



Text and Voice Based Emotion Monitoring System

MR. ANIL S NAIK

Department of Information Technology, Walchand Institute of Technology, Solapur, India.

Abstract

An Emotion monitoring system for a call-center is proposed. It aims to simplify the tracking and management of emotions extracted from call center Employee-Customer conversations. The system is composed of four modules: Emotion Detection, Emotion Analysis and Report Generation, Database Manager, and User Interface. The Emotion Detection module uses Tone Analyzer to extract them for reliable emotion; it also performs the Utterance Analysis for detecting emotion. The 14 emotions detected by the tone analyzer are happy, joy, anger, sad and neutral, etc. The Emotion Analysis module performs classification into the 3 categories: Neutral, Anger and Joy. By using this category, it applies the point-scoring technique for calculating the Employee Score. This module also polishes the output of the Emotion Detection module to provide a more presentable output of a sequence of emotions of the Employee and the Customer. The Database Manager is responsible for the management of the database wherein it handles the creation, and update of data. The Interface module serves as the view and user interface for the whole system. The system is comprised of an Android application for conversation and a web application to view reports. The Android application was developed using Android Studio to maintain the modularity and flexibility of the system. The local server monitors the conversation, it displays the detected emotions of both the Customer and the Employee. On the other hand, the web application was constructed using the Django Framework to maintain its modularity and abstraction by using a model. It provides reports and analysis of the emotions expressed by the customer during conversations. Using the Model View Template (MVT) approach, the Emotion monitoring system is scalable, reusable and modular.



Article History

Received: 21 January 2020
Accepted: 13 February 2020


Keywords

Android Application;
Django Framework;
Model View Template (MVT);
The Emotion Analysis.

CONTACT Mr. Anil S Naik ✉ anil.nk287@gmail.com 📍 Department of Information Technology, Walchand Institute of Technology, Solapur, India.



© 2019 The Author(s). Published by Oriental Scientific Publishing Company

This is an  Open Access article licensed under a Creative Commons license: Attribution 4.0 International (CC-BY).

Doi: <http://dx.doi.org/10.13005/ojcs12.04.05>

Introduction

Emotion plays a significant role in successfully communicating one's intentions and beliefs. Therefore, emotion recognition has recently become the focus of several studies. Some of its applications include computer games, talking toys and call center satisfaction monitoring. In a call centre environment, emotion analytics is important since ineffective handling of conversations by the agents can often lead to customer dissatisfaction and even loss of business. In view of this, we propose an Emotion Monitoring system that performs a prosodic analysis of call center agent and client conversations.

To construct this kind of system, it is necessary to know some basic points that can help us in building a robust emotion monitoring system. There are various types of emotions such as surprise, anger, happiness, fear, boredom, and sadness and sometimes their no specific emotion related to it. It is necessary to choose only three emotions that are significant in a call center environment: Neutral, Joy, and Anger. With these emotions, it is desirable to look for specific features that can easily distinguish these three emotions.

Literature survey research reveals that prosodic features are enough for effective classification of emotions. These features include pitch, energy and audible/in audible contours, rhythm, melody, flatness and the like. But among these features, it is observed that the fundamental frequency of an utterance is very useful in detecting emotions. There is a very high inconsistency in recognizing emotions between anger and happiness, two of the main important emotions in the environment. Often, these emotions are classified or labeled interchangeably. To extract these features from the utterance, feature selection methods such as forward selection, and backward elimination are frequently employed. In, anger, boredom, happiness or satisfaction, and neutral were the four emotions detected by their systems. Multivariate discriminant analysis was used and detected that the Median Derivative of Pitch obtained the highest percentage accuracy.

In implementing the emotion detection system, the Tone analyzer is used for detecting the emotion. Detected Emotions are classified into three

categories. Using this information, building a system that can detect the emotions of a call center agent and client during their conversation is feasible. It is also feasible to build a web application that provides a report of the performance of each call center agent to their supervisor.¹

The development of an emotion monitoring system for call center agents is significant because both call center agents and supervisors can benefit from feedback reported by the system. The system described in this paper can detect and display the emotions of the call center agent as well as the caller's emotions is detected at the end of the conversation. This will help the Employee manage his emotions and handle the conversation properly. The detected emotions are anger, neutral and joy. For the supervisor/manager in a call center, the system will also provide the statistics of emotions of call center conversations for monitoring the Employee's emotional performance.

Classification of Emotions and Its Process

In the diagram, we see that Dataset is taken as input which is the conversation between the Customer and the Employee is considered as the call which is performed using the two Android apps which are connected to Server. The server is monitoring the Conversation and storing it for Emotion Detection purpose. In Emotion Detection, emotion is detected for each statement of the conversation. This Emotion Detection phase is an important part of the project. After Emotion Detection, the classification of Emotion is done into the 3 categories. Three Categories are Neutral, Joy, and Anger. This classification is based category of Emotion. After the classification the next important phase is Analysis. In which we are using the scoring point technique to calculate the Employee Score for the Conversation. And it also monitors the last 60% conversation of the customer for checking Customer satisfaction. When all analysis part is completed it stores the conversation with the emotion of each statement into the database. This stored data is used by the manager to check the Employee performance for conversations performed in a call center. This is checked by the manager using the Website where the graphical representation is used for easier understanding.³

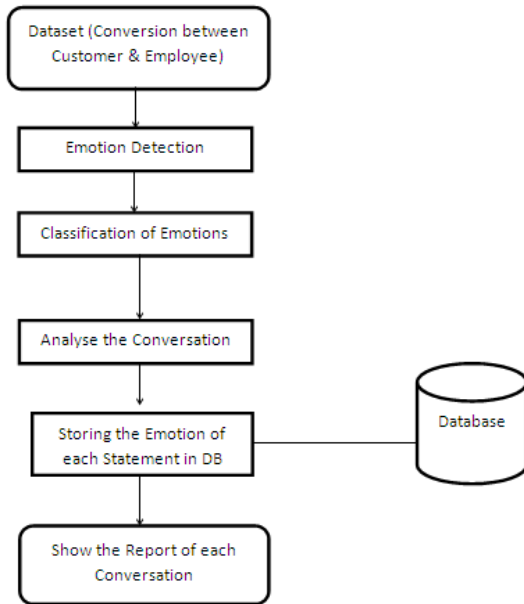


Fig. 1: System model

Existing System

Emotion plays a significant role in successfully communicating one’s intentions and beliefs. As a consequence, emotion recognition has recently become the focus of several studies. Some of its applications include computer games, talking toys and call center satisfaction monitoring.

In a call center environment, emotion analytics is important since ineffective handling of conversations by the employees can often lead to customer dissatisfaction and even loss of business. In view of this, we propose a real-time emotion recognition system that performs a prosodic analysis of call center agent and client conversations.

Previous research reveals that prosodic features are enough for effective classification of emotions. These features include pitch, energy and audible/inaudible contours, rhythm, melody, flatness and the like. But among these features, it is observed that the fundamental frequency of an utterance is very useful in detecting emotions. There is a very high inconsistency in recognizing emotions between anger and happiness, two of the main important emotions in the environment.²

Disadvantages

- The existing system is based on the frequency of the voice that not give the appropriate result of emotion.
- Their no such method for checking whether the customer is satisfied or not

Proposed System

As mentioned in the existing system disadvantage, we are going to implement the proposed system to overcome this. We are going to develop our system that tracks the Emotion from the conversation for that we are using the Tone analyzer, and for the second disadvantage, we are classifying the Detected Emotion into the three categories: Anger, Joy and Neutral. This classification is used for checking Employee Performance and the last 60% conversation is used for checking customer satisfaction.

Advantages

- Helps manager to analyze the working behaviour of all Employees
- Helps manager to check whether the Customer satisfied or not.
- It helps the Employee to check his own performance.
- It helps the manager to easily analyze the performance of the Employee.

System Architecture

Customer and employee communicate with each other. This conversation is monitored by the monitoring system. After storing this conversation scoring is performed. Each message is assigned a point according to its emotion. In this way, the conversation is analyzed and emotion and score of the conversation are stored in the database. Taking all the above points into consideration data is retrieved from database and report is generated. The generated report is displayed to the manager or owner with the help of web application.

Technique or Algorithm used

A proposed system that we have implemented is mainly for checking customer satisfaction and employee performance in the call center environment. For this, we are using the two techniques to achieve these goals. These Techniques are:

- First, we are using the classification technique. In this when we are giving conversation statements as input and detecting emotion. There is a total of 14 types of emotions. So, classify it into 3 categories as shown in the fig. This classification helps to detect only the required emotion.⁴
- The second technique is to Point Scoring method. In this, we are using the point table

as shown in the above fig. By using this point table, we are going to calculate the Employee Score for conversation. This score helps to check the employee Performance. For customer satisfaction, we are monitoring the last 60% conversion. Point Scoring table plays an important role here.⁵

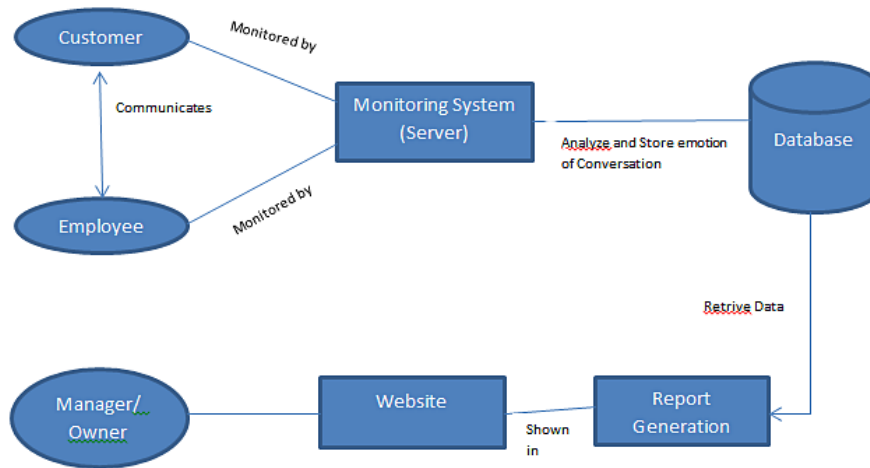


Fig. 2: System Architecture

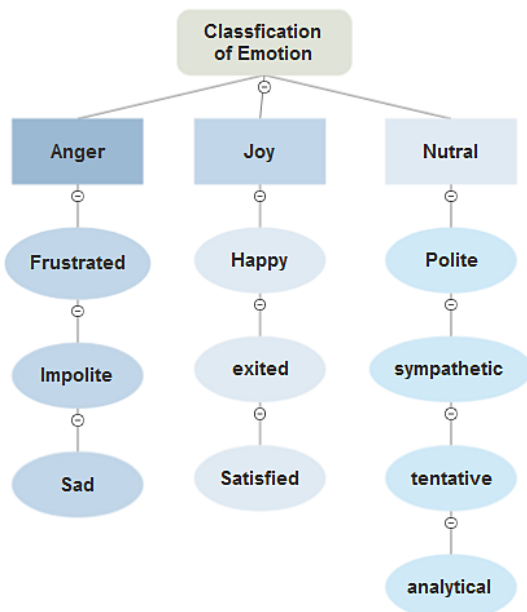


Fig. 3: Classification of Emotions

+2	+1	-1	-2
(A,N)	(N,N)	(A,J)	(A,A)
(J,J)	(J,N)		(J,A)
(N,J)			(N,A)

Fig. 4: Point Scoring table

```

Message_Format mf=result.get(i);
if(mf.Side.equals("Customer")){
{
String s=mf.Tone_name;
if(s.equals("Anger"))
pint+/-2;
else if(s.equals("Joy"))
pint+=2;
else if(s.equals("Neutral"))
pint+=1;
}
}
    
```

Point Scoring table specifies the customer tone, if it equals "Anger" than values is +2, if it equals "Joy" than value is +2 and lastly if it equals "Neutral" than value is +1.

Modules

The emotion monitoring system for call center employees consists of the following four modules:

- Emotion Detection
- Emotion Analysis
- Report Generation
- Database Manager & User Interface

Emotion Detection

Conversation performed between Customer and call center employee (for our project it is considered as the call) is used for Emotion Detection. Each statement of the conversation is separated as a message from the Customer and response to it from Employee. Each statement Emotion is Detected by giving this statement to the IBM Tone Analyzer. This performs the detection task and gives the result for

it. Suppose in any case there is no emotion or tone dedicated then it goes for the Utterance Analysis. The result of it is the emotion for that message. This is performed for the entire conversation⁷

Emotion Analysis

In Emotion Analysis, the data from the previous is taken i.e. from the Emotion Detection phase. Input is the conversion with the related emotion to each message. This emotion detected is classified into three categories: Anger, Neutral, and Joy. As shown in figure 2. After next is to calculate the scoring point of Employee. This scored point calculated by using the table as shown in fig 3. After this from the whole conversation, we are going to analyze the last 60% conversion of Customers for checking Customer satisfaction.⁵

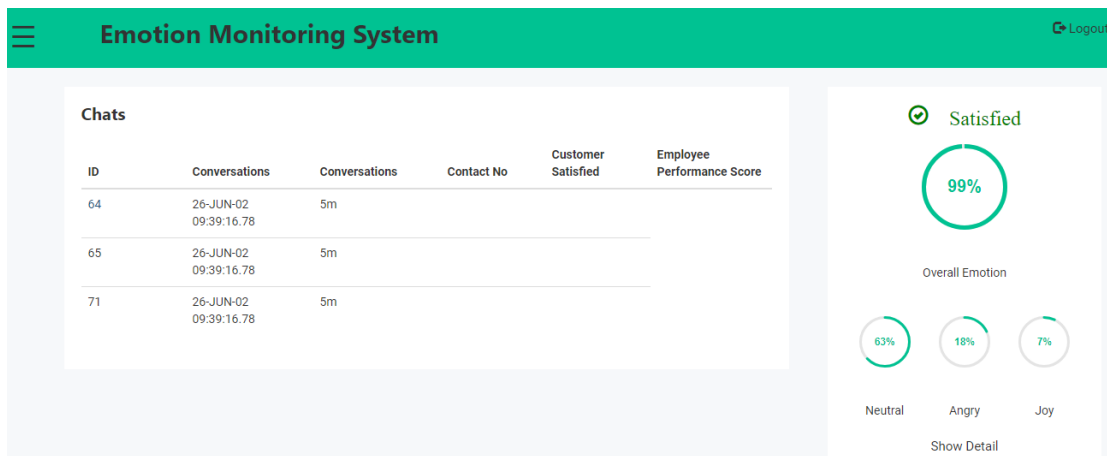


Fig. 5: Statistics of Conversation

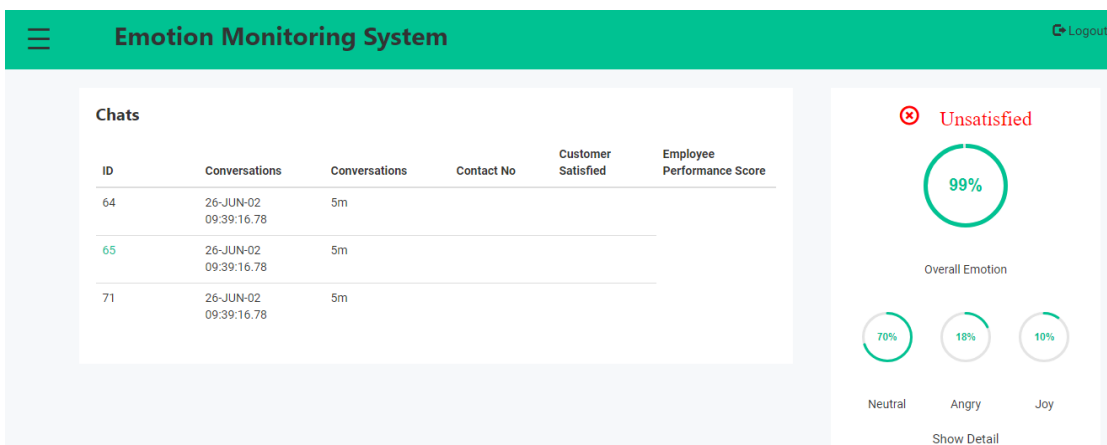


Fig. 6: Statistics of Conversation (Unsatisfied Conversation)

This module is responsible for sending information about a certain utterance such as its corresponding emotion, Employee id, caller id and timestamp of the utterance to the Database Manager module.

This module is also in charge of the analysis of the emotions of an agent. To produce better analysis, this module computes the statistics of the emotions found in a conversation.⁶

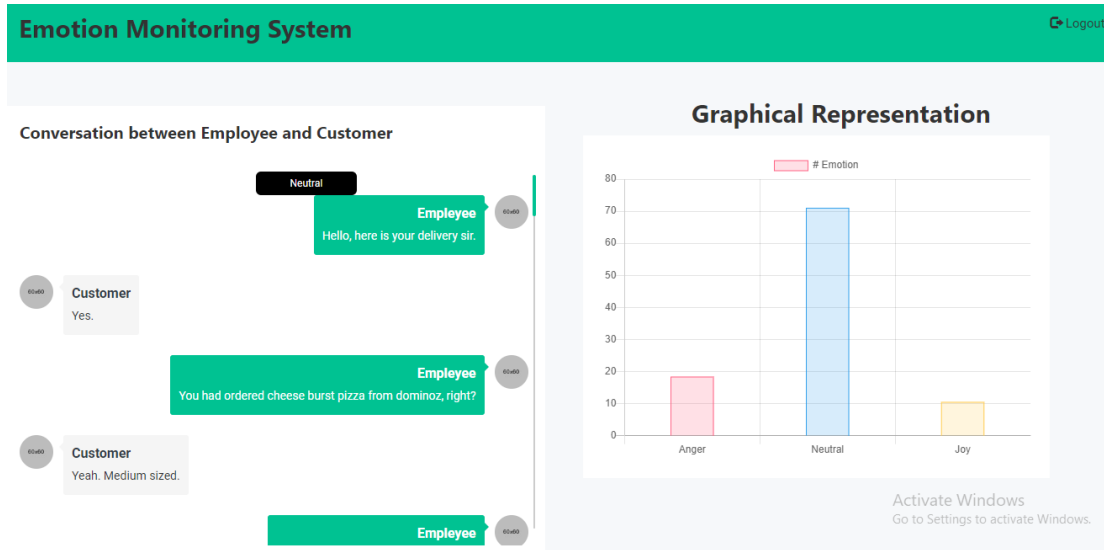


Fig. 7: Sample Conversation

Seq. No.	Message From	Message	Message Tone
1	Employee	Hello, here is your delivery sir.	Neutral
2	Customer	Yes.	Neutral
3	Employee	You had ordered cheese burst pizza from dominoz, right?	Neutral
4	Customer	Yeah. Medium sized.	Neutral
5	Employee	Okay, any suggestions to be given, sir?	Neutral
6	Customer	The service is totally good but there are some points I'd like you to look into.	Joy
7	Employee	Sure sir.	Neutral
8	Customer	The last time I had ordered a dish, it did not taste that good.	Neutral
9	Employee	Well sir, it depends on the restaurant from which you have ordered.	Neutral
10	Customer	That is why I am instructing your company to put the names of those restaurants on the app which serve tasty food.	Neutral
11	Employee	It will not happen the next time, sir.	Neutral
12	Customer	First of all you people could check if the food really tastes well as that is the first priority of every customer."	Neutral
13	Employee	The company will look into the matter totally, sir.	Neutral
14	Customer	Yes, it has to. The delivery also is late sometimes.	Anger

Fig. 8: Sample Conversation

Results and Discussion

We presented an emotion monitoring system for call center agents which has four modules for Emotion Detection, Emotion Analysis and Report Generation, Database Management, and User Interface. The tone Analyzer is used in detecting the emotions during the agent-client conversations. The three emotions detected by the system are happiness, anger, and neutral. A user-friendly interface with a professional look that can assist both agents and supervisors in enhancing client satisfaction was constructed.

Future Enhancement

We are going to take the call recording as input instead of the Android app. For that, we are using a

speaker dissertation which separates call recording into customer and Employee.

Acknowledgement

The authors acknowledge Walchand Institute of Technology for providing us the opportunity to work in this research.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors do not have any conflict of interest.

References

1. Princess Florianne O. Boco, Diana Karen B. Tercias and Kenneth R. Dela Cruz (2010). EMSys: An Emotion Monitoring System for Call Center Agents, University of the Philippines-Diliman, 2010.
2. C. Busso, S. Lee, S. Narayanan, Analysis of Emotionally Salient Aspects of Fundamental Frequency for Emotion Detection, *IEEE Transactions on Audio, Speech, and Language Processing*, Vol.17, No.4, pp.582-596, May 2009.
3. L. Cen, W. Ser, Z. Yu, Speech Emotion Recognition Using Canonical Correlation Analysis and Probabilistic Neural Network, *Seventh International Conference on Machine Learning and Applications*, pp.859-862, 2008.
4. Asim Smailagic, Daniel Siewiorek, Alex Rudnicky (2013). Emotion Recognition Modulating the Behavior of Intelligent Systems, *2013 IEEE International Symposium on Multimedia*, pp.378-383, 2013.
5. L. Devillers, L. Lamel, I. Vasilescu, Emotion Detection in Task-oriented Spoken Dialogues, *IEEE International Conference on Multimedia and Expo*, pp. 549-552, 2003.
6. C.M. Lee, S., Narayanan, Toward Detecting Emotions in Spoken Dialogs, *IEEE Transactions on Audio, Speech, and Language Processing*, Vol.13, No.2, pp.293-302, March 2005.
7. D. Morrison, R. Wang, L. De Silva, W.L. Xu, Real-time Spoken Affect Classification and its Application in Call-Centers, *Third International Conference on Information Technology and Applications*, 2005.