Whistle Blower Identification for Security Doors

Pournima Mishra¹, Puja Kumari Raut² & Rajkanya Sapkale³
¹, ²&³Department of Computer Engineering, Dy Patil College of Engineering, Ambi, Talegaon, India.

Abstract: Whistle blower identification in security doors uses Sound Recognition which is a process of identifying the identity of an unknown whistle on the basis of individual information that contain in the sound signal. Sound recognition is one of the biometric technologies used by the security system to reduce cases of fraud and traits. It is used in variety of applications such as security control for secret information areas, remote access to computer, database access service, security system in cars. In this paper we intend to build a biometric security system using the sound recognition process. We include database of human whistle that contains parameters such as the frequency, timbre and pitch of vocal in MATLAB. By using MATLAB software for coding the sound recognition, the administrator whistle can be authenticated.

1. Introduction

Nowadays there are various types of security threats which can attack your sensitive information to deal with it we design a whistle blower identification system. This whistle blower identification system we use to secure our crucial information from various security threats. We design the system by collecting the whistle inputs of authenticated users and apply three main techniques such as feature extraction, classification and identification [2]. The purpose of feature extraction is to compress the audio signal into a form that characteristics the important sound event information. A good feature should be able to discriminate easily between different classes of sounds, while keeping the variation within a given sound class small. It should also be insensitive to external influences, such as noise or the environment. Classification is the process to classify the extracted features to produce an audio segment, a basic approach is to simply store the training features in a database, and use a distance measure to compute the similarity between the database and the features observed during testing. This is the basis for techniques such as k-NN (k-NEAREST NEIGHBOUR), SVM (SUPPORT VECTOR MACHINE), K-means, ANN (Artificial Neural network). Now lastly identification method is used to recognize the whistle from user and granted permission or if it is not recognize the whistle from user then it denied.

Here, the key for whistle blower identification is to convert the sound waveform to a type of parametric representation for further analysis and processing. A wide range of possibilities exist for parametrically representing the whistle signal for the sound recognition system such as Mel-Frequency Cepstrum Coefficients (MFCC) [1]. The input whistle signal is recorded and computer will compare the signal with the signal that is stored in the database by using MFCC method. An administrator whistles once in the training session so as to train and stored. In testing session the users can whistle again in order to achieve recognition if there is a match. The output of system can be achieved using MATLAB simulation to obtain whether the user is being recognized or rejected. From the result of testing the system is successfully recognizes the specific user’s whistle and rejected other users’ whistle. There are three elements involved in whistle recognition, which is feature extraction, classification, and identification. Feature extraction is the process that extracts a small amount of data from the whistle signal that can later be used to represent each user while classification involves the step to classify the whistle inputs of unknown user by comparing extracted features and identification is the process of identify the user’s whistle. The whistle signal and its characteristics can be represented in two different domains which are time and frequency domain. In this paper, we propose to use procedures described by MIR (music information retrieval) Toolbox of MATLAB for feature extraction. We will use four Classification methods like k-NN (k-NEAREST NEIGHBOUR), SVM (SUPPORT VECTOR MACHINE), K-means, ANN (Artificial Neural network) to get the output with highest accuracy.

2. Techniques

We use four techniques for classification in whistle blower identification for security doors. These techniques are as follows:
2.1 Support vector machine (SVM)

In speech recognition system the sample of speech signal is preprocessed by applying pre-emphasis, then framing and windowing. From short time wavelet signals fundamental frequency, Energy, Zero crossing rate linear predictive coding and Mel-frequency cepstral coefficient are investigated. In feature normalization statistical features are calculated for each and every window of a specified number of frames by using statistical method \[4\]. By combining these features a different training model is developed, SVM is used for classification of whistle inputs. Support vector machine is supervised effective approach for pattern recognition. The concept used in SVM technique is presented here. In SVM approach, the basic aim is to determine hyperplane or decision boundary \[3\]. The objective of hyperplane is to separate two classes of input data points. This hyperplane is shown in given figure 2.1 below. Here the margin \(M\) is distance from the Hyperplane to the nearest point for both classes of data points. The data points are seperated by two types linearly seperable and non-linearly seperable. In SVM classifier the decision boundary is placed by using maximal margin among all possible hyper planes.

![Figure 2.1: SVM Technique](image)

The feature MFCC is extracted from the whistle blower. Classifier classify different whistle inputs based on age, gender from database in which various whistle inputs are present.

2.2 K-means

Clustering is a technique of classification of similar objects in one cluster and dissimilar objects in another cluster. It is basically partitioning technique so that same dataset share common traits. K-means clustering is one of the clustering technique in which approximate method is used to simplify and accelerate convergence. Here, the goal is to find K means vector which would be K cluster centroids. This partitioning method is applied to analyze the data and treats. Observations of the data as objects based on locations and distance between various input data points \[5\]. The partitioning of objects in clusters is done in such a way that objects in same cluster remain close to each other and in different cluster are far away from each other. The distances in clustering do not represent spatial distances most of the time. The only solution to this problem of global minimum is exhaustive choice of starting points. Use of several replicates with random starting points also leads to solution i.e. a global solution. In a dataset, we take desired number of clusters \(K\) and a set of \(K\) initial starting points, the K-Means clustering algorithm finds the desired number of distinct clusters and their centroids \[5\]. We centroid obtain by means of computing the average of each of coordinates of points of sample assigned to cluster. Finally, the aim of algorithm is to minimize an objective function in this case a squared error function. The objective function

\[
J(U,V) = \sum_{i=1}^{k} \sum_{j=1}^{n} \| x^{(j)} - c_j \|^2
\]

2.2.1 Algorithm:

The algorithm for k-means clustering is as follows:

Step 1: Set \(k\), select \(k\) whistle inputs randomly.

Step 2: Initialization Each whistle input data represents an initial cluster center.

Step 3: Classification- to examine each point in dataset and assign it to cluster whose centroid is nearest to it \[5\].

Step 4: Centroid calculation-When each point in dataset is assigned to cluster, we need to recalculate the new \(k\) centroids.

\[
v_j = \frac{1}{c_j} \sum_{j=1}^{c_j} x_j
\]

Step 5: Convergence criteria-step 3 and 4 are repeated until no point changes cluster assignment or until no centroids move.

2.3 k-NN(k-NEAREST NEIGHBOUR)

In pattern recognition k-NN (k-Nearest Neighbour) is a type of non-parametric technique used for classification of whistle data inputs. In this case, input consists of the \(k\) closest training examples in the future space. In the classification phase, \(k\) is a user-defined constant, and an unlabeled vector (a query or test point) is classified by assigning the label which is most frequent among the \(k\) training samples nearest to that query point \[6\]. We use a commonly used
distance metric for continuous variables is Euclidean distance. In our research, we use the system to extract the whistle’s feature. After the feature extraction, we give each whistle sample with the corresponding whistle class label. After that we input them to the SVM classifier and gain a model file by training the data set. When an unclassified speech sample come into this system, the system extract the feature coefficients and use the model file to classify the whistle input dataset.

2.4 Artificial neural network (ANN):
Neural networks are similar to Markov models. Neural networks are a type of statistical models which are represented as graphs. In Markov models we use probabilities for state transitions whereas in neural networks we use connection strengths and functions. A key difference between them is that neural networks are fundamentally parallel while Markov chains are serial.

In the neural network, the challenge is to set the appropriate weights of the connection, the Markov model challenge is finding the appropriate transition and observation probabilities. In many sound recognition systems, both techniques are implemented together and work in a symbiotic relationship. In this paper sound features (spectrogram and cepstrum) will be sequentially presented at neural network inputs and will be classified at the output of the network [7]. This process is visualized in given fig.2.3 classification process in the NN. Here, we focus on two typical NNs: Multilayer Feed forward (back propagation) networks and Radial basis networks.

![Figure 2.2 k-NN flowchart](image)

3. Conclusion :
In this paper, we have presented the design of system used for whistle blower identification for security doors. The problem of whistle blower identification is solved by using various algorithms and techniques for feature extraction and feature classification. The features used for extraction are loudness, intensity, pitch and timbre. For feature extraction we have used algorithms like Fast Fourier Transform and Techniques like MFCC (Mel Frequency cepstrum coefficient). For feature classification we have used techniques like K-means, k-NN (k-Nearest Neighbour), SVM (Support Vector Machine), ANN (Artificial Neural Network). We have used these four techniques for feature classification to get the maximum accuracy of the system. Future work to be done for this system is to increase the accuracy of system and reduce the effect of sound to noise ratio for the system.

4. References

[2] Nidhi Desai, Prof Kinnal Dhameliya, Prof Vijayendra


[4] Shubhangi S. Jarande¹, Prof. Surendra Waghmare² “A Survey on Different Classifier in Speech Recognition Techniques”, ISSN VOLUME 3 ISSUE 5 MARCH 2014

