SmartShuffle: An Intelligent Algorithm for Song Selection

Tarik Tosun, MAE 345

9/22/11

Introduction

SmartShuffle is a music selection software program of my own design that is intended to run on a computer or portable music player. The program records a user's past listening habits, and then uses them to intelligently predict songs the user would currently like to hear. The motivation to develop this software came from my own experience with shuffle play on my mp3 player, which I believe is one that most users share. I enjoy the unpredictability of shuffle play, but my music library is large and varied enough that I often find myself skipping through many songs in succession because I am simply not in the mood for them at the time.

The key idea behind SmartShuffle is that of a semantic network. A semantic network is a network that represents semantic relations among concepts, and is used in psychology to model the way knowledge is represented in the mind. Pieces of knowledge that are semantically similar are more closely connected in the network, and thoughts about a given concept are more likely to trigger thoughts about closely connected concepts than concepts which are far away. To take a simple example from the network in Figure 1 , if you are thinking about fish, you are more likely to next think about whales than bears.

SmartShuffle uses a semantic network to model the closeness between songs in a user's music library according to that user's tastes. As the user listens to songs that SmartShuffle picks, it records whether a song is skipped or listened to, and uses this as feedback to refine its knowledge of the semantic relationships between songs in the user's mind. This same feedback is also used to determine where in the network the user's musical mood currently lies, in order to pick songs that the user will enjoy. SmartShuffle lives up to the "smartness" implied by its name because it picks songs according to a model that reflects the semantic relationships between songs in the human mind.

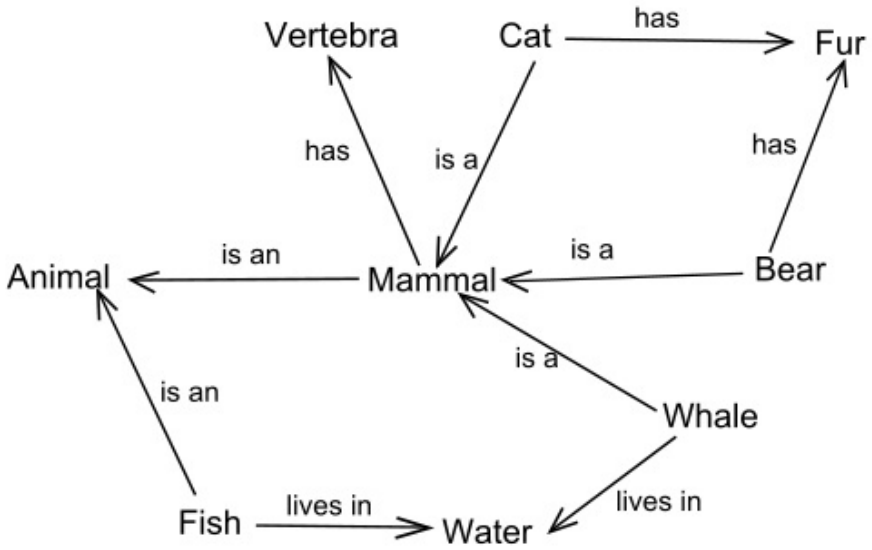

Figure 1: Simple example of a semantic network. Picture taken from http://en.wikipedia.org/wiki/Semantic_network

Implementation

As this is intended to be a short essay, I will give only a high-level description of how SmartShuffle is implemented. Long-term knowledge of the user's tastes is recorded in an undirected graph in which each node represents a song in the user's library. When two songs are listened to one after another, an edge is created between the nodes representing the two songs. Conversely, if a song is skipped, the edge (if it exists) between that song and the song listened to before it is eliminated. In this way, high levels of connectivity are established between semantically related songs, while semantically unrelated songs are not well connected.

As the user listens to music, knowledge of the user's immediate mood is developed through use of a virtual "activation energy" that flows from the song to which the user is currently listening to all of its neighbors in the graph. The connection paths in the graph cause songs that are semantically related to the current song to be more strongly activated than those that are not. The next song is then selected from the set of activated songs, with probabilities of selection weighted according to activation level. If a song is skipped rather than listened to, the opposite occurs – "negative activation energy" flows through the graph, which decreases the weighting of songs in the selection process. Both positive and negative activation persist for a certain amount of time, so that after a few song selections, the regions of graph activation reflect the user's current mood.

Technological Implications

This program is meant for the specific and relatively benign purpose of music selection, so I do not believe there are any significant ethical or moral implications of its use. I do believe, however, that it would be a novel technology. Several "intelligent" music selection algorithms do already exist, for example, the Apple Itunes Genius playlist creator and Pandora Radio's Music Genome Project. However, to my knowledge none of these technologies deal with semantic relatedness on a per-user basis. The Genius playlist creator, for example, analyzes songs in a user's library from a signal processing perspective, and groups songs based on sonic similarity, which may not necessarily correspond to the way songs are grouped in a person's mind. The Music Genome Project classifies songs based on a large vector of musical "genes" or traits (ie: "heavy guitar," or "female vocalist"). In my opinion, SmartShuffle has an advantage over other music selection algorithms because it uses user feedback to determine semantic closeness directly, rather than relying on some other metric (such as musical traits or sonic similarity) to predict whether the songs will be semantically similar for a given user.