



Tools for Education – A Personalized View

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Motivation

- Education increasingly takes place in larger and larger classes - both in traditional classroom teaching and in MOOCs.
- Challenges:
 - heterogeneous student backgrounds and abilities
 - heterogeneous student styles of learning
- Personalization is important to maintain student engagement and reduce drop-outs.
- Education is a life-long pursuit – beyond college....

My Agenda

- Use Machine Learning and Data Mining to create a personalized interactive environment for each student –
One teacher for one student
- Personalized Remedial Materials
- Life-long Education/Personal Growth
- Study and Support Networks
- Incentivizing Collaborations

Goal: Identify students who need help (grade/performance prediction)

...as early as possible

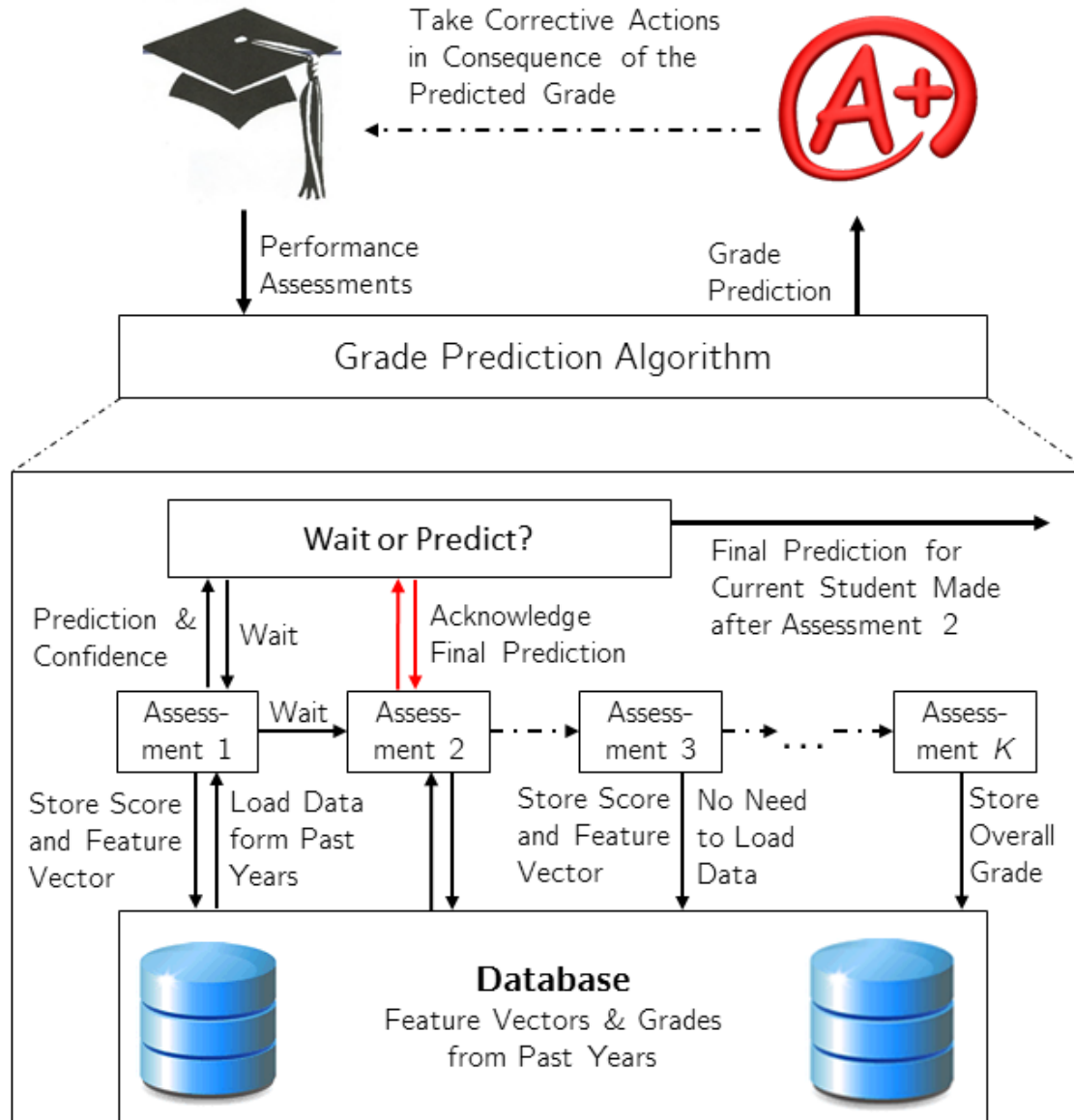
...with predefined confidence

- **Assumption:** Early performance assessments (e.g. homeworks, quizzes) available
- **Constraint:** *Only* early class performance used
- **Tested on:** Digital Signal Processing (DSP) (Undergrad) Course

Y. Meier, J. Xu, O. Atan, M. van der Schaar, "Personalized Grade Prediction: A Data Mining Approach," *IEEE ICDM, 2015*.

Y. Meier, J. Xu, O. Atan, and M. van der Schaar, "Predicting Grades," to appear in *IEEE Transactions on Signal Processing, 2015*.

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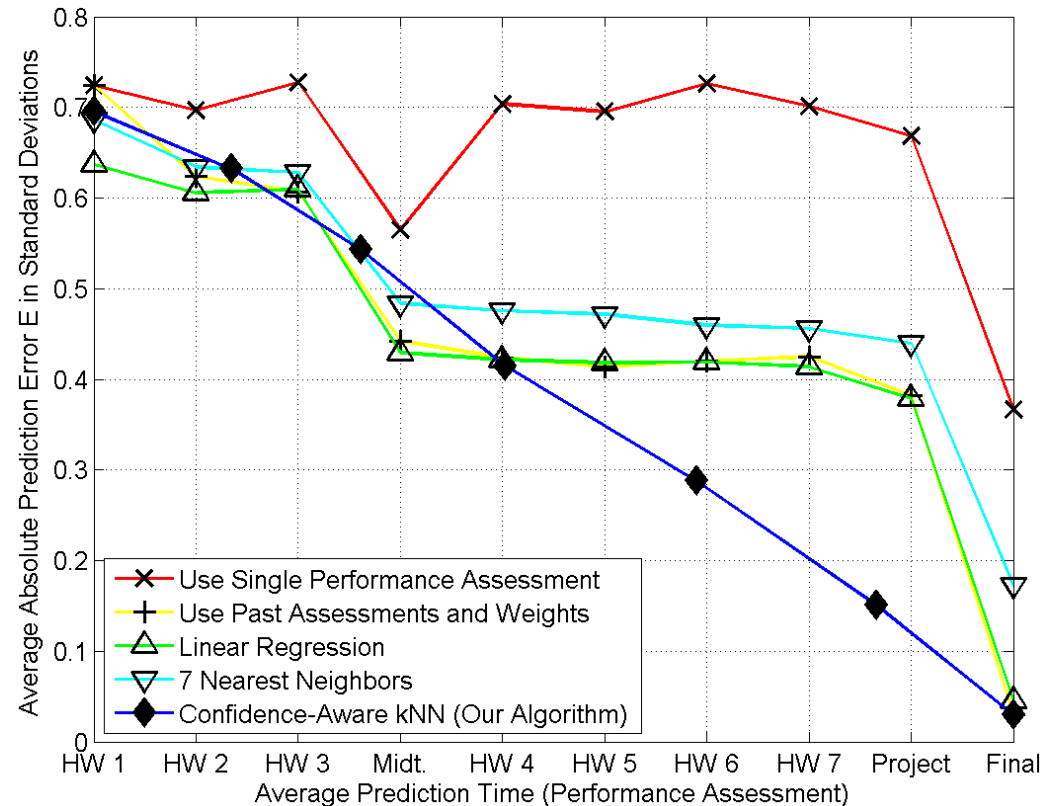
Performance

Benchmarks:

- Use single/few past assessments
- Linear regression
- k-Nearest Neighbors

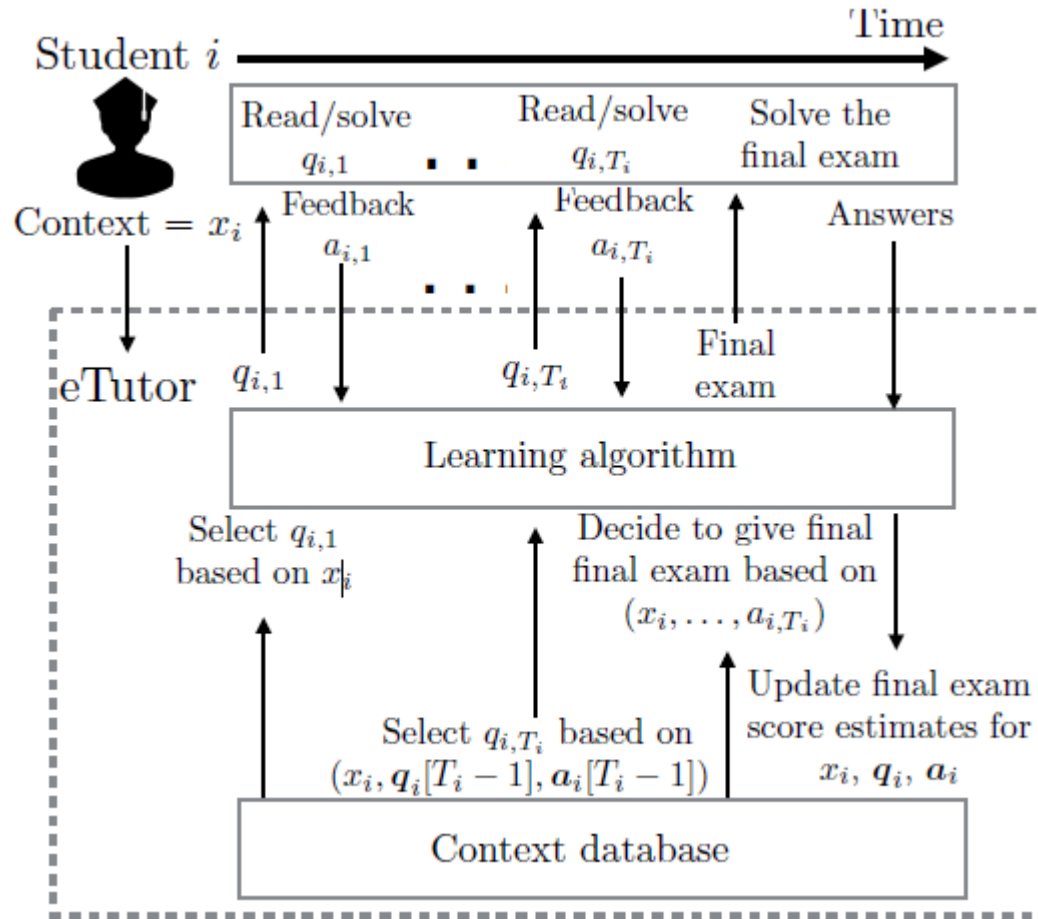
Advantages:

- Personalized prediction (stopping)
- Confidence/guarantees
- Rescuing students
- More assessments early on can improve prediction
- Use data from past classes



Goal: Adapt the teaching methodology to

- maximize student performance/learning
- minimize student time/effort



Staged
Multi-Armed
Bandits

Ongoing

- Personalized Course Sequence Recommendation
- Life-long Education/Personal Growth
- Study and Support Networks
- Incentivizing Collaborations

Tools

- Novel Multi-Armed Bandit Algorithms
- Novel Clustering Methods
- Novel Game-Theoretic Methods (Repeated Matching, Network Formation, etc.)

Y. Xiao, F. Dörfler and M. van der Schaar, " Incentive Design in Peer Review: Rating and Repeated Endogenous Matching"