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PROJECT LOG - WEEK 2

What I wanted to learn this week

To develop a plan for my work over the next coming months I had to clearly define the project and identify key areas in which further research was required. During this preliminary stage I was familiar with several of components of the system, however I was unsure of how they would work as a whole. My main task of this week was to resolve this, through research and discussions with my project supervisor.

My project is based around reproducing and generating audio signals using probabilistic techniques, primarily Markov Chains and Factor Oracles. Using these systems, particularly Markov Chains, to generate data such as MIDI note information is widespread practice and many resources covering it are available. Applying these systems to generate a signal, rather than meta-data, appears at this stage to be a relatively unique application. Successful implementation requires a thorough knowledge of the systems.

Tasks completed

Over the week I gathered numerous resources that covered Markov chains and Factor oracles at a suitable introductory level. Numerous academic papers found through Google Scholar proved to be helpful in developing my understanding, particularly as many covered probabilistic techniques applied to music prediction/generation. Sourcing appropriate papers was time-consuming as I had to identify which papers I could understand at this stage. I consulted through online forums with students and lecturers of the topic to identify recommended texts. Using this, I purchased the following : Probability, Markov Chains, Queues, and Simulation [1], Markov Chains[2]. Over the week I progressed through the introductory chapters which helped me understand the basics.

I met my project supervisor 17th January to discuss the project as a whole and address my questions regarding specific topics. The following topics were addressed:

1. **Markov Models**

   a. General overview of how these work and their application

   b. Introduction to hidden Markov chains

   c. Higher orders

   d. Previous applications in music categorisation, reproduction and generation.

2. **Factor Oracles**

   a. I presented my knowledge after research in this area was previously suggested.

b. Briefly covered the process

3. Transition/State type features

a. What types of features could be used

i. Frequency domain representation

ii. Cepstrum

iii. Mel-frequency cepstrum

b. How information would be passed through the system (determined this may be done in frames of the original signal, potentially set with overlap)

c. How the above in a Markov chain could be trained

The meeting gave me with clarity in regard to how the system would work and provided me with a base on which to plan research for the following week.

Week 3 Plan

Over the week I shall continue to work through the textbooks with the aim to have a solid understanding of the fundamentals by the beginning of week 4. I also develop a basic Markov chain which handles primitive features to apply my current knowledge and help identify areas which require further study. Developing this will hopefully begin my understanding of the final project.

1. William J. Stewart, 2009. Probability, Markov Chains, Queues, and Simulation: The Mathematical Basis of Performance Modeling. Edition. Princeton University Press.

2. J. R. Norris, 1998. Markov Chains (Cambridge Series in Statistical and Probabilistic Mathematics). Edition. Cambridge University Press.