Lab 1: Modeling Packet Losses

Zhipeng Ye

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1 Hidden Markov Model

Gilbert-Elliott Model is packet loss model which is based on two-state Hidden Markov Model. In other words, Gilbert-Elliott Model is a simply version of Hidden Markov Model. Therefore, It's necessary to learn more about Hidden Markov Model to understand Gilbert-Elliott Model completely.

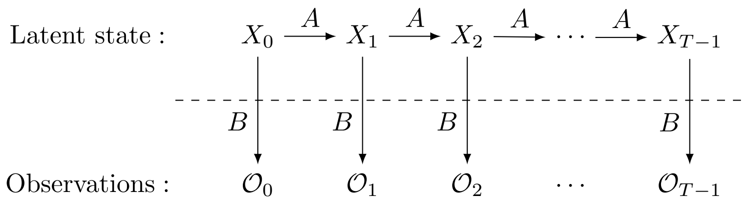

Figure 1: Hidden Markov Model

Hidden Markov Model introduce two random variable - Latent state and Observations. Latent state is a variable that we can't see. Observations is a variable that we can observe at the experiment. Furtheremore, HMM also has three parameters - initial probability vector π, transition probability matrix A, emission probability matrix B. So if we can compute three parameters $\{A, B, \pi\}$, we will reconstruct HMM. Researchers have developed numerous approaches to estimate parameters of Hidden Markov Model (HMM) such as Forward/Backward Algorithm.

Markov Model simplifies the Hidden Markov Model (HMM). It only uses two parameters $\{A, \pi\}$ and removes the Latent state. Maximum likelihood estimation (MLE) is a good way to estimate these parameters. The relationship between Hidden Markov Model and Markov Model is similar to the relation between Gilbert-Elliott Model (GM) and Simple Gilbert-Elliott Model (SGM). Section two of this article will demonstrate the reason.

2 Gilbert-Elliott Model

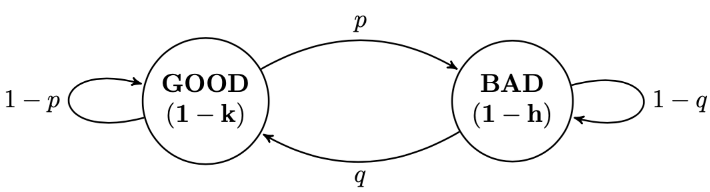

Figure 2: Gilbert-Elliott Model