**LITERATURE REVIEW:**

Speech is the most common way of communication among humans. Speech also carries the information related to the speaker. To recognize the speaker of the speech there are features exists in the speech signal. These extracted features will be useful in training of the model for speech recognition.

In audio processing feature extraction is the backbone. The extraction of speech feature set is an important stage in speech processing applications like speech analysis, speech recognition and speech synthesis[8]. But extracted feature should meet some criteria while dealing with the speech signal such as:

* Easy to measure extracted speech features
* Not be susceptible to mimicry
* Perfect in showing environment variation
* Stability over time[9]

For feature extraction audio samples are collected and then converted to digital signals at a regular interval. At these voice samples noise reduction is performed so that the original audio sample can be find to perform feature extraction on it. For the speech recognition we extract the features from the digital signals which provides the acoustic properties of that specific digital dataset that is really useful for representing the speech signal.

These speech signals are slowly timed varying signals (quasi-stationary). When examined over a sufficiently short period of time (5-100 msec), its characteristics are fairly stationary. But, if for a period of time the signal characteristics changes, it reflects to the different speech sounds being spoken. The information in speech signal is actually represented by short term amplitude spectrum of the speech wave form. This allows us to extract features based on the short term amplitude spectrum from speech (phonemes)[10].

There are various techniques to extract features of speech, that includes :

* MFCC
* PLP
* RASTA
* LPCC
* PCA
* LDA
* Wavelet
* DTW
* Combined LPC and MFCC
* Kernel based feature extraction
* ICA
* Integrated phoneme subspace method
* PLDA
* LPC
* DWT
* WPD
* GFCC
* GMM

The main features that will be discussed in this paper are the following:

1. **Mel-Frequency Cepstral Coefficients (MFCC):**

In [29], author has extracted MFCC feature and denoise the audio sample and also enhanced the MFCC feature by calculating the delta energy for the coefficient.

In [30], author has extracted MFCC feature for the speech emotion detection. MFCC feature is extracted and worked very efficiently and train the model for the detecting of speech detection emotion.

In [31], authors focused on the isolated speech recognition by using the MFCC and Dynamic Time Wrapping (DTW). In this research features for the isolated speech recognition were extracted by using the MFCC.

In research [32], authors has identified and focused on the problem of optimizing the acoustic features set by Ant Colony Optimization for the Automatic speech recognition. Speech signal is considered as input in this research and feature extraction is performed over this signal using MFCC extraction method, total 39 coefficients are extracted in this research by using MFCC.

1. **Perceptual Linear Predictive (PLP):**

In [33], author has done the comparative analysis of speech recognition in noisy conditions on the widely used feature extraction techniques named MFCC,LPCC,PLP, RASTA-PLP and HMM and has analyzed that PLP distinctly gave the maximum percentage of recognition and the grouping of LPCC, PLP and RASTA provided the output as third maximum recognition percentage.

In [11], authors focused on the comparative analysis of widely used feature extraction techniques related to speech recognition and in the end of the research has conclude that the PLP is extracted on the conception of logarithmically spaced filter bank, combined with the conception of human hearing system and has improved results than LPC.

1. **Principal Component Analysis (PCA):**

In paper [34], writers has worked on the change in detection in multi-dimensional unlabeled data in which features were extracted by using the PCA feature extraction technique.

In [35], authors focused on the PCA drawbacks which are high computational cost, extensive memory utilization and low adequacy in handling expansive dimensional datasets, so author has proposed a new technique Folded-PCA. By using this new proposed technique these drawbacks can be resolve.

In [36], author discussed the drawbacks of PCA: computational cost, extensive memory utilization and low adequacy in handling expansive dimensional datasets, so they analyzed two variation of the PCA technique SPCA and Seg-PCA. These variation can be helpful to reduce the drawbacks of PCA.

1. **Linear Prediction Coefficient (LPC):**

In [37], authors has done the survey over the feature extraction technique and concludes that the LPC is vector dimension and has high computational cost and also reduce accuracy and their window size which is not good for non-stationary speech signals such as speech signal.

In [38], writers has proposed the new technique for the noisy speech recognition based on auditory filter modeling-based feature extraction and gives the result that LPC is less efficient in this manner in comparison with PLPaGc.

1. **Linear Predictive Cepstral Coefficient (LPCC):**

In [39], author has done the comparative analysis for the speech recognition specific for Hindi language words, and has analyzed that LPCC gives less recognition rate for isolate, paired and hybrid words as compared to MFCC.

In[40], a new recognition system was proposed that uses the acoustic waves generated by the construction equipments, this will be very helpful to avoid external damages. Feature extraction for the recognition system was done by combining LPCC and SVM.

1. **RASTA:**

In [41], author has used RASTA feature extraction technique in combination with TANDEM, that is an efficient way to represent the message-information in the speech signal.

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