Student Modeling

Group 48

PES University, Electronic City

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Brief Outline

1. Introduction
2. Algorithm
3. Status of Project

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Abstract

- **Domain:** Educational data mining, statistical learning

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- **How:** Several algorithms proposed in literature, based on BKT
- **Data:** 2009-10 Skill-builder ASSISTments data
- **Metrics:** RMSE, MAE

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Intelligent Tutoring Systems

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Bayesian Knowledge Tracing (BKT)

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- Fundamentally, a two-state HMM–*learned* and *unlearned*.
- Viterbi algorithm can be used to solve for the hidden state sequence.

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BKT Extensions

- Pardos and Heffernan, 2011. Incorporated problem difficulty.
- Yudelson et al., 2013. Incorporated student learning speed.
- Schultz and Arroyo, 2014. Combined BKT with HMM-IRT, called Knowledge and Affect Tracing (KAT) model.
- Lin and Chi, 2016. Added student response time directly into the model, creating the Intervention-BKT (I-BKT).
- Spaulding, Gordon, Brezeal, 2016. Used commercial affect-analysis tool called Affdex.

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Why not Deep Neural Networks?

- RNNs, LSTMs successfully applied (Piech et al., 2015; Lin and Chi, 2017)
- Difficult to interpret!
- With HMMs, can identify "most likely" hidden state sequence, and can also find HMM parameters (EM algorithm)

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So what are we doing?

- Implement a web-based ITS solution

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- Individual models for each user
- Idea: start with simple models (single concept, basic BKT), go increasingly complex, hopefully implement KAT.

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Technologies

- Python + Flask back end
- MongoDB database, passwords hashed with bcrypt
- Authentication implemented with JSON Web Tokens (JWTs)
- Front end with Angular
- Code quality ensured with *pycodestyle*

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Work completed

- User registration and login (back end and database)

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- Implemented basic BKT model

Work left

- Analyze data, plan architecture, $\approx$ 3 weeks

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- Analyze data, plan architecture, $\approx$ 3 weeks
- Integrate BKT model into application $\approx$ 2-3 weeks
- Find metrics on the model, $\approx$ 1 week
- Implement extensions and KAT (ideal) $\approx$ 2-3 months

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Thank you!

Any questions?

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