Hidden Markov Music

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1. Algorithmic Composition
2. Markov Processes
3. Hidden Markov Music

Algorithmic Composition

Knowledge-based Systems

- follow a set of rules defined by the programmer
- depends on knowledge of the programmer

Machine Learning

- existing compositions are used to create a model
- new compositions are produced based on the model
  - deterministic
  - probabilistic
- the challenge is in finding a model which captures the essence of music

Markov Processes

Definition

- a Markov process is a system which can exist in a number of states
- each state has a certain probability of transitioning into the next state
- that probability is independent of the past states
    - only the present matters
- this may not perfectly represent the system being modeled, but it often serves as a good approximation

Markov Chain

- one of the simplest forms of a Markov process
- *do the traffic light here*

Training a Markov Chain

- *you know what to do*

Hidden Markov Model

- often the states you wish to model cannot be observed directly
- perhaps you do not even know what the states are
- hidden Markov models are Markov chains where the states cannot be observed, but each state has a certain probability of "emitting" one or more observables

Hidden Markov Model Example

- *do the traffic light here, and talk about Marvin the Martian or whatever*

Hidden Markov Music

Overview

- we model songs as Markov processes
- notes are observed
- some underlying states are hidden from us
- we use a number of songs from the same composer to train our model
  - allows us to generate new music (algorithmic composition)
  - allows us to compare existing songs against the model, to determine how similar it is (classification)

Random Walk

- *show a graph of a simplistic model and walk through it*

Audio Samples

- *play a few audio samples here*
- *perhaps start with one of my first creations (sounds terrible)*
- *and then play some better samples (improvement!)*

Improvements

- *talk about some more advanced models which may work better*

Thank You

Questions?

Bonus Samples

- *add some extra samples in case time permits*