# Continuos-time HMM

**Description:**

Hidden Markov model (HMM) is a model for representing probability distributions over sequences of observations in which the system generating sequences is assumed to be a Markov process with unobserved states. Nowadays, the theory of HMM is well developed in case of finite discrete process and HMMs are well implemented in many languages such as Java, Python and Matlab. However, in many applications, discrete-time models are not ideal and continuous-time models can better describe the real process.

In continuous-time hidden Markov model it is assumed that the underlying Markov chain is continuous-time instead of discrete-time. A general EM framework for continuous-time dynamic Bayesian networks works for CT-HMM but there is a need for efficient CT-HMM learning methods that can scale to large state spaces (e.g. hundreds of states or more).

The goal of the thesis is to study existing CT-HMM learning methods compare them and implement and evaluate one of them.

**Literature:**

[1] Liu, Yu-Ying, et al. "Efficient learning of continuous-time hidden markov models for disease progression." Advances in neural information processing systems. 2015.

[2] J. M. Leiva-Murillo, A. Arts-Rodrguez, and E. Baca-Garca, "Visualization and prediction of disease interactions with continuous-time hidden markov models," in NIPS, 2011.

[3] Y. Liu, H. Ishikawa, M. Chen, and et al., "Longitudinal modeling of glaucoma progression using 2-dimensional continuous-time hidden markov model," Med Image Comput Comput Assist Interv, vol. 16, no. 2, pp. 444-51, 2013.