Extending a Dynamic Bayes Net Toolkit to Trace Multiple Subskills

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Dynamic Bayesian Nets (DBNs) provide a powerful representation to 1) model the relationships between students' evolving knowledge and behavior in an intelligent tutoring system, and 2) infer changes in a student's hidden knowledge from the student's observed sequential steps. Chang et al. (2006) introduced a Matlab tool called BNT-SM, which inputs a concise specification of a DBN and uses the Bayes Net Toolbox (BNT) (Murphy 2001) to generate Matlab code to train and test the DBN. The input DBN specification, expressed in XML, is a fraction of the size of the generated output, thereby sparing researchers considerable coding.

However, the DBNs represented by BNT-SM did not model steps that involve multiple subskills. To overcome this limitation, LR-DBN (Xu and Mostow 2011b) uses logistic regression in DBNs to trace multiple subskills. As reported at EDM2011 (Xu and Mostow 2011b, 2011a), LR-DBN fits student performance data significantly better than previous methods, with only half as many prediction errors on unseen data.

Therefore we have extended BNT-SM to make LR-DBN available to researchers in easy-to-use form. [1] Compared to implementing a LR-DBN model directly in BNT, implementing it in BNT-SM now requires substantially less user effort and code. For example, the simplest LR-DBN model uses logistic regression in Knowledge Tracing (Corbett and Anderson 1995). Implementing it directly in BNT required 86 lines of code. In contrast, implementing it in BNT-SM needs only half as many lines of XML to specify its structure and parameters.

[1] Available at http://www.cs.cmu.edu/~listen/BNT-SM/

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