

# Music Genre Classification

## Alex Stable

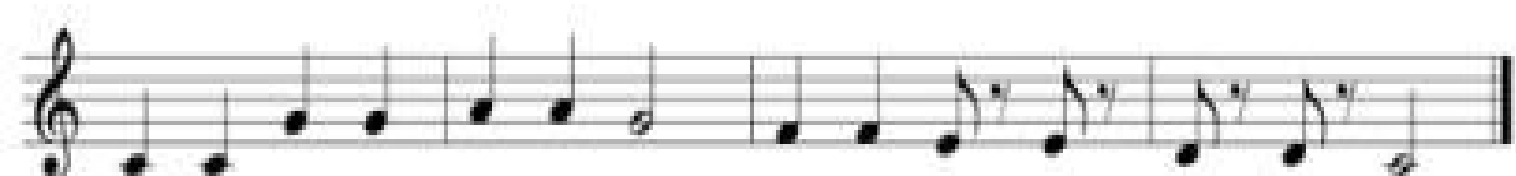
### Abstract

The goal of this project is to write code that can accurately group given pieces of music into appropriate genres. Genres are often generalities that may not perfectly fit a given piece of music, but by analyzing different musical qualities we may determine what genre best describes it and what other pieces of music it is most similar to. Computer code that can accomplish this task could have applications in sorting large libraries of music or suggesting music to individuals based on musical qualities, rather than manually entering information or comparing with common likes and dislikes. For ease of analyzing musical qualities, midi format music files are used as input for the program. We theorize that information about harmonies will be enough to distinguish among basic genres of music. For future research, analyses of other low-level musical qualities may be implemented to provide a fuller picture of a given piece. A neural network will be trained by analyzing harmonic data from a set of music (whose genre is known) to learn how to appropriately categorize music it has not seen before. This project will focus on music written for solo piano, so that harmonic analysis rather than instrumentation will be used to determine genre.

### Background

Current research often uses statistical models to determine how a given piece of music should be categorized. One especially successful experiment was "On musical stylometry—a pattern recognition approach" (Backer et al). Different musical aspects of pieces were analyzed, and a statistical model was created to group new pieces into their appropriate period. By analyzing more musical characteristics, their model became more fine-tuned. These characteristics included harmonies, dissonance, note entropy, and types of intervals.

No method has yet yielded perfectly successful results, nor should it be expected to – even many people cannot successfully place music into its correct genre.



(Delta time, MIDI protocol bytes)

```
00 ff 58 04 04 02 30 08 00 ff 59 02 00 00 00 90 3c 28
81 00 90 3c 00 00 90 3c 1e 81 00 90 3c 00 00 90 43 2d
81 00 90 43 00 00 90 43 32 81 00 90 43 00 00 90 45 2d
81 00 90 45 00 00 90 45 32 81 00 90 45 00 00 90 43 23
82 00 90 43 00 00 90 41 32 81 00 90 41 00 00 90 41 2d
81 00 90 41 00 00 90 40 32 40 90 40 00 40 90 40 28 40
90 40 00 40 90 3e 2d 40 90 3e 00 40 90 3e 32 40 90 3e
00 40 90 3c 1e 82 00 90 3c 00 00 ff 2f 00
```

### Harmonic Analysis

Code was written to read and organize the information stored in a midi file. A midi file is a sequence of commands preceded by how long to wait until they are executed (delta-time). This information is stored in a Beat class.

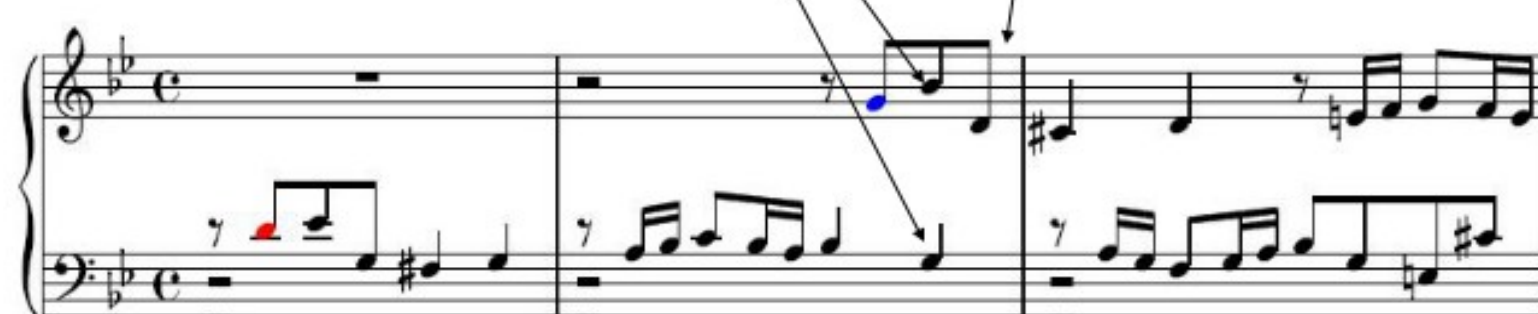
Each instance of a Beat knows which notes sound on its downbeat and off the beat. It also contains which beat it represents from the piece (beat 1, beat 2, etc.), and can be sorted according to this number. When the notes that sound within a beat are passed to the chord identification method, it returns what chord most accurately represents the notes in that beat.

### Organization/Parsing file

- **Beat class**

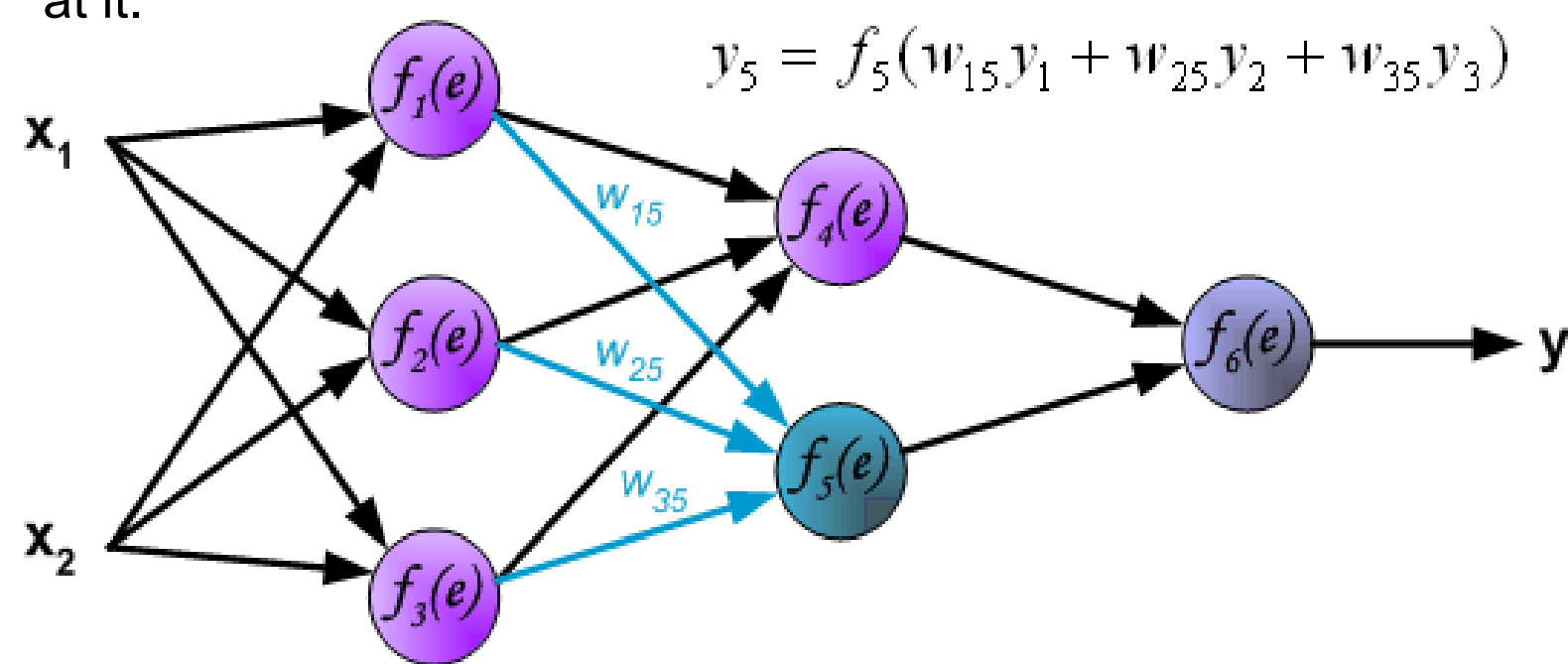
- Notes on beat
- Notes off beat

(8)



### Machine Learning

A neural network was constructed to analyze harmonic data. A network contains different layers of "perceptrons:" nodes that contain an activation value and that are associated with a weight. The input layer of the network is at the top, and consists only of the different inputs the network will receive. In my project, these inputs are the ratios of different types of chords found in a piece. These ratios become the values of the input-layer nodes, and weights are generated randomly for all the nodes. The given values are then "fed" through the network, and are used to calculate values for all the other nodes. The output layer consists of just one node, whose final value will be matched with a genre. The network is "trained" by giving it a large data set containing inputs and their respective outputs. When the network produces an output far off from its target, its weights are adjusted to achieve better results. Theoretically, analyzing enough data will yield a network consistent not just with the training data, but also any inputs that may be thrown at it.



### Discussion

Successful results from this project could be a valuable tool in organizing large quantities of music. By analyzing musical qualities, results generated by code could often be the most representative of what kinds of music should be grouped together. The information yielded by this project could also provide insights into how we interpret music and what gives different styles their distinct feels.