**Report for Part 5 Machine Learning Project**

For the initial implementation of Hidden Markov Model (HMM) for part 2 to 4, we are using the first order HMM where the emission parameters is depend on the current tag to produce the word and the transition parameter is depend on the transition from previous to current . This may not give a good estimation for predicting the overall tags of a sentence. Thus, we are considering implementing second order HMM. The different between second order and first order HMM is lied in the transition parameters. Second order HMM’s transition parameters considers the transition from two previous tags i and j to current tag k. This will give us more thorough predicted labels.

However, second order HMM requires a greater amount of training dataset in order to give good result as the three tags that are used in estimating the transition parameter may not have been appearing in the training set. We need to find a way to solve this problem. Instead of calculating the transition parameter as P(i|j,k) = P(i|j,k), we need to consider the transition parameter from previous tag j to current tag i and transition parameter at current tag i. Hence,

The sum of

**First order HMM**

**Second order HMM**

Xj

Xj

Emission

Emission

Transition

Transition

**Result**

**References:**

Park, J., Chebbah, M., Jendoubi, S., & Martin, A. (2014, September). Second-order belief hidden Markov models. In *International Conference on Belief Functions* (pp. 284-293). Springer, Cham.

Thede, S. M., & Harper, M. P. (1999). A second-order hidden Markov model for part-of-speech tagging. In *Proceedings of the 37th annual meeting of the Association for Computational Linguistics* (pp. 175-182).