

Discrete Dynamic Bayesian Networks

Benjamin Feher

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Abstract

Our topic is the discrete case of Dynamic Bayesian Networks (or DBNs for short), which is a special graphical model applied to time series data, or a statistical model that is associated to a graph. I am going to use Bayesian Networks (or BNs for short) as a base for our DBNs.

In this thesis I am going to use some basics of Graph theory and Probability theory in order to introduce BNs in Chapter 2. I will also write about how to learn the structure and parameters of a BN. I will describe how to make inference with this static model and then proceed to explain the algorithms which will be needed for this including transforming the directed acyclic graph (or DAG for short) we are working with into a so called junction tree for faster computing.

Chapter 3 is about introducing DBNs, and then adjusting the methods we have seen for BNs to help us set up and make inference in our DBN. In this chapter I write more about the different kind of inferences we can make and introduce the interface method for it which will be using the so called Forwards-Backwards algorithm.

In chapter 4 an application of DBNs is presented. I have used data from an offices sensors which collect information about the environment to demonstrate the methods described in chapter 3. The original goal behind the data was to predict whether the office is occupied at any given moment but with a DBN we can make additional inferences as well, which have been coded into the program i have wrote for it. I have tested our model by asking a couple of inferences based on it and then counting those occurrences in the data the model is trained on and then on another set of data from the same source.