Exploiting Synergy Between Ontologies and Recommender Systems

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Exploiting Synergy Between Ontologies and Recommender Systems

- Cold-start and interest acquisition problems
- Quickstep architecture and approach
- OntoCoPI approach
- Integration of Quickstep, Ontology and OntoCoPI
- Empirical evaluation
- Issues arising from empirical evaluation
- Future work
Cold start and interest acquisition problems

Recommender systems reduce WWW information overload
- Observe behaviour to profile user interests
- Suffer from cold-start problems
- New-system and new-user cold start

Ontologies hold knowledge about a domain
- Domain knowledge held is commonly static in nature
- Acquiring ever changing interests is challenging

Synergy between ontologies and recommender systems
- Ontologies can bootstrap recommender systems
- Recommender systems can acquire interests for an ontology
Quickstep architecture and approach

Research papers
  TF vector representation
  Research topic ontology
Classifier
  k-nearest neighbour
  Users can add examples
Classified paper database
  Grows as users browse
Profiler
  Feedback and browsed papers give time/interest profile
  Time decay function computes current interests
Recommender
  Recommends new papers on topics of interest
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- **OntoCoPI approach**

Identifies communities of practice using an ontology
Informal groups of individuals sharing an interest
Network analysis applied to a populated ontology
Breadth-first search over selected relationships
Discovers connections that infer common interest
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• OntoCoPI approach

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- Integration of Quickstep, Ontology and OntoCoPI

New-system cold start
Ontology bootstraps new-system profiles
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- Integration of Quickstep, Ontology and OntoCoPI

New-system cold start
- Ontology provides each user’s publications
- Quickstep computes publication topic classifications
- Bootstrap profile is computed from publication topics
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• **Integration of Quickstep, Ontology and OntoCoPI**

  New-system cold start
  Ontology bootstraps new-system profiles

  New-user cold start
  OntoCoPI and Ontology bootstraps new-user profiles
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- Integration of Quickstep, Ontology and OntoCoPI

New-user cold start
- Ontology provides new user’s publications
- OntoCoPI provides a set of similar user’s to the new user
- Bootstrap using similar profiles and previous publications
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- Integration of Quickstep, Ontology and OntoCoPI

New-system cold start
Ontology bootstraps new-system profiles

New-user cold start
OntoCoPI and Ontology bootstraps new-user profiles

Interest acquisition
Recommender updates ontology interests every day

Example profile
1st April 2002, Recommender Systems, 6.0
1st April 2002, Interface Agents, 2.9
1st April 2002, Agents, 0.9

2nd April 2002, Recommender Systems, 5.0
2nd April 2002, Interface Agents, 2.6
2nd April 2002, Agents, 0.8

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• **Empirical evaluation**

Measured the reduction in the recommender cold-start
Used logged browsing behaviour from a real trial
   Quickstep trial logs, 9 users, first 7 weeks of browsing used
Measured convergence to a post cold-start state
   Week 7 used for post cold-start state
New-system bootstrap performance measured
New-user bootstrap performance measured

<table>
<thead>
<tr>
<th>Precision</th>
<th>Error rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>New-system bootstrapping</td>
<td>0.35</td>
</tr>
<tr>
<td>New-user bootstrapping</td>
<td>0.84</td>
</tr>
</tbody>
</table>

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• **Issues arising from empirical evaluation**

  Is the cold-start overcome?
  - New-system bootstrapping works well
    - Old interests were correctly identified
    - Recent interests harder to get from publications
  - New-user bootstrapping too error prone
    - Communities of practice were not focused enough
    - Not selective enough when taking similar users interests

  Is the interest-acquisition problem overcome?
  - Up-to-date interest profiles are acquired daily
  - Once the cold-start is over, profiles closely match behaviour
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- **Issues arising from empirical evaluation**

  How does the quality of the ontology effect the quality of the communities of practice identified?
  - Ontology was only partially populated
  - We only used users who had previous publications
  - OntoCoPI relationship weights not custom to our problem

  Can the new-user algorithm be significantly improved?
  - Could pick topics only a majority of similar users like
  - OntoCoPI confidence values can weight user similarity

  What other information sources could be used?
  - Other university databases
  - Structured web pages with associated metadata
Issues arising from empirical evaluation

Will our approach work with other problem domains?
Classifier needs textual information sources
User behaviour must be monitored
Need an ontology for the domain
Classifier needs a new training set of class examples
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- **Future work**

  Further recommender / ontology experimentation
  - Improve the set of relationships and weights used
  - Find a better new-user algorithm
  - Conduct further trials with some more users
  - Look into profiling context and task structure

  **Foxtrot recommender system**
  - Year long trial, over 100 staff and students
  - Searchable paper database with recommendation facility
  - Users can visualize and update their own profiles

  **OntoCoPI**
  - Prototype enhanced and developed further
  - Evaluation planned with people in the IAM lab
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• Quickstep architecture and approach

K-Nearest Neighbour - kNN
TF vector representation
Examples exist in a term-vector space
New papers are added to this space
Classification is a function of its ‘closeness’ to examples

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Quickstep architecture and approach

Profiling

- Time/Interest profile
- Is-a hierarchy infers topic interest in super-classes
- Time decay function biases towards recent interests

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