AFEL-REC
A Recommender System for Providing Learning Resource Recommendations in Social Learning Environments

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1. Introduction to the AFEL project & this paper

2. AFEL-REC system overview & examples

3. Evaluation setting & results

4. Conclusion & future work

5. Questions & discussion
Introduction: The AFEL Project & This Paper

- **Analytics For Everyday Learning**
  - H2020-funded European project (2015 - 2018)
  - [http://afel-project.eu/](http://afel-project.eu/)

- **Goal**
  - Develop tools to understand and support informal and collective learning in **online social learning environments**
  - **Evaluate** in Spanish social learning environment Didactalia
    - [https://didactalia.net/](https://didactalia.net/)

- **Tools**
  - Visual analytics, e.g., show learning progress via indicators
  - **Recommender systems**

- **The present work**
  - (i) contribute to sparse line of research about **recommender systems for social learning environments**
  - (ii) demonstrate the value of **social tags for resource recommendations**
AFEL-REC: System Overview

- Based on ScaR framework: [http://scar.know-center.tugraz.at/](http://scar.know-center.tugraz.at/)
AFEL-REC: Example (user profile)

Scope: Machine_learning

diversity
intensity
complexity

coverage

the average complexity of activities of in this scope: 49%

topics in this learning scope

Data_mining_algorithms
Human_body
Eukaryotes
Machine_learning
Morphology
Cerebrum
Biota
Biomedical_systems
Neural_networks

Artificial_neural_networks
Cybernetics
Data_analysis
Classification_algorithms
Human_anatomy
Organ_systems
Autonomy
Skills
Categorical_data
Neuroanatomy
Computational_neuroscience

Series 1: 183.49744240670548

Decorative_arts
Primate_anatomy
Veterinary_medicine
Recommendations

- machines minds and computers
- learning about numbers
- systems practice managing sustainability
- representing and manipulating data computers
- models and modelling
- the environmental impact teaching and learning
- modelling object oriented software introduction
- prices
- design
- brief guide neuroimaging

Latest activities in the scope

http://www.google.com/search?q=knowledge
discovery
tugraz

http://www.google.com/search?q=knowledge
discovery
tugraz
Evaluation: Setting

• Research Question
  • How useful are social information in the form of tags for recommending learning resources?

• Evaluate 3 Use Cases
  • UC1: MostPopular (MP) → Baseline
  • UC2: Collaborative Filtering (CF\textsubscript{i}) → CF without social information
  • UC3: Tag-based CF (CF\textsubscript{t}) → CF with social information (= our approach)

• Evaluation Protocol
  • For each user → most recent 20\% of interactions for testing
  • Remaining interactions are used for training

• Evaluation Metrics
  • Accuracy: R@20, P@1, F1@10
  • Ranking: MRR@20, MAP@20, nDCG@20
  • Coverage: User coverage (C) → fraction of users with recommendations
Evaluation: Data

- Data from social learning environment Didactalia
  - **15 months**: 26th February 2017 – 28th May 2018
- Tags are currently the only social information used in the evaluation

**Dataset statistics**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of interactions (i.e., clicks)</td>
<td>1,879,761</td>
</tr>
<tr>
<td>Number of users</td>
<td>1,274,858</td>
</tr>
<tr>
<td>Number of learning resources</td>
<td>35,346</td>
</tr>
<tr>
<td>Number of social tags</td>
<td>485,295</td>
</tr>
<tr>
<td>Average number of interactions per user</td>
<td>1.47</td>
</tr>
<tr>
<td>Average number of interactions per resource</td>
<td>53.18</td>
</tr>
<tr>
<td>Average number of tags per learning resource</td>
<td>13.73</td>
</tr>
</tbody>
</table>
Evaluation: Results

- Average metrics over all users

<table>
<thead>
<tr>
<th>Approach</th>
<th>R@20</th>
<th>P@1</th>
<th>F1@10</th>
<th>MRR@20</th>
<th>MAP@20</th>
<th>nDCG@20</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC1: MP</td>
<td>0.007</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.003</td>
<td>100%</td>
</tr>
<tr>
<td>UC2: CFᵢ</td>
<td>0.046</td>
<td>0.022</td>
<td>0.012</td>
<td>0.025</td>
<td>0.026</td>
<td>0.032</td>
<td>40%</td>
</tr>
<tr>
<td>UC3: CFᵣ</td>
<td>0.070</td>
<td>0.027</td>
<td>0.016</td>
<td>0.034</td>
<td>0.035</td>
<td>0.044</td>
<td>53%</td>
</tr>
</tbody>
</table>

- **MP provides the highest coverage** (100%) → cold start users

- **CFᵢ provides 10 times higher accuracy than MP** but low coverage

- Our approach **CFᵣ provides best accuracy and ranking results** and **higher coverage than CFᵢ**
Conclusion: Discussion & Future Work

• Two main contributions
  – **We presented AFEL-REC** as a recommender system for social learning environments
  – Validated the usefulness of **social information in form of tags** for learning resources recommendations
    → **Answers RQ:** good trade-off between **accuracy, ranking and coverage**

• Limitations & Future Work
  • Currently tags are the only social information used
    → **Friendship connections, group memberships**, etc.
  • Indicators of learning scope are neglected
    → **Adaptive recommendations** (e.g., complexity, diversity)
  • Currently only offline evaluation
    → Evaluate the real user acceptance with **online evaluation study**
  – Research on novel recommendation approaches
    → See our paper in the **EYRE workshop @ CIKM (session 2)**
Questions / suggestions?

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Back-Up: AFEL-REC Use Cases

- **UC1:** Recommendation of popular resources in the environment
- **UC2:** Recommendation of resources of like-minded users
- **UC3:** Recommendation of resources based on social information
- **UC4:** Recommendation of similar resources of the user
- **UC5:** Recommendation of alternatives for a resource
- **UC6:** Recommendation of alternatives for a user and resource
- **UC7:** Adaptive recommendation of resources for a specific user and a specific learning goal (e.g., getting more complex or diverse)