Recommender Methods Based on Collaborative Filtering in E-Learning

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Create a recommender system for e-learning

E-learning: Provide educational content and experiences via digital platforms.

Online materials, interactive assessments, adaptive pathways.

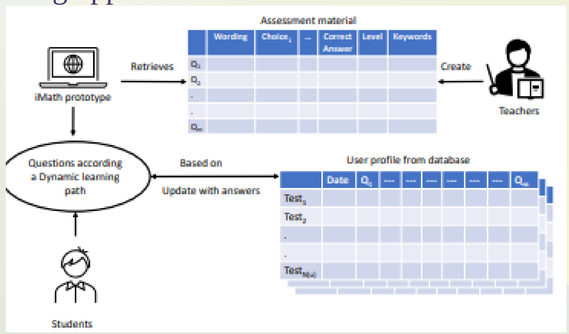
Supports independent, flexible, and scalable learning opportunities.

Inputs:

- Student background & preferences
- Interaction data
- Content metadata

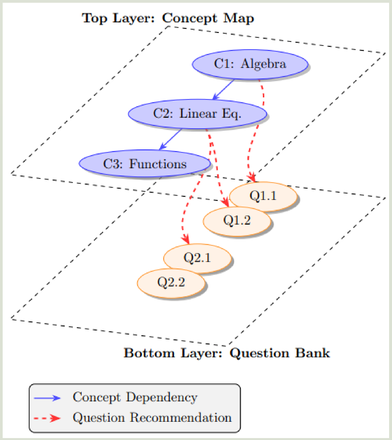
Outputs:

- Personalized recommendations
- Adaptive learning paths



- Goal: Use data to predict and provide next question/material that optimizes learning outcomes
- Aimed Recommendation: Personalized, adaptive questions and resources that maximize student learning

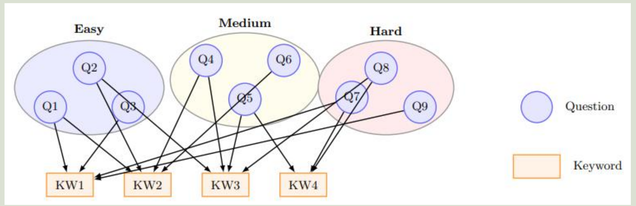
Comparing data-hungry ML methods with efficient matrix factorization approaches



Two level view: Concept layer versus question layer

Investigated methods:

- Random Forest
- Concept map tour
- Clustering on difficulty level

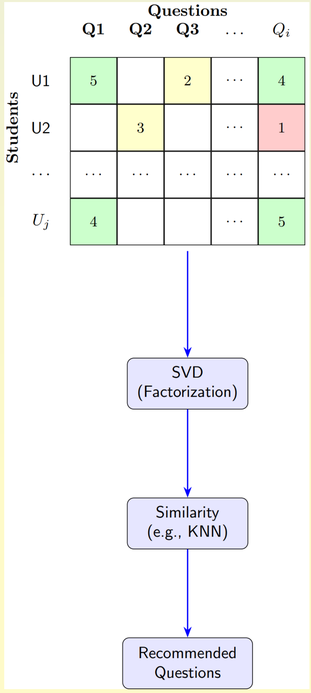


Predict which next question or material (video, description) will help students obtain insight, measured by correctly answering subsequent questions.

Conclusions

- Matrix factorization methods provide efficient alternatives to ML approaches
- Layer-specific optimization improves overall system performance
- Personalization crucial for e-learning effectiveness
- Balance between complexity and practical implementation essential

Method	Layer	Complexity	Data Requirements	Personalization
Concept Map & Graph Walk	Top	Medium	Low	High
Collaborative Filtering	Bottom	Medium	Medium	High
Clustering-Based	Top	Low	Low	Medium
Random Forest	Bottom	High	High	Medium
Reinforcement Learning	Top	High	High	High



References

- Fuster López, A. et al. (2024), On conceptualization and an overview of learning path recommender systems in e-learning, Working Paper, RIUMA 10630/31566
- Fuster López, A., Guerrero García, P., Hendrix, E.M.T., Martínez-Cruz, J. and Nowak, I. (2023), On an OptLearn implementation using collaborative filtering, Working Paper, RIUMA 10630/27214

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