementarily identifies words in their grammatical forms as nouns, verbs, adjectives, past tense, etc. using a set of lexicon rules coded into the computer. After these two processes, the computer probably now understands the meaning of the speech that was made.

The third step taken by an NLP is text-to-speech conversion. At this stage, the computer programming language is converted into an audible or textual format for the user.

2. Machine Learning:

Machine learning is the concept that a computer program can learn and adapt to new data without human interference. Machine learning is a field of artificial intelligence (AI) that keeps a computer's built-in algorithms current regardless of changes in the worldwide economy.

Various sectors of the economy are dealing with huge amounts of data available in different formats from disparate sources. The enormous amount of data, known as Big Data, is becoming easily available and accessible due to the progressive use of technology. Companies and governments realize the huge insights that can be gained

from tapping into big data but lack the resources and time required to comb through its wealth of information. As such, Artificial Intelligence measures are being employed by different industries to gather, process, communicate, and share useful information from data sets. One method of AI that is increasingly utilized for big data processing is machine learning.

3. **Deep Learning:**

   Deep Learning has evolved hand-in-hand with the digital era, which has brought about an explosion of data in all forms and from every region of the world. This data, known simply as Big Data, is drawn from sources like social media, internet search engines, e-commerce platforms, online cinemas and more. This enormous amount of data is readily accessible and can be shared through fintech applications like cloud computing. However, the data, which normally is unstructured, is so vast that it could take decades for humans to comprehend it and extract relevant information.

   One of the most common AI techniques used for processing Big Data is Machine Learning, a self-adaptive algorithm that gets increasingly better analysis and patterns with experience or with new added data. If a digital payments company wanted to detect the occurrence of or potential for fraud in its system, it could employ machine learning tools for this purpose. The computational algorithm built into a computer model will process all transactions happening on the digital platform, find patterns in the data set and point out any anomaly detected by the pattern

4. **Rule-based System:**

   NLU (Natural Language Understanding) modules for applications. Their purpose is to transform natural user language into actionable data and can be designed to manage a conversation flow in a specific way. The above transformations are done using techniques such as Word2vec

   Machine learning allows our system to understand user inputs in natural language and convert them into structured data, extracting relevant parameters. The system uses machine learning algorithms to match user requests to specific intents and uses entities to extract relevant data from them.

1.2 Hardware Specification Required

1.2.1 Raspberry Pi 3

1.3 Software Specification

1.3.1 Microsoft Word

1.3.2 Pycharm

1.3.3 Vim

1.3.4 Spyder

1.3.5 Mongo DB

1.4 Languages Used

1.4.1 Python

LITERATURE REVIEW

Speech Recognition

In Speech Recognition technology speech given as an input is converted to text, Automatic Speech Recognition is used for that purpose. Automatic Speech Recognition (ASR) can be defined as the independent, computer-driven transcription of spoken language into readable text in real time. ASR is technology that allows a computer to identify the words that a person speaks into a microphone or telephone and convert it to written text. Although ASR technology is not yet at the point where machines understand all speech, in any acoustic environment, or by any person. It is used on a day-to-day basis in a number of Natural Language Processing applications and services.

The ultimate goal of ASR research is to allow a computer to recognize in real-time, with 100% accuracy, all words that are intelligibly spoken by any person, independent of vocabulary size, noise, speaker characteristics or accent. Today, if the system is trained to learn an individual speaker‘s voice, then much larger vocabularies are possible and accuracy can be greater than 90%. Most commercial companies claim that recognition software can achieve between 98% to 99% accuracy if operated under optimal conditions. Optimal conditions usually assume that users have speech characteristics which match the training data, can achieve proper speaker adaptation, and work in a clean noise environment [1].

Figure 2 shows the block diagram of a typical ASR system. It is composed of two major components: the front end and the decoder. The front end block extracts spectrum representation of the speech waveform. The most widely used features are Mel Frequency Cepstral Coefficients (MFCC) [2]. The decoder block searches the best match of word sequences for the input acoustic features based on acoustic model, lexicon, and language model.

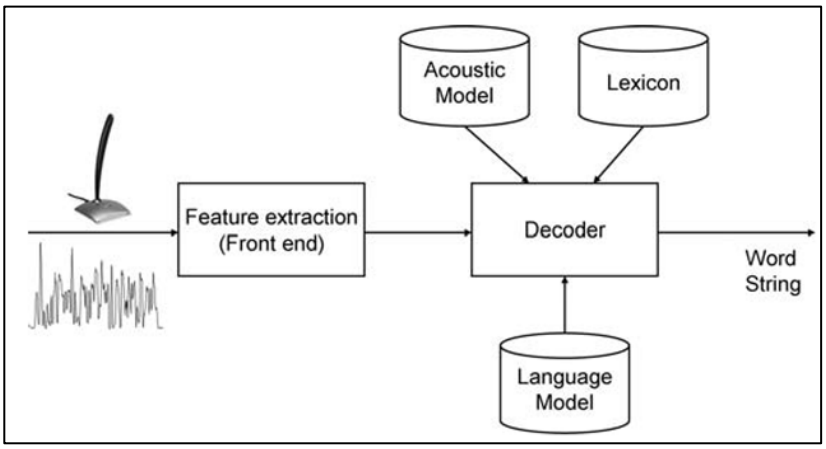


Figure 2: Automatic Speech Recognition System[3]

Rule Based System

Our current Rule Based System involves the following approaches:

* rule based system

* core concepts like word2vec

Overall Architecture of AI Assistant Based Applications

(A given example of alexa)

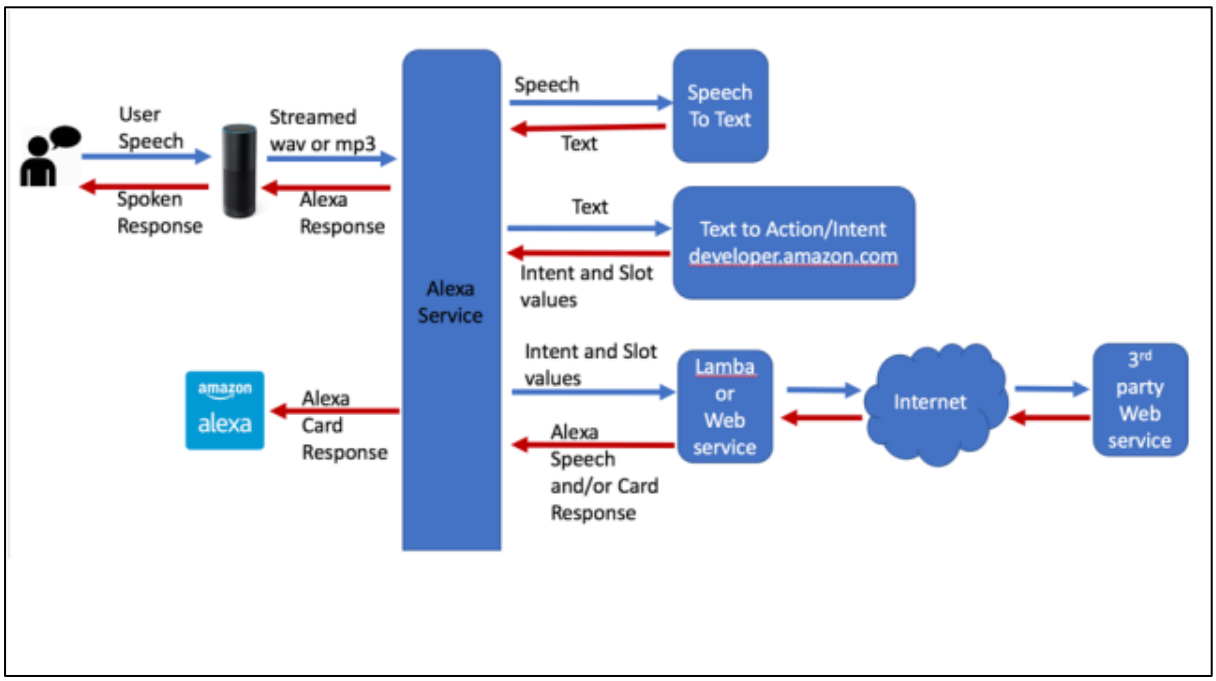


Figure 3: Working Flow diagram for Alexa[4]

Explaining Core concepts (Word2Vec, Glove)

What are word embeddings?

> In very simplistic terms, Word Embeddings are the texts converted into numbers and there may be different numerical representations of the same text. But before we dive into the details of Word Embeddings, the following question should be asked
>
> Sound and images have feature rich embeddings

Why do we need embeddings?

As it turns out, many Machine Learning algorithms and almost all Deep Learning Architectures are incapable of processing strings or plain text in their raw form. They require numbers as inputs to perform any sort of job, be it classification, regression etc. in broad terms. And with the huge amount of data that is present in the text format, it is imperative to extract knowledge out of it and build applications. Some real world applications of text applications are – sentiment analysis of reviews by Amazon etc., document or news classification or clustering by Google etc.

Why Learn Word Embeddings?

Image and audio processing systems work with rich, high-dimensional datasets encoded as vectors of the individual raw pixel-intensities for image data, or e.g. power spectral density coefficients for audio data. For tasks like object or speech recognition we know that all the information required to successfully perform the task is encoded in the data (because humans can perform these tasks from the raw data). However, natural language processing systems traditionally treat words as discrete atomic symbols, and therefore 'cat' may be represented as Id537 and 'dog' as Id143. These encodings are arbitrary, and provide no useful information to the system regarding the relationships that may exist between the individual symbols. This means that the model can leverage very little of what it has learned about 'cats' when it is processing data about 'dogs' (such that they are both animals, four-legged, pets, etc.). Representing words as unique, discrete ids furthermore leads to data sparsity, and usually means that we may need more data in order to successfully train statistical models. Using vector representations can overcome some of these obstacles.

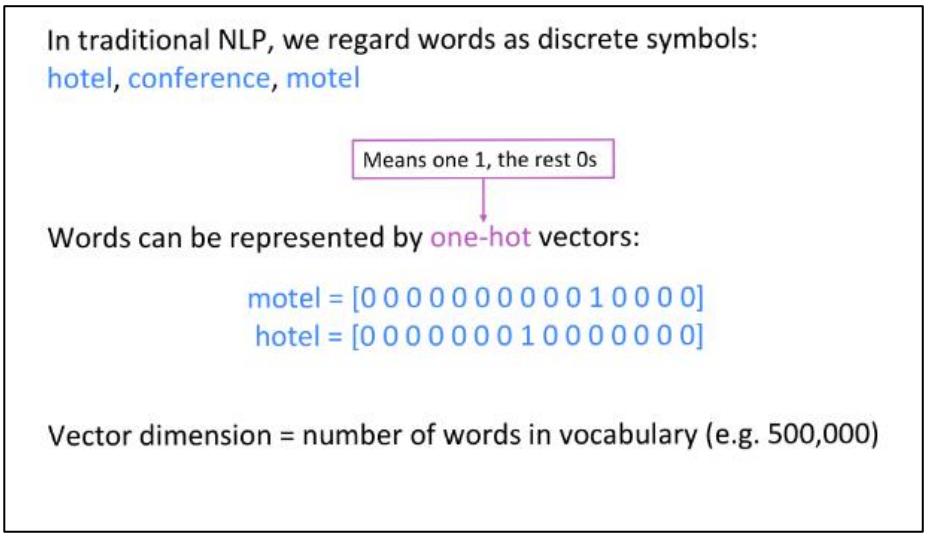


Figure 4: Traditional Ways to embed Words[5]

Types of word vector techinques :

* Word2Vec

* Glove (Count based model)

Word2vec

What exactly is happening?

If we take any two vectors, both of say, 300 dimensions, that are randomly initialized with some values, and if we add just a tiny bit of one vector to the other, the vectors get “closer” to each other (the cosine similarity increases), simply by virtue of vector addition. Figure below shows this for 2 dimensions.

if we subtract a tiny bit of one vector from the other - the vectors will move “apart” (cosine similarity decreases) by a tiny bit (In the boundary case of both vectors being exact opposite direction of each other, one vector will be nudged to eventually flip from opposite to same direction, as its magnitude decreases/increases with each positive nudge).

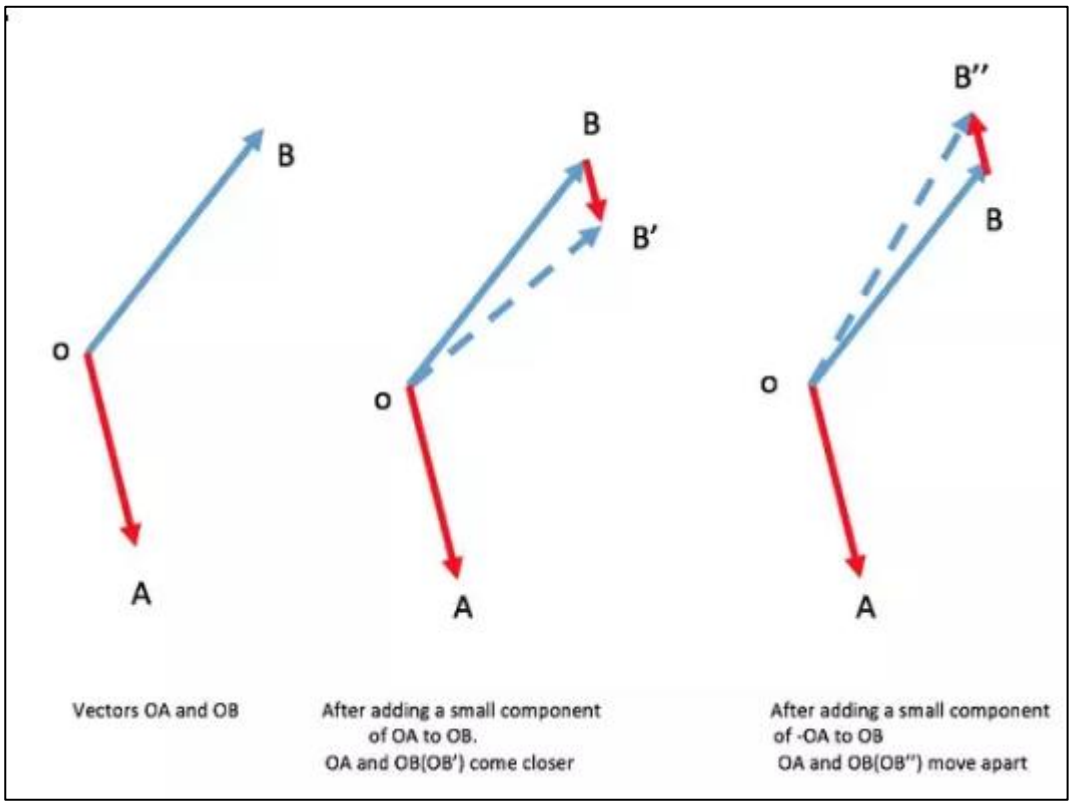


Figure 5: Vector Representation for Word 2 vector on every iteration[5]

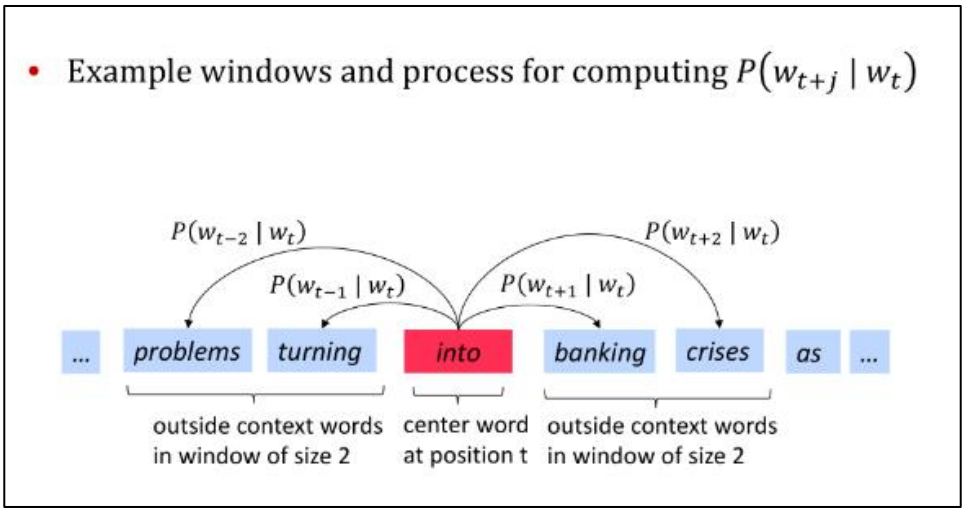


Figure 6: Word 2 Vector using skip gram model[5]

Glove :

The statistics of word occurrences in a corpus is the primary source of information available to all unsupervised methods for learning word representations, and although many such methods now exist, the question still remains as to how meaning is generated from these statistics, and how the resulting word vectors might represent that meaning. In this section, we shed some light on this question. We use our insights to construct a new model for word representation which we call GloVe, for Global Vectors, because the global corpus statistics are captured directly by the model.

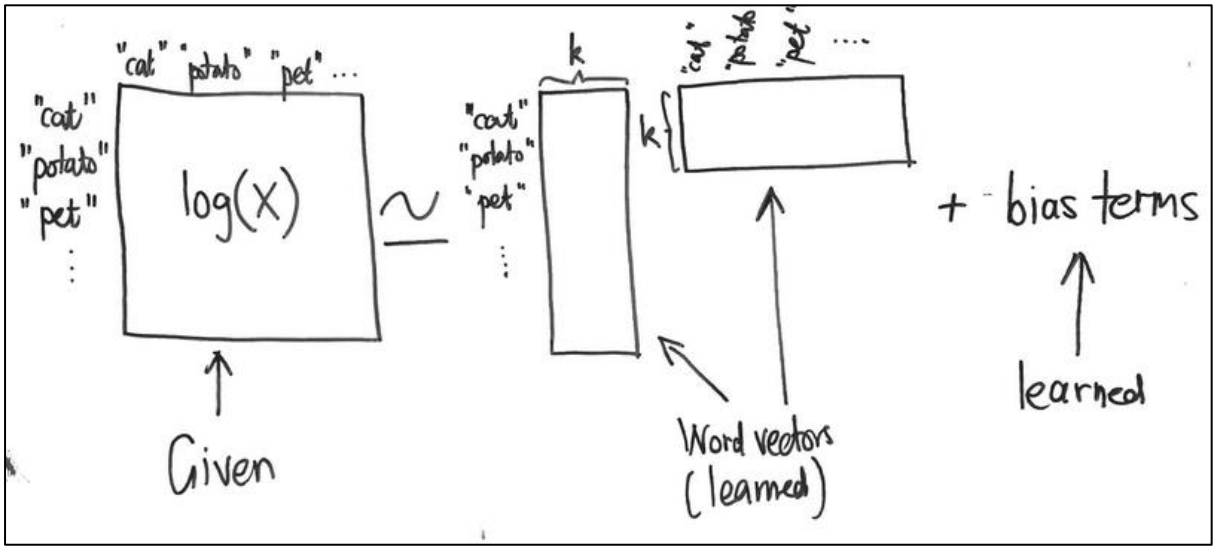


Figure 7: Working of Glove Vectors[6]

Database (MongoDB)

MongoDB is a document-store database designed for best scalability, high availability and good performance. It allows data persistence in a nested state and has the ability to query the nested data in an undefined fashion with embedded queries. In addition, it does not inflict schema, allowing it to adapt quickly as applications. Moreover, a MongoDB document can contain field types that other documents of the same collection do not have. Anyhow of this flexibility, MongoDB still ensures expected functionalities such as full query language and consistency.

MongoDB is in the forefront of NoSQL databases, providing agility and scalability to businesses. More than thousand companies and new start-up companies have acquire and are using MongoDB to develop new applications, refine client experience, fast track marketing time and minimize costs. It's use of mostly bigger web applications like Facebook, Amazon, Google etc.

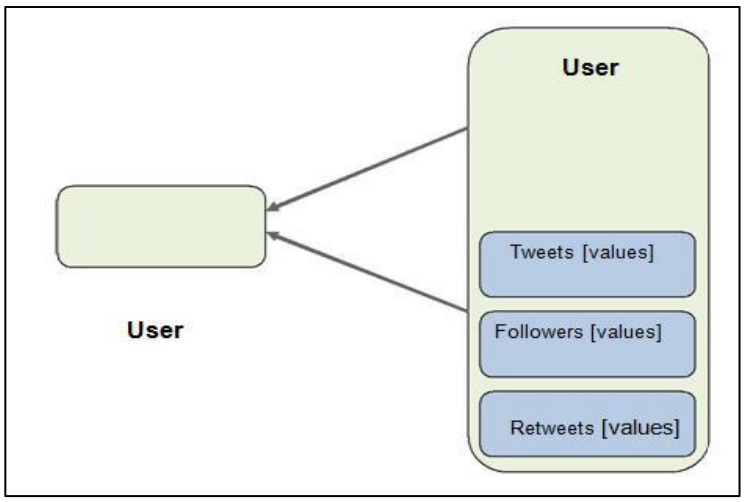


Figure 8: Demonstration of MongoDB[7]

MongoDB stores data as document in a binary-encoded form called BSON or simply Binary JSON. Like in relational databases, MongoDB organizes documents that tend to have similar structure as collections. A Collection in MongoDB corresponds to a table in relational databases, a document is a row, and a field is a column.

Let us consider the data model for a twitter clone application is a example for understanding. A relational database will model the data as multiple tables of User, Followers, Tweets and Retweets. However, in MongoDB Database content the data could be represented as a single collection of Users. Each User's document may be contain followers, Tweets, Retweets, represented as an embedded array because in MongoDB Database joins like inner join and outer joins are not working it's use for joins type working done with embedded queries. In order words, while information of a each different-2 record in relational databases is usually spread across multiple tables with multiple row and column, MongoDB may have all data of a particular record in a single document. so it's a worth doing database.

Table I: Difference between SQL and MongoDB Queries[7]

SQL Queries	MongoDB Queries
Select Query: Select * From Students where id=”200A20”	Select Query: db.Students.find({ },{t_id:1})
Insertion Query: Insert into students (s_id,name, course, branch ,email) values(“200A20”,“Lokesh”,” M.Tech”,”CSE”,” lkbansal1993@gmail.com”)	Insertion Query: db.students.insert({s_id:"200 A20",name:”Loke sh”,course:“M.Tech”,branch:” CSE”,email:lkba nsal1993@gmail.com})
Create Query: Create table students (s_id char,name varchar(50),course varchar(100),branch varchar(100),email varchar(50));	Create Query: db.students.insert({s_id:"200 A20",name:”Loke sh”,course:“M.Tech”,branch:” CSE”,email:lkba nsal1993@gmail.com})
Drop Query: Drop table students;	Drop Query: db.students.drop();
Delete Query: Delete From students where s_id=’200A20’	Delete Query: Db.students.delete({s_id:”200 A20”})

Dynamic Schema

The structure of a MongoDB document can vary from document to document in the form of JSON, unlike in a relational database where the structure for a row must be defined. For instance, all documents describing Twitter Users might contain user ID, tweets and followers. However, some documents do not necessarily have to require user ID for one or more third-party applications. Hence, fields can be added to a document if need be, without disrupting other documents or updating the central system catalog or having system downtime.

Advantages of MongoDB over RDBMS

- **Schema less** − MongoDB is a document database in which one collection holds different documents. Number of fields, content and size of the document can differ from one document to another.
- Structure of a single object is clear.
- No complex joins.
- Deep query-ability. MongoDB supports dynamic queries on documents using a document-based query language that's nearly as powerful as SQL.
- Tuning.
- **Ease of scale-out** − MongoDB is easy to scale.
- Conversion/mapping of application objects to database objects not needed.
- Uses internal memory for storing the (windowed) working set, enabling faster access of data.

Why Use MongoDB?

- **Document Oriented Storage** − Data is stored in the form of JSON style documents.
- Index on any attribute
- Replication and high availability
- Auto-sharding
- Rich queries
- Fast in-place updates
- Professional support by MongoDB

Where to Use MongoDB?

- Big Data
- Content Management and Delivery
- Mobile and Social Infrastructure
- User Data Management
- Data Hub

Feedback Analysis

Restaurants always want their customers to feel good about their food. This can be achieved by analyzing the feedbacks given by the customer. From this knowledge, restaurants can improve themselves and serve the customers well.

Articulating the emotions and feelings with the succor of words makes human beings inimitable. Technobabbly these feelings are known as sentiments and the process of analyzing these statements is called Sentiment Analysis/Opinion Mining.

A. Survey of Product Reviews using Sentiment Analysis[8]

In this paper, author has proposed a technique called sentiment orientation, which automatically finds the frequently used terms for an aspect of a product from online customer reviews. The methodology which is put forward provides an efficient way of predicting the user's opinion and thereby suggesting them. Classifying the product review/opinion on the basis of positive and negative is the major task in one of the supervised machine learning approach called lexicon based approach. This work is said to be sentiment orientation.

The problems which arose are confection (i.e) multiple ways to arrive at the solution and the second one is to deal with the context based words. To overcome these problems, the sentiment orientation algorithm is proposed by the author. It includes two major approaches:

1. Corpus based approach: It is classified as a linguistic based approach and mainly identifies the emotional similarity of the word. It follows 3A perspective which is: Annotation, Abstraction and Analysis.
2. Dictionary based approach: This approach makes use of datasets like wordnet. By using the resources of words provided by wordnet it is possible to identify the large set of text from the comments that are retrieved. Some of the major advantages of this approach include ease of use, increases time efficiency, removes unwanted, duplicate content and the dataset.

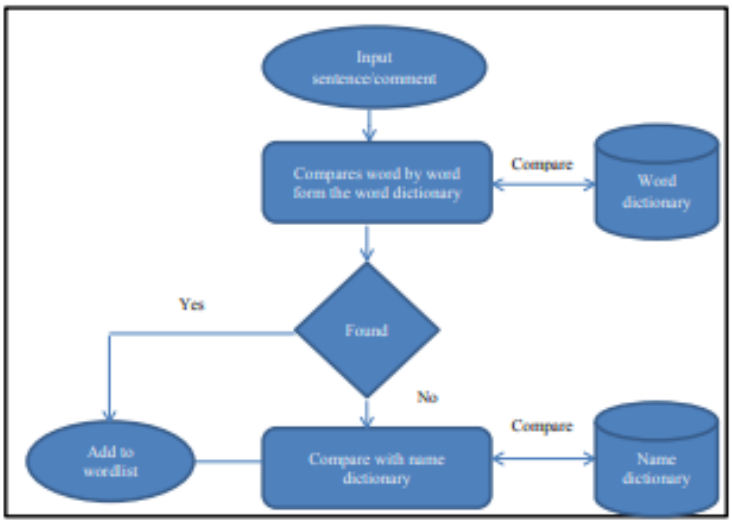


Figure 9: Flowchart for Sentiment Orientation

Above Figure shows the flowchart explanation for sentiment orientation. Wordlist is the output of this system which is created by comparing words in word dictionary and name dictionary respectively.

Parameters	Existing product aspect ranking model	Semantic orientation model
Time Efficiency	70%	90%
Accuracy	70%	100%

B. Application of Machine Learning Techniques to Sentiment Analysis[9]

Sentiment Analysis/Opinion Mining is the process of identifying whether the user-generated text expresses positive, negative or neutral opinion about an entity which can be product, people, topic, event etc.

In this paper, author has proposed several Sentiment Analysis approaches which include following:

1. Lexicon Based approach
2. Machine-Learning Based approach
3. Hybrid approach

1. Lexicon Based approach:

This approach deals with counting of positive and negative words in the output text. If the text consists of more positive words, then the text is assigned a positive score and if there are more number of negative words, then it is assigned as negative score. There must be some cases where there are equal number of positive and negative words then it is assigned as neutral score. This process is called building an opinion lexicon. Two main approaches for this purpose are:

   a. Dictionary based approach
   b. Corpus based approach

2. Machine Learning based approach:
   In this approach, dataset is divided into training and testing dataset. Various Machine Learning Algorithms which are usually used for classification of text are: Maximum Entropy, Naïve Bayes, Support vector machines
3. Hybrid approach
   This approach combines both lexicon and machine learning based sentiment analysis techniques. The advantage of this is best of both worlds can be attained.

   In this paper[#] author has briefly described each step which needs to be followed for Sentiment analysis procedure, below described steps are applied on twitter dataset, hence describing them in detail-

   1. Data Collection: Twitter data is collected using Twitter API
   2. Data Preprocessing: Once data is collected using Twitter API, there is so much of noise present in it which needs to be removed for getting good performance. This process of removal of noise from data is called data preprocessing.

Steps that are carried out in preprocessing are as follows-

a. Case Conversion
b. Stop-words Removal
c. Punctuation Removal
d. Stemming
e. Lemmatization
f. Spelling Correction

3. Feature Extraction: Once tweets are preprocessed, features are extracted which are relevant for sentiment analysis. Some example features are- team presence and frequency, parts of speech tagging, opinion words and phrases, negation, presence of emoticons in tweets, hashtags which are all twitter specific features.

4. Training and Testing Machine Learning classifier: After features are selected, a Machine Learning classifier is chosen for sentiment Analysis. List of Machine Learning Classifier:

a. Naïve Bayes Classifier

b. Support vector machines

c. Decision trees

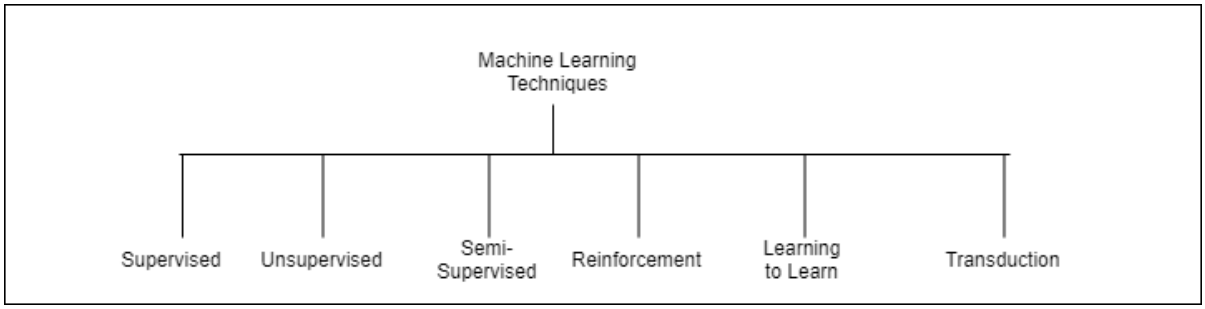
In the paper[9], authors have used Apache Spark to obtain quicker results. In the proposed work, analysis is performed on datasets of different sizes and domains to demonstrate that the proposed framework works on data of all sizes and domains. Three different datasets of varying sizes and domains are considered for analysis.

The following points can be elaborated based on outcome persual:-

- Multinomial Naïve Bayes does not perform as expected when supplied with small training dataset.
- Decision tree takes longer training time than Naïve Bayes.
- Decision tree takes very less time for predicting unseen data compared to multinomial Naïve Bayes.
- Decision tree performs better than Multinomial Naïve Bayes for datasets of varied sizes and domains.
- This work uses Apache Spark Cluster for processing. Hence, the proposed framework is able to produce the results of analysis quickly.

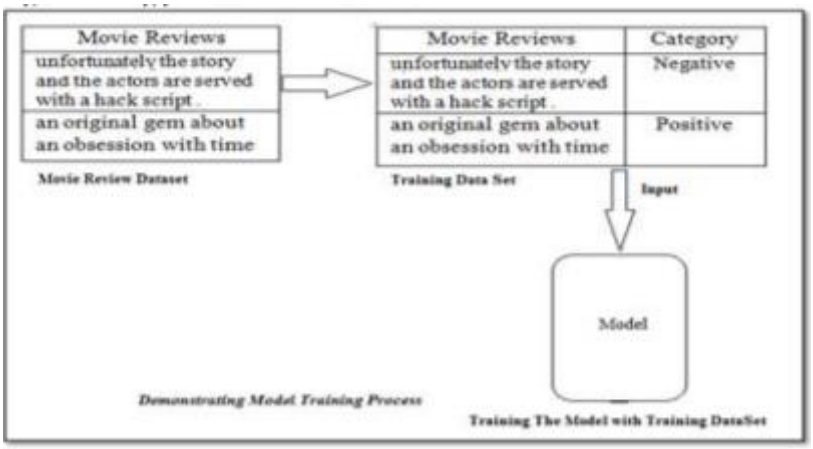
C. *Performance Analysis of Supervised Machine Learning Techniques for Sentiment Analysis[10]*

Human beings always tries to make the machine smarter to solve all its problem smartly and efficiently with in some stipulated period of time. Therefore, machine learning techniques come to action by using which machines get trained and expected to work accordingly. Machine Learning (ML) is a field of Computer Science in which machines of computers are able to learn without being programmed explicitly.

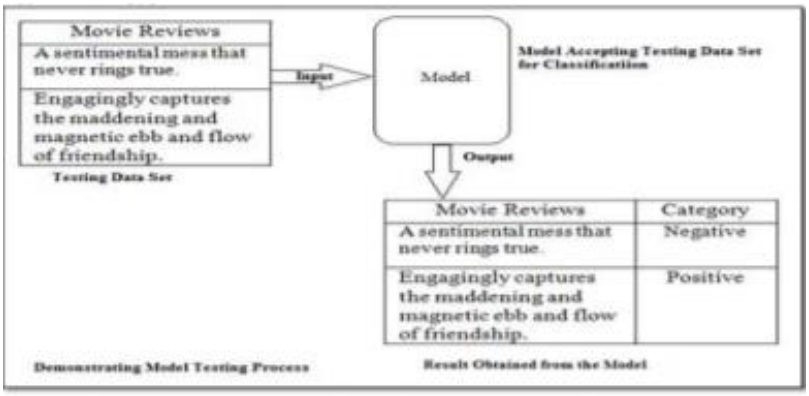


In [#] author has proposed a methodology where Sentiment Analysis is done on movie reviews. Step-by-Step procedure for the same is described below:

1. Collecting Movie Reviews Data Sets
2. Cleaning the Data Sets: Characters, numbers, special characters, and unrecognized characters are all removed from the dataset, this process is called cleaning or pre-processing of data.
3. Data Categorization: Supervised Machine Learning technique take labelled data, which needs categorizing the data into positive or negative. In this, author has used python for labelling the data.
4. Preparing training and testing datasets: 70% of data is considered as training dataset and 30% as testing data
5. Training the Model with training Data Sets



6. Testing the Model with Training DataSets



Results:

Classifiers	10600	25000	35600	50000	85600
Naive Bayes	87.34295643	93.89467593	94.1190275	94.82060185	95.58089034
Multinomial naive Bayes	86.9152633	92.25260417	93.06768047	94.39380787	95.21534564
Bernoulli naive Bayes	87.12910986	92.41898148	93.29296912	94.23466435	95.15019906
Logistic Regression	88.62603582	96.81712963	97.8550643	98.94748264	99.46073109
SGDClassifier	84.92381716	94.48784722	95.06242373	97.62008102	98.55591748
LinearSVC	89.00026731	98.61834491	99.61513189	99.91319444	100
NuSVC	86.56776263	92.41898148	92.61710316	93.81510417	94.37929786

The above table shows the experimental results of 6 classifiers. From which LinearSVC performs the best.

Speech Synthesis

Speech synthesis is the artificial production of human speech. A computer system used for this purpose is called a speech computer or speech synthesizer, and can be implemented in software or hardware products. A text-to-speech (TTS) system converts normal language text into speech.A text to speech output is based on generating corresponding sound output when the text is inputted [11].Wide range of applications use text to speech technique in medicals, telecommunications fields, etc. Each spoken word is created from the phonetic combinationof a set of vowel and consonant speech sound units. Producing an artificial human speech is known as speech synthesis.

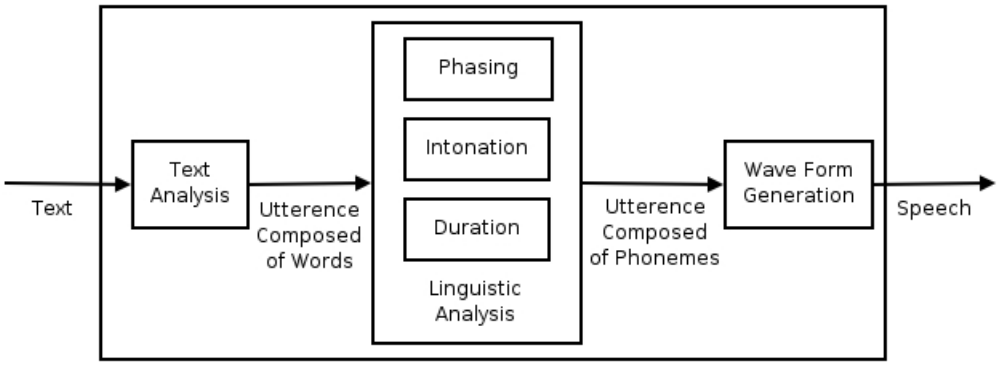


Figure 10: Speech Synthesis Module[12]

The Various speech synthesis methods that have been used for text to speech output for obtaining intelligible and natural output are Concatenative, Formant, Articulatory, Hidden Markov model (HMM).

1. Concatenative Synthesis: Concatenative synthesis is based on the concatenation (or stringing together) of seg-ments of recorded speech.In concatenative synthesis, the spoken sentence is broken down into words and words into syllables, demisyllables, phonemes, diaphones or triphones. Then concatenation and rearrangement of the above segments of recorded samples is done to create new words and sentences is known as concatenative synthesis [13].

2. Formant Synthesis: Also called as rules-based synthesis. The synthesized speech output is created using a model called acoustic model and also some additive parameters are used. Parameters such as fundamental frequency, voicing, and noise levels are varied over time to create a waveform of artificial speech [11].

3. Articulatory Synthesis: Articulatory synthesis refers to computational techniques for synthesizing speech based on models of the human vocal tract and the articulation processes occurring there [23].

4. Hidden Markov Model(HMM): HMM-based synthesis is a synthesis method based on hidden Markov models, also called Statistical Parametric Synthesis. In this sys-tem, the frequency spectrum (vocal tract), fundamental frequency (voice source), and duration (prosody [26]) of speech are modelled simultaneously by HMMs [11], [13].

ANALYSIS & DESIGN

USE CASE DIAGRAM:

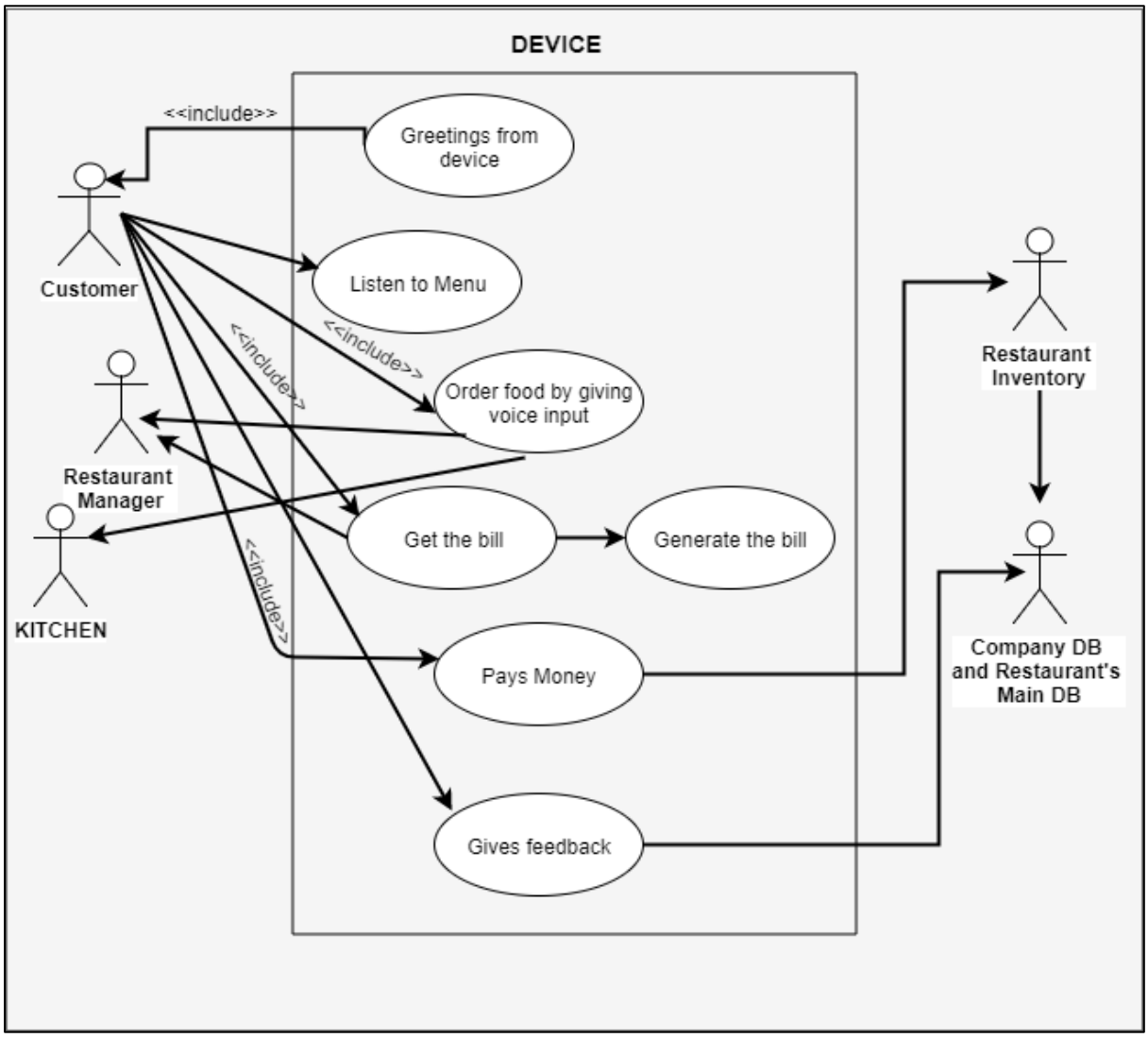


Figure 11: Use Case Diagram

CLASS DIAGRAM:

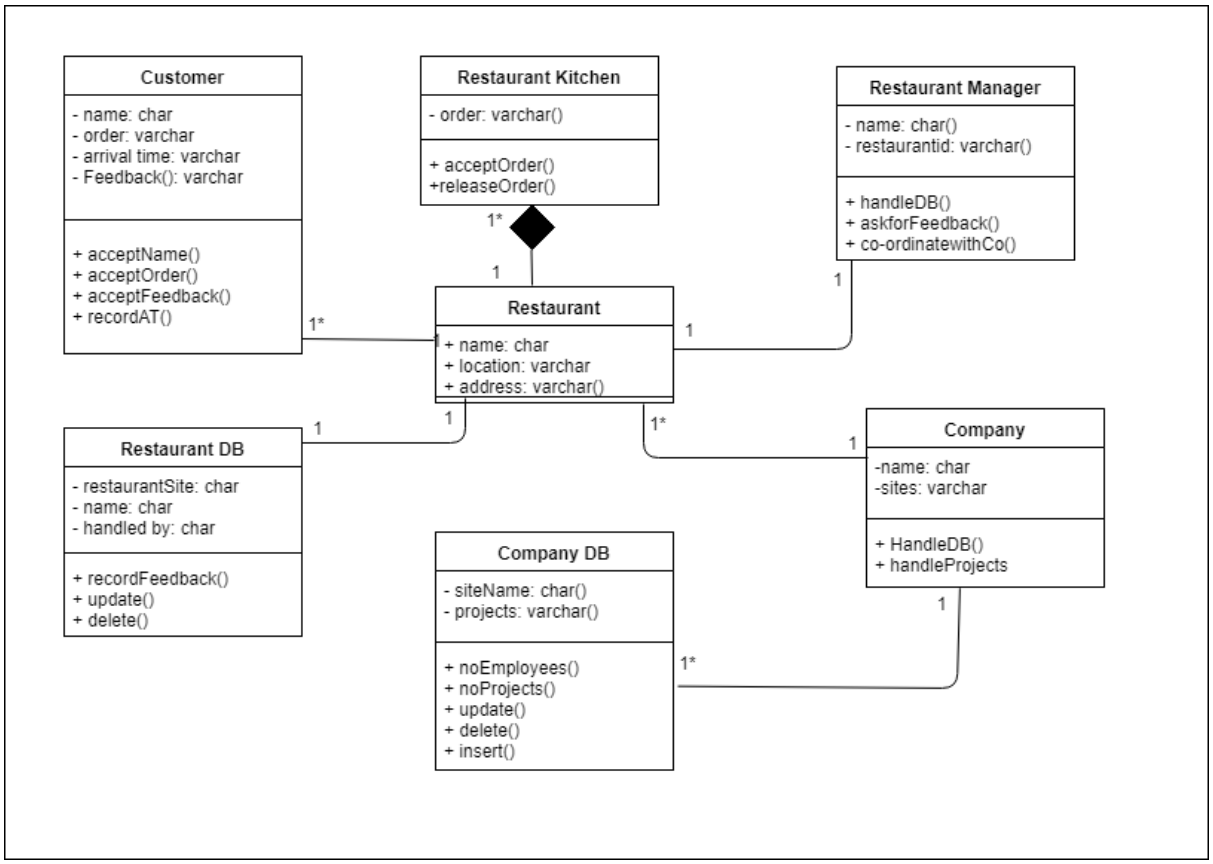


Figure 12: Class Diagram

SEQUENCE DIAGRAM:

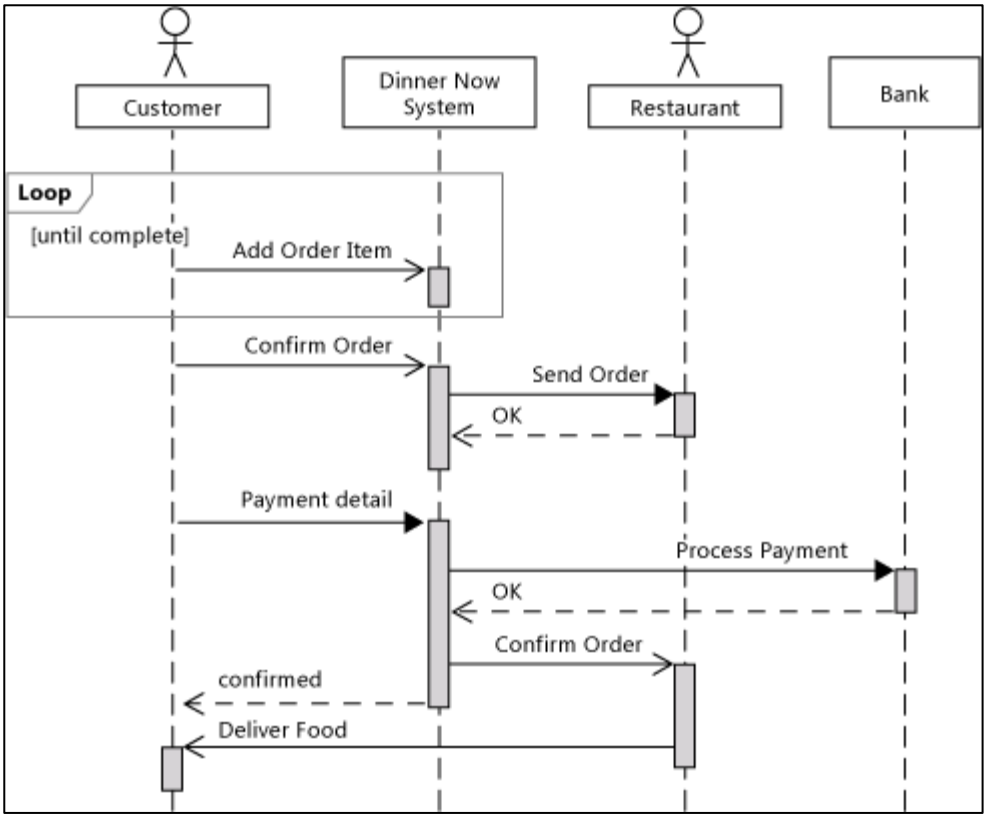


Figure 13: Sequence Diagram

SYSTEM ARCHITECTURE:

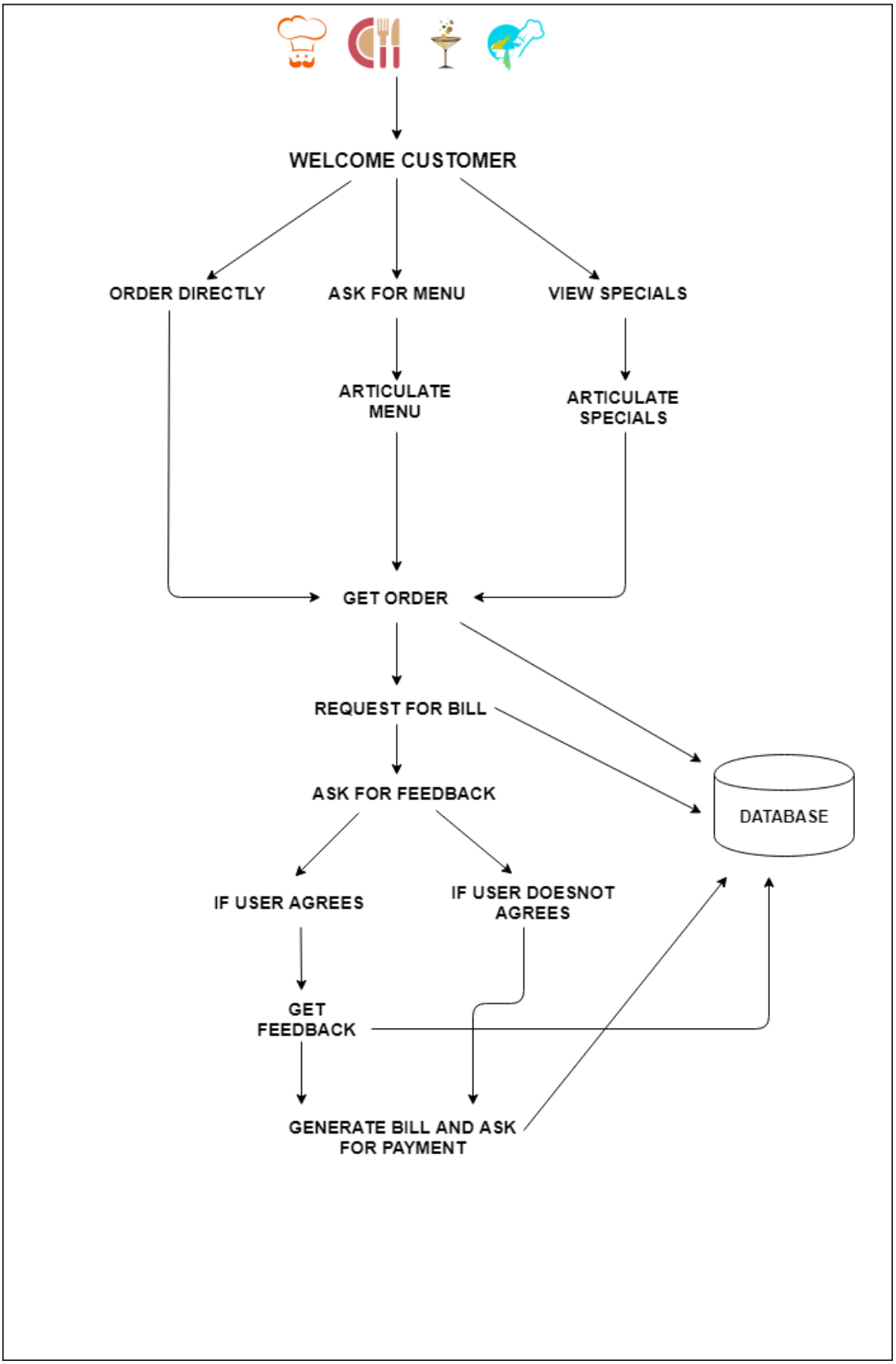


Figure 14: System Architecture

METHODS IMPLEMENTED

The code first analyzes the speech given by the user. The google text to speech algorithm in python (https://pypi.org/project/gTTS/) will convert the spoken sentence into a text format . Once the speech format is converted into text, the text will be sent to the rule based system for proccessing, this request will be sent using a post request (rest api) which will take an input of the text as the headers and return multiple attributes such as the response, intent as well as entities .Our system will then process the text and detect intents out of the given input, generating an apt response for the user query.Meanwhile based on the given intent the order and the bill will be recorded for futher storage into the database.Once the user is done with his food he will be given an option to give a feedback about his experience, during this time the user will also be prompted about his total bill. The bill will be calcualted by getting the default prices from the mongodb server and multplying them by thier quantities. If the user feels like giving a feedback the feedback will be processed.

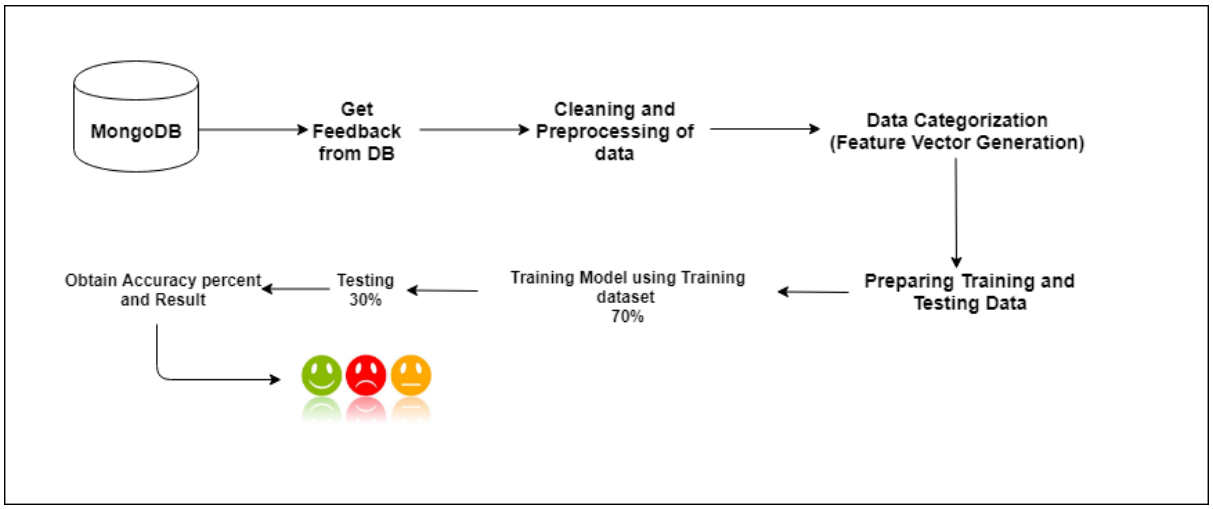


Figure 15: Steps for Feedback Analysis

Feedback Analysis/ Sentiment Analysis is done using nltk with python 3.5.2. By using spyder ide, preprocessing steps performed are[14]:

1. Tokenizing
2. Stop Words
3. Stemming
4. Part of Speech Tagging
5. Chunking
6. Lemmatizing
7. Named Entity Recognition

The Dataset which is used for training and testing, is taken from nltk corpora. Words are converted to featuresets, to compare with the test data. Classifiers which are used for classifying the text are:

1. Naive Bayes(original):

It is a classification technique based on Bayes' Theorem with an assumption of independence among predictors. In simple terms, a Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature.

2. Multinominal Naive Bayes:

It is used for discrete counts. For example, let's say, we have a text classification problem. Here we can consider bernoulli trials which is one step further and instead of "word occurring in the document", we have "count how often word occurs in the document", you can think of it as "number of times outcome number x_i is observed over the n trials".

3. Bernoulli Naive Bayes:

The binomial model is useful if your feature vectors are binary (i.e. zeros and ones). One application would be text classification with 'bag of words' model where the 1s & 0s are "word occurs in the document" and "word does not occur in the document" respectively.

3. Linear Regression:

In this technique, the dependent variable is continuous, independent variable(s) can be continuous or discrete, and nature of regression line is linear.Linear Regression establishes a relationship between dependent variable (Y) and one or more independent variables (X) using a best fit straight line (also known as regression line).

It is represented by an equation Y=a+b*X + e, where a is intercept, b is slope of the line and e is error term. This equation can be used to predict the value of target variable based on given predictor variable(s).

5. SGD() Classifier:

Stochastic Gradient Descent (SGD) is a simple yet very efficient approach to discriminative learning of linear classifiers under convex loss functions such as (linear) Support Vector Machines and Logistic Regression.

6. SVC:
Uses one-against-one approach

7. Linear SVC:
Uses one-against-rest approach

8.NuSVC:

The nu-SVM has the advantage of using a parameter nu for controlling the number of support vectors. The parameter nu represents the lower and upper bound on the number of examples that are support vectors and that lie on the wrong side of the hyperplane, respectively.

Python library called 'Pickle' is used for storing the classifiers soo thst we dont need to run the classifiers again and again. 'Voted Classifier' is used as a highlight of the system, where the highest vote is taken from the above defined classifiers and given as the output.

The generated query will then be converted into speech again using the Espeak module. Once the user is done with everything his details are stored in the database with attribuites such as:

* total bill

* name

* feedback

* sentiment processed

RESULTS & DISCUSSION

Figure 16: Chat between Customer and Device

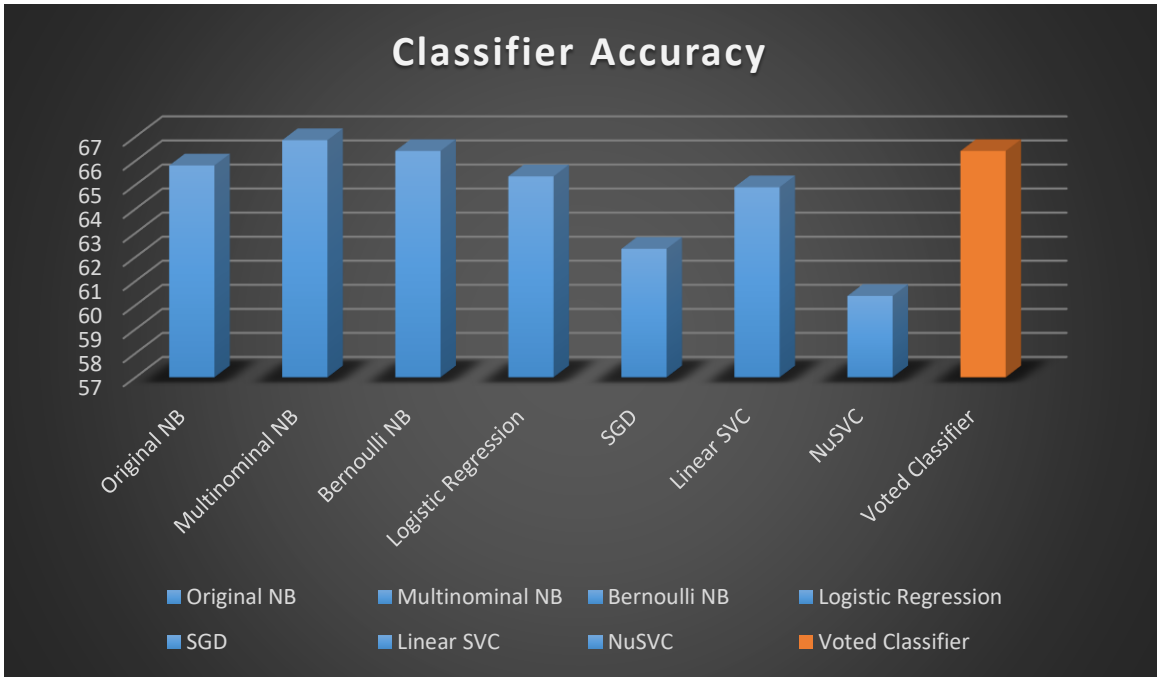


Figure 17: Graphical representation of all classifiers performance comparison

CONCLUSION

There is a saying “the best interface is no interface,” many people are considering voice interface as an excellent approach to reduce friction of Chatbot. Furthermore, with the proliferation of Smart Speakers like Amazon Echo, Google Home, Apple Homepod, the use of voice is starting to become a new trend. And hence our project tries to solve the above issues in a restaurant management space where there is a need for automation as humans may be bottlenecking the limits of the system. Based on the thorough study of various different technologies during the semester we can say that an Object-oriented database (MongoDB) is way more efficient than a normal SQL database. We have also compared different ML Classifiers used to carry out Text Classification in sentiment analysis on our feedback system. In the end, we can successfully conclude that Restaurant management system using modern technologies like NLP, RBS, ML, etc is way more effective and systematic than traditional restaurant management systems.

FUTURE SCOPE

- In the future we also plan to integrate an **inventory management system** to the NLP system so that restaurant management team does not necessarily need a separate system for inventory management.
- **Managing the inventory of the restaurant** which means helping them determine which and what quantity of raw materials they need to buy at a specific time.
  Restaurant authorities can decide on the prices of the food being served in their premises, this can be achieved through **Regression**. Also feedback related to prices can be taken as one of the input for regression.

BUSSINESS PLAN

- This system can be used by restaurants who wish to succeed faster in the food industry, as this system will attract people and foodies because of its advantages and uniqueness like talking to a machine.
- We can license this system to emerging restaurants so that their marketing game becomes strong and inimitable.

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