Abstract for Tutorial on Markov Models in Health Care

A chronic condition is a human health condition or disease that is persistent or otherwise long-lasting in its effects or a disease that comes with time. Common chronic diseases include arthritis, asthma, cancer, COPD, diabetes and viral diseases such as hepatitis C and HIV/AIDS. Chronic diseases especially Diabetes constitute a major cause of mortality. Based on World Health Organization, 38 million deaths a year is caused by the non-communicable diseases of this group. In United States, 25% of adults have at least two chronic conditions and 1 in 2 Americans (133 million) has at least one chronic medical condition.

One out of every $3 of medical expenditure is spent on diabetes care and treatment and ten percent of the US population are currently suffering from type 2 diabetes. Almost 40 percent of the US population is in the pre-symptomatic stage of the disease which over time will develop into diabetes. The key solution to this problem is to diagnose the patient when the disease is still in its earlier stages.

One way to find out is to do screening. Screening can be used to identify pre-symptomatic individuals in order to perform interventions to prevent the development of diabetes. Population-based screening is an expensive task and thus whom to screen and how often to screen becomes of interest from a decision-making point of view. A Markov Decision Process (MDP) is usually used to model the progression of the disease in patients using discrete states and to identify the optimal set of decisions called a policy. The transition probabilities for the MDP are estimated using a Hidden Markov Model. Hidden Markov Models are almost similar to Markov Chains but has two types of states. As well as the main set of states which are called hidden states in HMM, they also have a set of observed states. Hidden Markov Models use the Baum-Welch algorithm to derive the maximum likelihood estimate of the parameters.