

Query-by-Humming System to Illustrate Signal Processing for Prospective Students

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Abstract

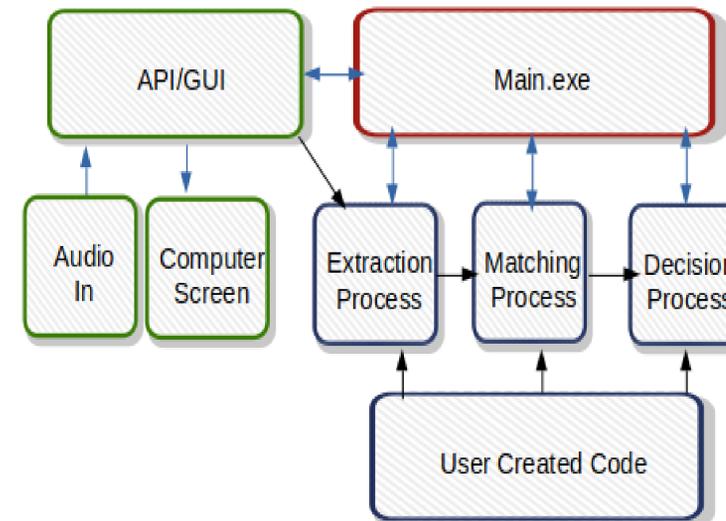
Query-by-humming is a content-based music information retrieval system where a user hums part of a tune into a microphone, the audio is sampled and processed by a computer and compared against a database of stored songs. The tune hummed by the user is identified, a matching score is provided, and the actual song is replayed back to the user. The purpose of this project is to illustrate signal processing for prospective students at NIU. This system is built using C++ and Python.

Introduction

High school students often have a limited view of all the fields of electrical engineering. This limited view may cause students to overlook electrical engineering as a possible career. This project highlights the field of signal processing by developing a real time Query-by-Humming system with an informative graphical user interface (GUI). This system is divided into 4 sub-components: The Audio processing framework and real time usage (C++), feature extraction, matching & decision making, and the GUI (python).

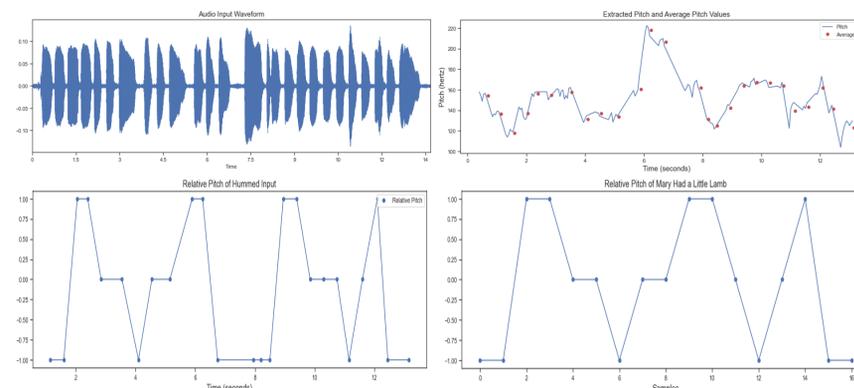
Audio Processing Framework

The main program has three persistent sub processes that control the different aspects of the Query-by-Humming system. The block diagram below shows the structure of the entire system:



Visual Information

Informative elements of the GUI are shown below:



Testing & Results

Song Name	Prob of Error
Happy Birthday	9.09%
Mary Had a Little Lamb	9.09%
Jingle Bells	9.99%
Twinkle Twinkle Little Star	0.0%
Itsy Bitsy Spider	12.5%
Total Probability Of Error	8.88%

With 45 samples we achieved a total probability of error less than 10% with 5 songs, reaching the performance goal. This system is also able to function for Males, Females, and children.

Conclusions

This system is an implementation of a Query-by-Humming educational application to illustrate signal processing for prospective students.

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