Task 1: Paper Summaries

Econ Paper:

This paper outlines the methods used by a researcher at Youngstown State University, outlining the usage of HMM in order to predict stock market behavior. It is worth noting that they use several economic/finance measures in order to optimize the number of states they use. But essentially They predicted the stock prices based only on historical prices. From my understanding the observation sequence in the HMM is the price of stock (S&P 500) and the hidden sequence is overall market behavior. In their study they found they could accomplish decent results with a 4-state HMM and it outperformed other SOTA models. It is worth noting this paper offered some outline as to their algorithm/equations.

Bio Paper:

This paper outlines how we can use HMMs to find genes within a eukaryotic genome. The first piece I noticed about this paper offers a much more in depth overview of HMMs, especially a nice outline of the Viterbi algorithm which allows us to decode our prediction based off the observed sequences. Now in terms of the implementation of the HMM, we see that we will use two hidden states, "one to represent highly hydrophobic segments which shall constitute potentially transmembrane regions and the other hidden state will represent hydrophilic segments". For these states, we observe an emission of the 20 amino states. From the provided images, we can see that usage of HMM begins to look fairly good at approximating the hydrophobicity fairly well given a sequence of amino acids.

Third Paper

https://www.aclweb.org/anthology/C96-2141.pdf

This is an older paper outlining how we can use HMM to aid in our ability to perform machine translation. The area they focus on is through word alignment. Something interesting about this data was that it involved parallel texts. In other words, we could imagine a symmetry occurring in the data such that we could apply the same strategy from English to German as German to English. The task of their model is to maximize the probability of a sequence of alignment positions given an observed language and it's translation known. Once again they achieved results similar to SOTA models at the time. However I do note that while looking for this source, it seemed to be used often as more recent models rely on neural nets or other "blackbox" methods.