



Introduction

Objective: To create software that facilitates computer-aided composition with:

- Use of statistical models
- Arbitrary input data
- Continuous User Feedback
- Simple User Interface

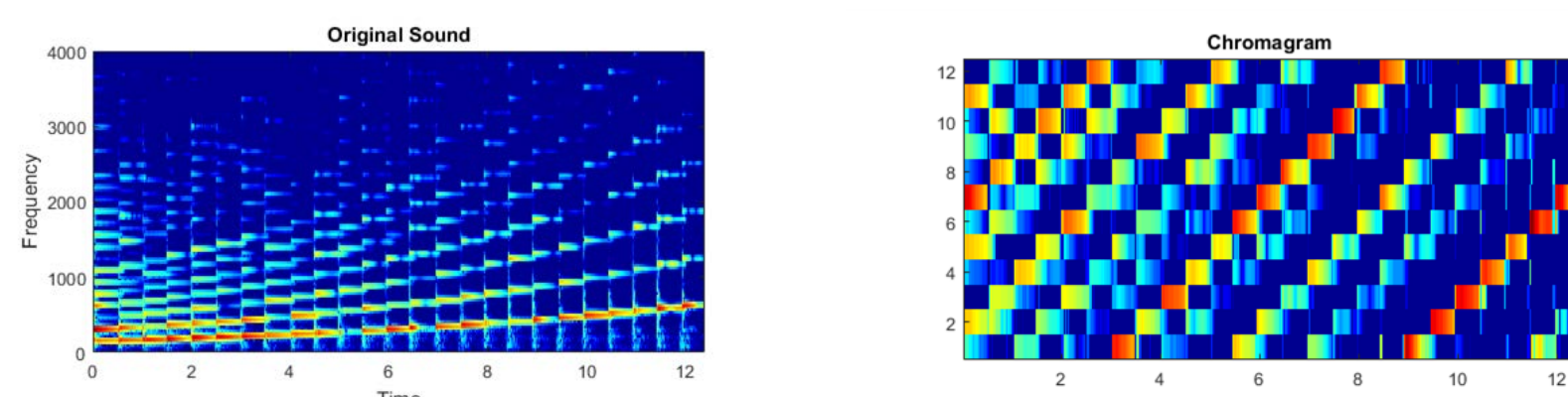


Fig 1. Music transcription performed on an ascending chromatic scale. The left shows the frequency domain while the right shows the normalized and overlaid to yield notes

Background

Music composition traditionally required years of arduous training of music theory. Is it possible to model the creative aspect of composition through algorithms?

- Music Information Retrieval (**MIR**) -- the study of extracting information from music
- foR cOmputeR assisted cOmposition (**ROR**) -- the practice of having a computer assist humans in composing music or the automation of creativity.

MIRROR combines the field of statistics and music theory to yield a simplified environment for those who lack training.

Implementation

Several modeling techniques were used for the generation of music.

1. Markov Chains

Stochastic models that use a sequence of events to generate probabilities of following events.

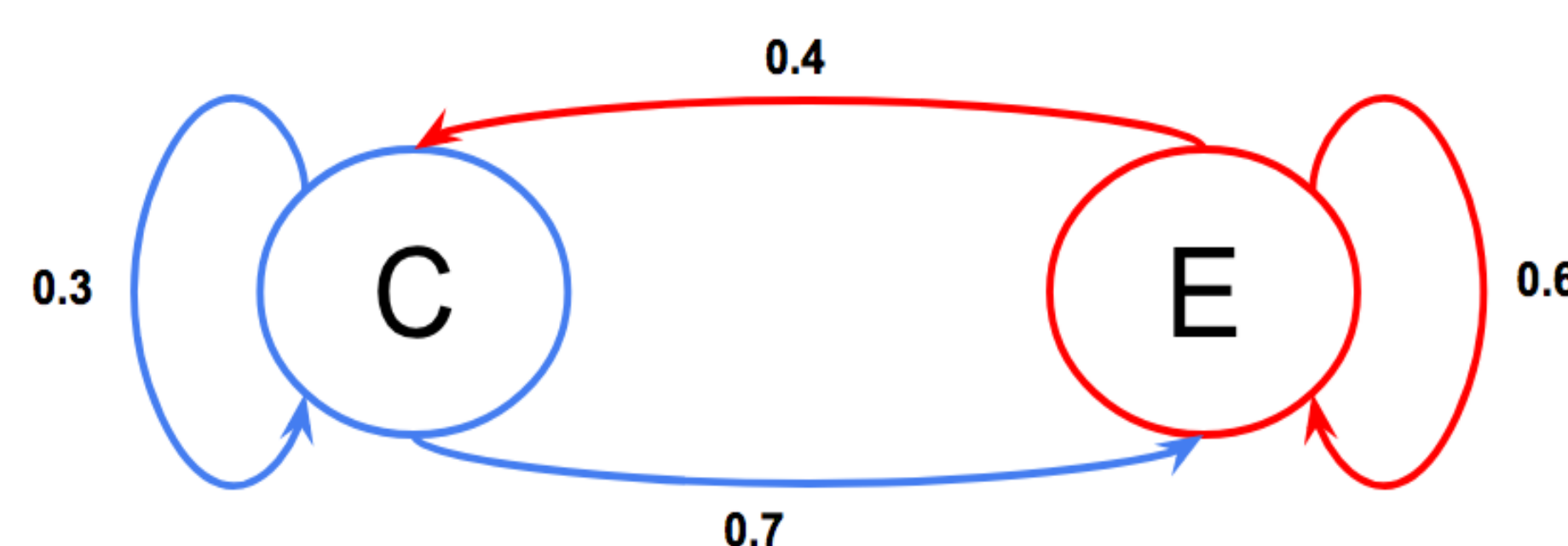


Fig 2. A simple Markov Chain between the notes C and E.

Applied to various music structures from notes to chords to phrases.

2. Lempel-Ziv

A dictionary-based algorithm known as Lempel-Ziv 78 (LZ78) was used to generate a dictionary of similar "themes" from a music source.

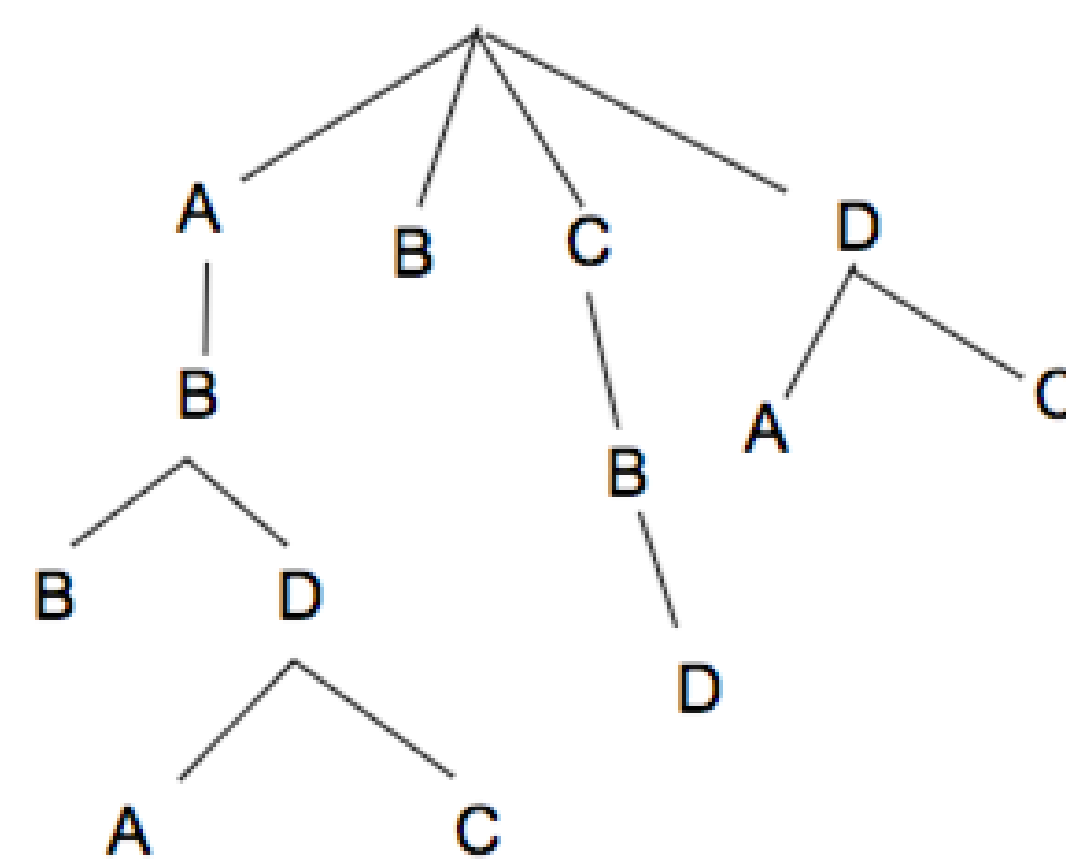


Fig 3. A simple tree built from a sequence of a melody. Certain branches can take on the identity of themes in a song.

Software

Python - for program implementation

Music21 - Python library for abstract musical notation analysis.

PyQt - Python GUI framework

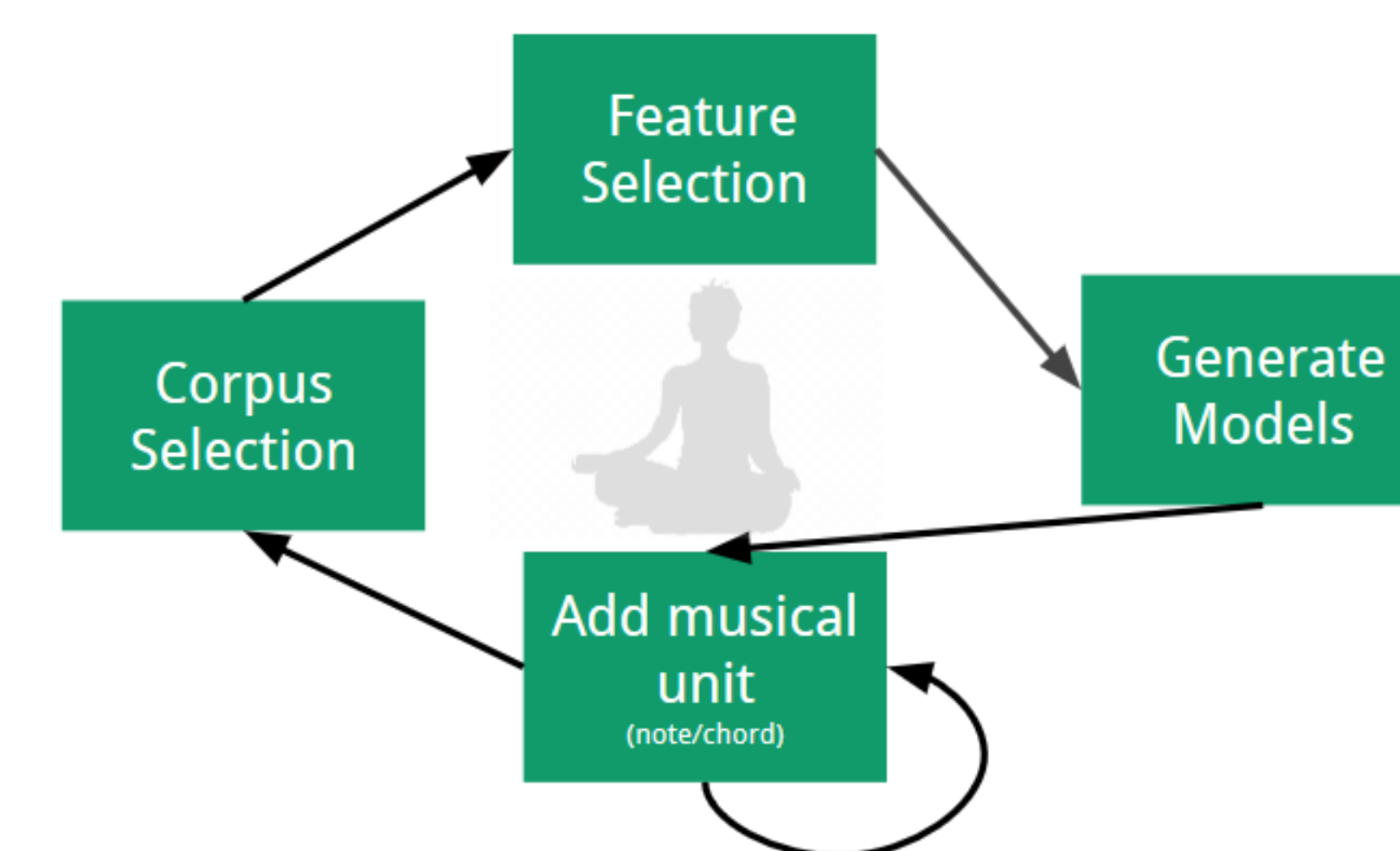


Fig 4. A general flow diagram for our a user experience. Note the cycle of creativity! The juices are strong in this one.

Future Directions

- Import more DAW features
- Support chord analysis both at note and signal level
- Add an actual tree-style GUI to visualize the choices
- Permit the use of additional models and grammar
- Transform into social media site to allow users to share their pseudo-creative works.

References

- Assayag, Gérard, et al. "Guessing the Composer's Mind: Applying Universal Prediction to Musical Style." *Semantics Scholar*.-Cuthbert, Michael Scott. *music21: a Toolkit for Computer-Aided Musicology*, M.I.T., web.mit.edu/music21/.
- Keller, Robert M. *Impro-Visor: Jazz Improvisation Advisor for the Improviser*, Harvey Mudd College, www.cs.hmc.edu/~keller/jazz/improvisor/.

