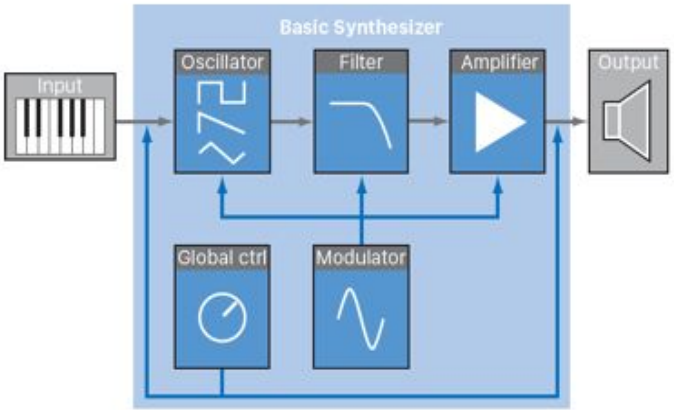
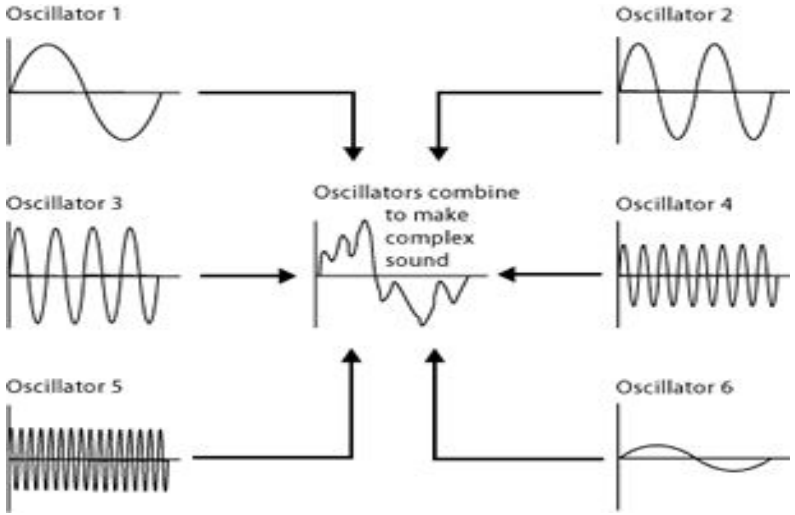
Timbre Reproduction of any recorded musical note for Sound Synthesis

Group 27
Kaushal Patil
Dhruvil Dave
Prachee Javiya
Dhir Oza

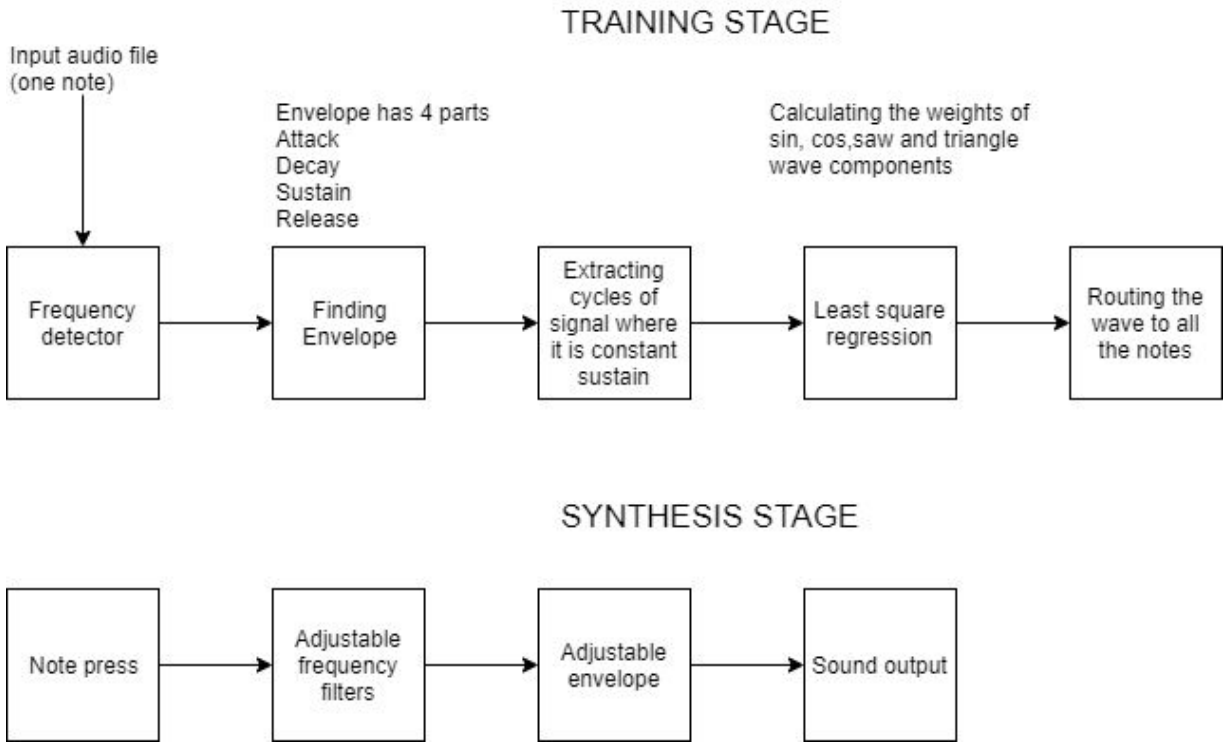
What is the project?

We plan to reproduce the timbre of any musical sample digitally using a combination of Additive/Subtractive sound synthesis and Least Squares Regression.





Block diagram



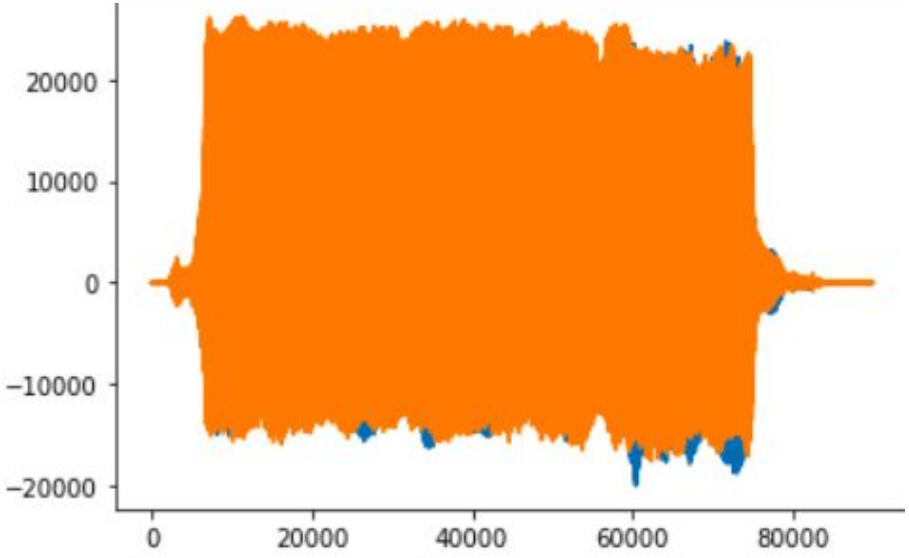
How do we plan to go about it?

This Project is divided into two stages:

1) Training Stage
2) Synthesis Stage

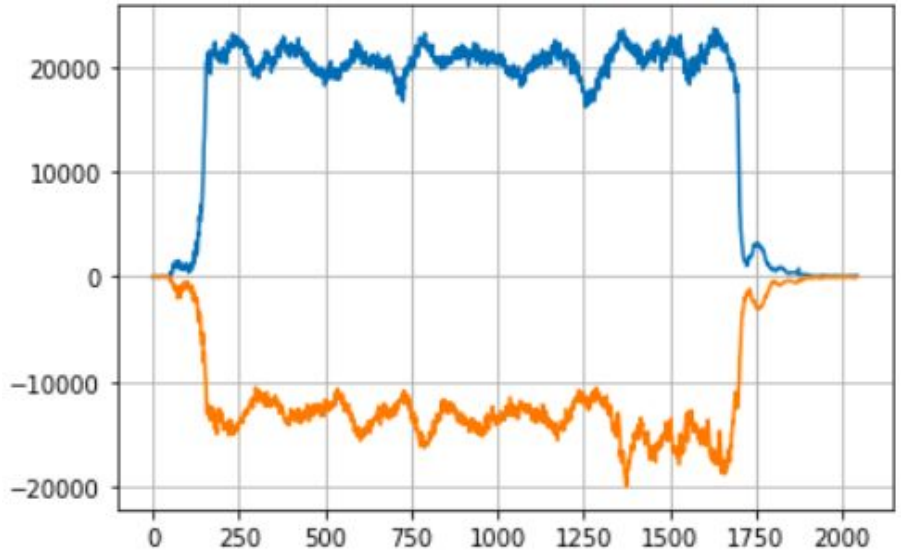
Training Stage

We first take the recorded note and detect its frequency.



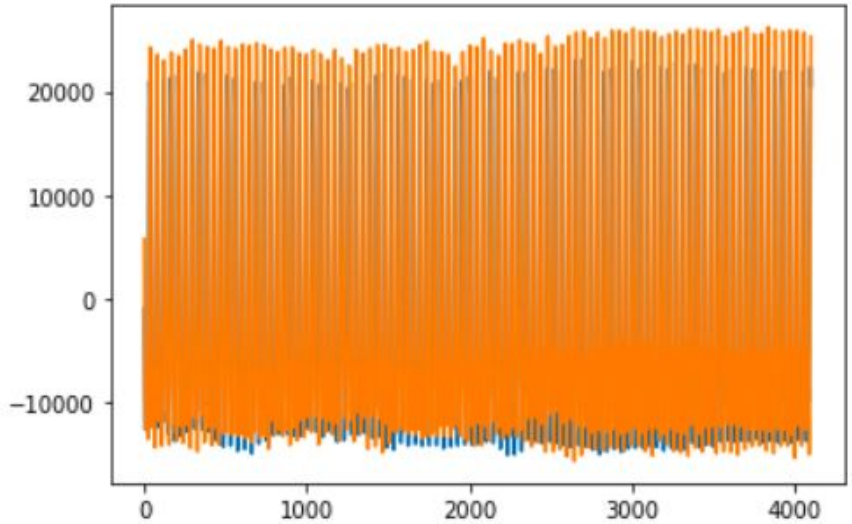
Input Audio Signal

We construct the envelope with respect to the input audio file



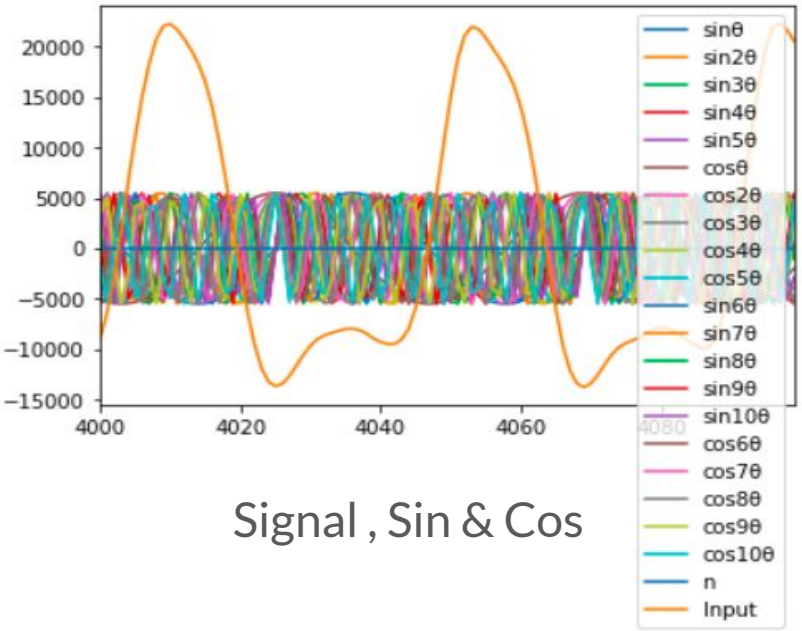
Extracted Envelope

Extracting cycles of signals where it is in constant sustain.



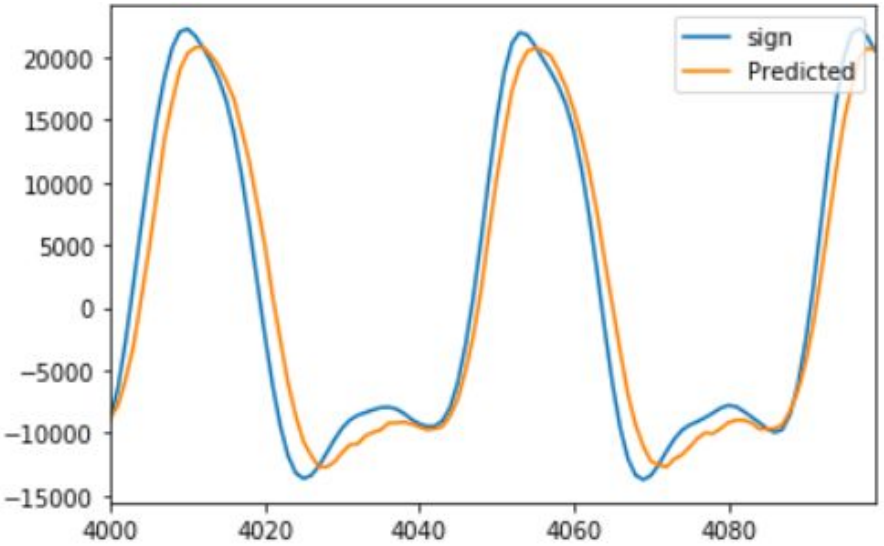
Signal in constant Sustain

Using frequency harmonics of sine and cosine we produce a function of frequency components for n cycles.



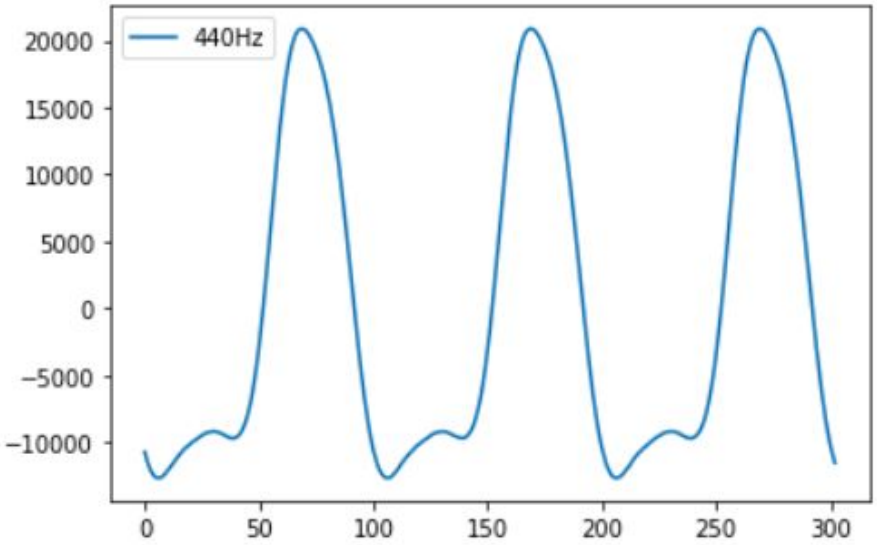
Signal , Sin & Cos

We apply Least Squares Regression to the individual frequency vectors and predict their weights



Original and Predicted Signal

We create this wave for frequencies of notes on keyboard.



Signal at 440 hz

Synthesis Stage

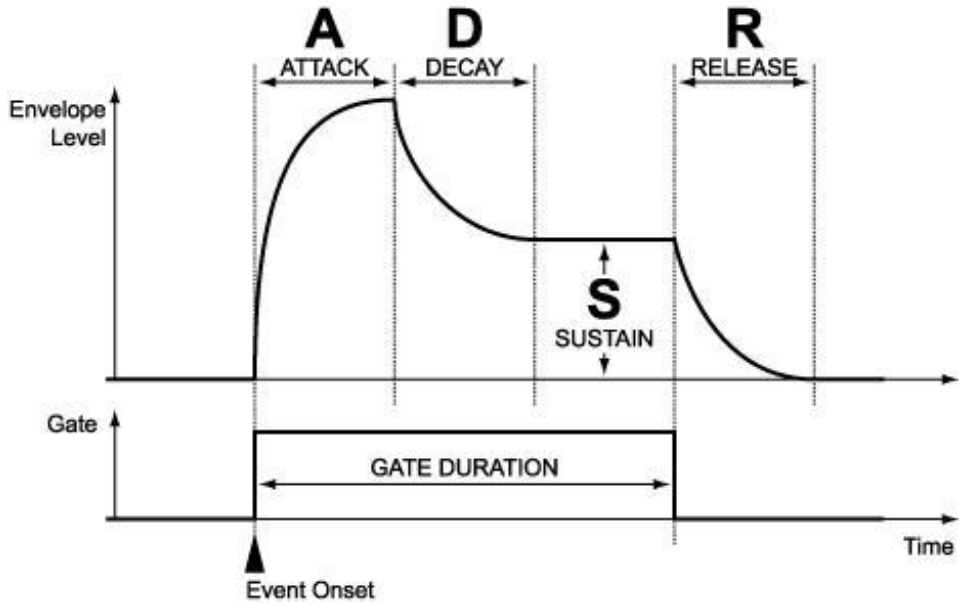
In this stage we plan to create a digital audio synthesiser which uses the weighted sum function of sin cos saw and triangle waves' frequency components to make a base wave(matching input signal) for each note.

Further to give the sound engineer some flexibility of digital sound profile before feeding the signal to speaker we pass the signal through an adjustable filter and then multiply it by an adjustable envelope

Adjustable Filter

Example Interface

Adjustable Envelope



Example Interface

Why this project?

This project makes it possible to produce music digitally using the timbre of any recorded sample ever.

For example: All the plots in this presentation were for a sample of a flute played at 1008 hz. Then we successfully recreated the timbre of flute and recreated it at 440 hz which is note A4.

Further it lets the engineer edit the basic sound profile of the recorded sound to create even richer and varied sounds digitally.

Thank You