Ecole Nationale Superieure d'Informatique et Analyse de Systemes

Project

Speech commands recognition using Hidden Markov Models

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Introduction

Hidden Markov models have give many successful results especially in speech recognition. In our report we apply the Hidden Markov model to create an speech recognize some words commands, we train the model by Baum-Welch algorithm in order to find the parametres $\lambda = \left\{ A, \pi, \mu, , \sum \right\}$ that maximize the likelihood of the observations.
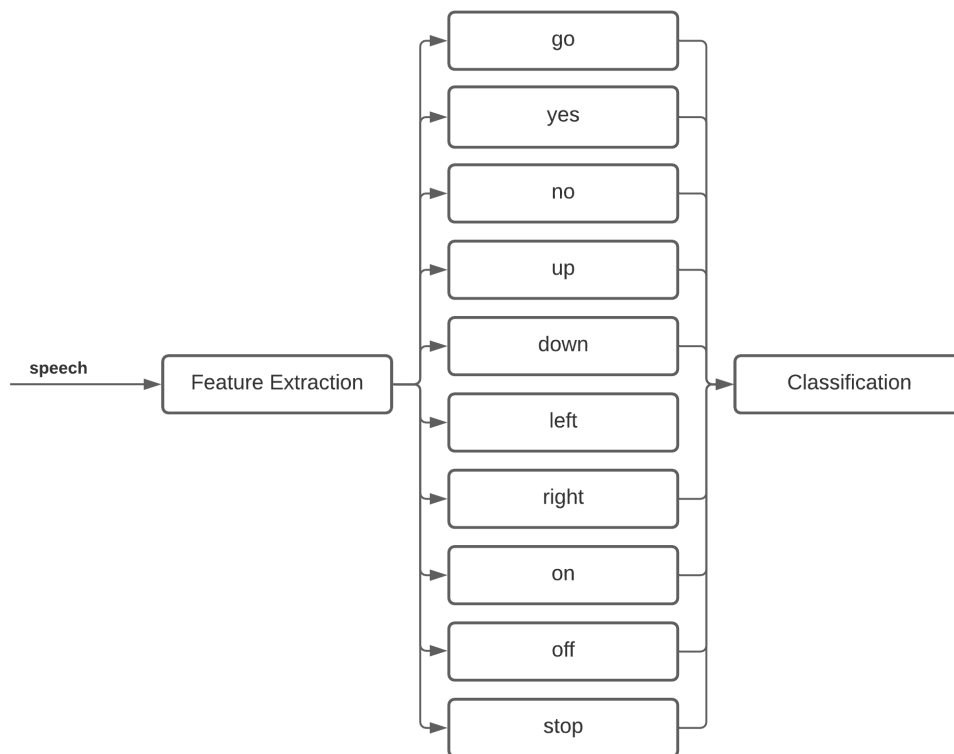

Figure 1: The features extracted from the speech signal are passed to each command model and the best match is selected.

1 Conception

1.1 Data Set

We have used the Speech commands dataset [1] . It contains the audios examples of many words, therefore we choose as our labels : yes, no, up, down, left, right, on, off, stop, go and we take only 10 audio example for each label. Then splitting the data to train and testing.

1.2 Feature extraction

The signal is split up in short frames corresponding to 10ms of speech. We will pick out the features from the frequency domain, but before we get there by taking the fast Fourier transform.
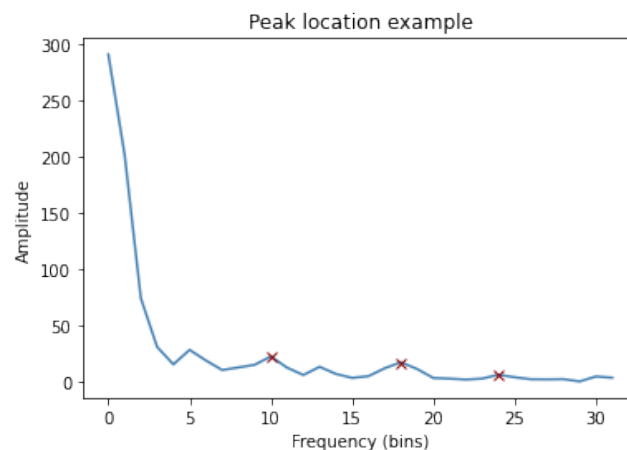
Figure 2: Picks Extraction

1.3 Training

We create ten hidden Markov model according to the number of our class, therefore we trained each one among them per word command with already classified speech signals. The training examples for each word are concatenated together, and Baum-Welch is run for 200 iteration.

1.4 Classification

We select the word command, from an observation $o_1, ..., o_T$ as follows:

$$Predict \quad word \quad command = argmax_i f(o_1, ..., o_T; \lambda_i)$$

where λ_i denote the parameter set for word command i.

The function $f(o_1, ..., o_T; \lambda_i)$ is the forward algorithm computes.

2 Experimentation

We train the HMM for 200 iteration, we get as accuracy 16.67%.

3 Conclusion

During this project a system for speech commands recognition was implemented based on HMM and trained by Baum-Welch algorithm. As a feature work, trying more efficient feature extraction methods and increase the numbers of the words.

Bibliography

[1]   P. Warden, "Speech commands: A public dataset for single-word speech recognition.," Dataset available from http://download.tensorflow.org/data/speech_commands_v0.01.tar.gz, 2017.