Music Information Retrieval (MIR)

- **General Information**
  - 75 min
  - 20-30 Students
  - High school students

- **Summary of activity**
  - We will demonstrate how music recommendation services work through an activity. The students will be broken up into four groups: manual, features (Pandora), tags (Last.fm), and collaborative filtering (iTunes Genius). The students will gernerate playlists using these methods but will not be told which popular service their method corresponds to until after the activity has ended.

- **Pre-requisite knowledge requirements**
  - Math - Addition/Subtraction
  - Music - Knowledge of basic musical description terms and instrumentation

- **Dependencies on other SMT activities**
  - None

- **Learning objectives**
  - Students should become aware that music recommendation is a really difficult and interesting problem
  - Clearly understand that math and engineering can be used to organize music in a variety of ways.

- **Relevant educational standards** (download Mathematics PDF and Science and Technology PDF from here)
  - 3.1.10
  - 3.6.10

- **List of materials**
  - Printed Handouts
  - iPad or music player with the songs pre-loaded

- **Detailed description of the activity**
  - Introduction/motivation

- MIR provides powerful methods for music recommendation and playlist generation in large databases of music. Given how many of them use services like Pandora we will introduce an activity that demonstrates how many of the popular music recommendation services work. Each group will perform different activities to organize the same songs into a playlist starting with the same seed song (starting song). Afterwards, the students will see what service they were simulating and compare the results across systems.
- Background
  - The students will be broken up into four groups: manual, features (Pandora), tags (Last.fm), and collaborative filtering (iTunes Genius/Spotify). The students will not be told which popular service their method corresponds to until after the activity has ended. Each group will be given 20 songs that will be saved on their usb flash drives.
- New Vocabulary/Definitions
  - Music Information Retrieval
  - Semantic Tags
  - Acoustic Features
- Procedure
  - **Before the Activity** - Ensure that all instruction sheets are printed out for all groups. Each student in each group labels a different subset of the 20 songs. If there are extra students in each group, just duplicate the instruction sheets.
  - **With the Students**
    - Manual Group - This group can perform the playlist generation manually. Given the 20 songs they need to listen to each one and agree on the ordering. This group should go first when showing their playlist and explain to the rest of the students the metrics they chose to order the songs. We'll be looking things like tempo, genre, 'feel', similarity as well as musical terms like key/mode/instrumentation because a lot of the kids have music training and this should set the stage for how we evaluate the other playlists.
    - Features Group (aka Pandora) - This Group assigns features to each song using attributes chosen from the music genome project. Each group member is assigned three songs and has to rate the song on 10 pre chosen features. They will then use a provided worksheet to compute the average rating for each song on each feature. To construct the playlist they will start from the seed song and need to construct the distance to each remaining song they can choose. They simply subtract each feature pair, take absolute value, and sum across all features. A worksheet and a calculator will be provided to make this easy.
    - Collaborative Filtering Group (aka iTunes Genius) - In this group each student is assigned three songs randomly and asked to put them in the best possible order for a playlist. This will be logged on a handout that's given to each student. Then using a separate sheet to create the master playlist they start with a seed song and then to determine which song comes next

based on the number of occurences in the mini-playlists. If two or more songs are represented equally they pick one of them randomly.

- **After the Session** - They should have a good idea of what MIR is and how many popular services that do it work. They should also see the motivation for content based methods and perhaps the application of engineering here.

- **Investigating question**
    - How could we construct an automated system for music recommendation?

- **Assessments**
    - Each groups playlists will be displayed at the end and we will discuss why some are better than others.