Ontological User Profiling in Recommender Systems

Stuart E. Middleton
IT Innovation
Dept of Electronics and Computer Science
University of Southampton
United Kingdom

Email: sem@it-innovation.soton.ac.uk
Web: http://www.ecs.soton.ac.uk/~sem99r

Ontological User Profiling in Recommender Systems

- Recommender systems
- User profiling in recommender systems
- Ontological user profiling
- Experimentation
- Future work

Ontological User Profiling in Recommender Systems

- **Recommender systems**

WWW information overload

Recommender systems

- Collaborative filters (several commercial examples)
- Content-based filters
- Hybrid filters

Knowledge acquisition

- Monitoring should be unobtrusive
- Explicit feedback should be optional
- Positive examples easier to acquire than negative examples

Problem domains

- Books, Music, News, Web pages, E-commerce…
- On-line academic research paper recommendation

Ontological User Profiling in Recommender Systems

- **User profiling in recommender systems**

  Binary class representation

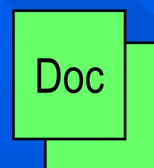
  - 'Interesting' and 'not interesting' examples
  - Machine learning classifies new information

Ontological User Profiling in Recommender Systems

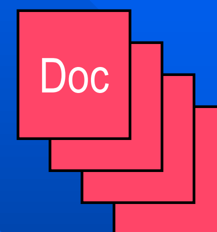
- **User profiling in recommender systems**

Binary class profile representation

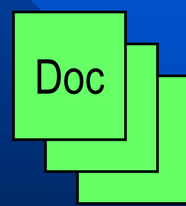
User A — Interesting



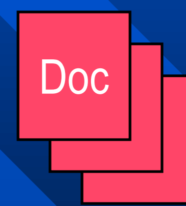
User A — Not Interesting



User B — Interesting



User B — Not Interesting



Ontological User Profiling in Recommender Systems

- **User profiling in recommender systems**

Binary class profile representation

- ‘Interesting’ and ‘not interesting’ examples
- Machine learning classifies new information

Multi-class profile representation

- Classes represent domain categories
- Examples can be shared between users

Ontological User Profiling in Recommender Systems

- **User profiling in recommender systems**

Multi-class profile representation

Topic A　　Topic B　　Topic C

User A

Interesting	Topic A,B
Not interesting	Topic C

User B

Interesting	Topic B,C
Not interesting	Topic A

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Multi-class profile representation
- Classes represent domain categories
- Examples of classes can be shared

Knowledge-based profile representation
- Interviews and questionnaires
- Asserted facts in a knowledge base

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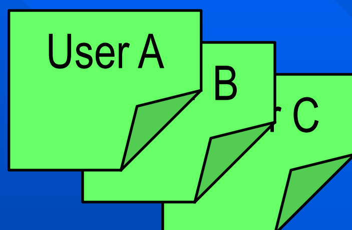
- **User profiling in recommender systems**

Knowledge-based profile representation

Questionnaires



User A

User A -> (interested, topic A) (interested, topic B)

User A -> (not interested, topic C)

User B

User B -> (interested,topic B) (interested, topic C)

User B -> (not interested, topic A)

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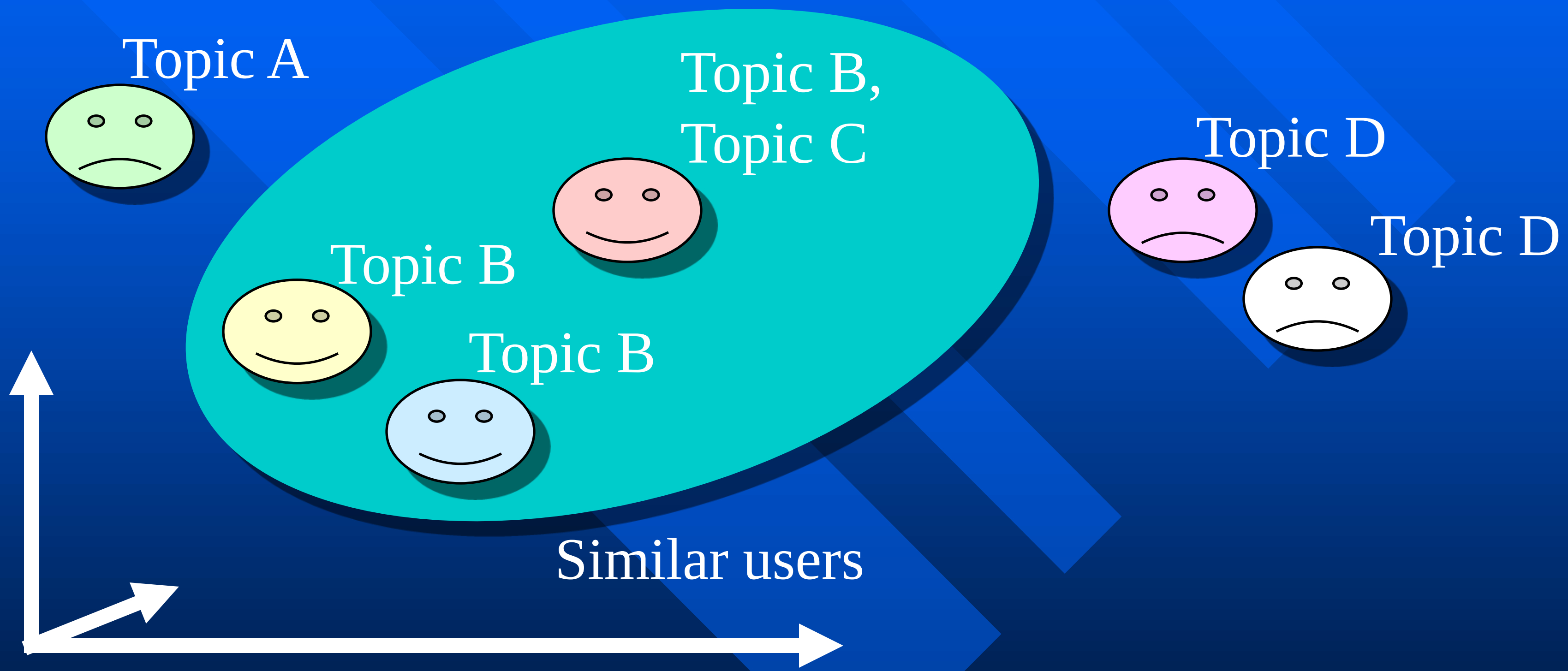
Knowledge-based profile representation
- Interviews and questionnaires
- Asserted facts in a knowledge based

Ratings-based profile representation
- Relevance ratings
- Statistical techniques find useful correlations

Ontological User Profiling in Recommender Systems

- **User profiling in recommender systems**

Ratings-based profile representation



Ratings vector space

Ontological User Profiling in Recommender Systems

- **Ontological user profiling**

Ontological profiling
- Multi-class profile representation
- Profile topics match ontology classes
- Ontology contains relationships between classes

Inference to assist profiling
- Infer related topics of probable interest

Profile bootstrapping
- External ontological knowledge can bootstrap profiles
- Overcome the cold-start problem

Profile visualization
- Ontological terms understood by users
- Visualize profiles and acquire direct feedback on them

Ontological User Profiling in Recommender Systems

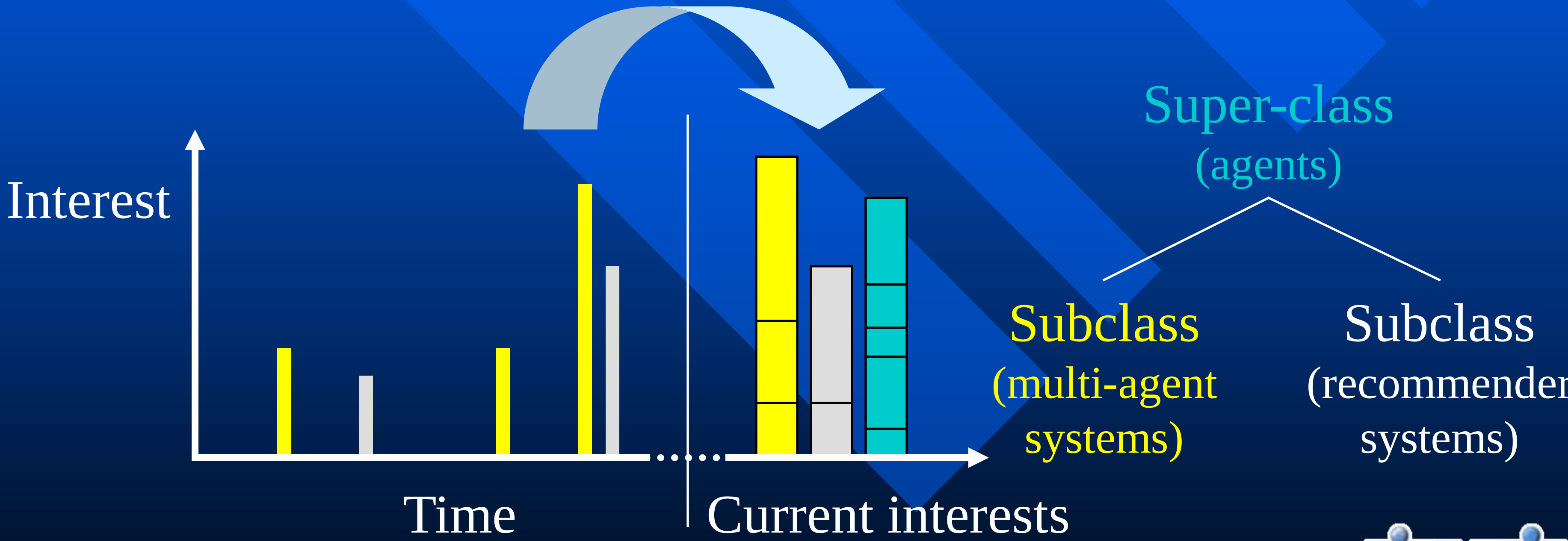
- **Experimentation**

Profile inference [Quickstep]

Time/Interest profile

Is-a hierarchy infers topic interest in super-classes

Time decay function biases towards recent interests



Ontological User Profiling in Recommender Systems

- **Experimentation**

Profile inference [Quickstep]

Time/Interest profile

Is-a hierarchy infers topic interest in super-classes

Time decay function biases towards recent interests

	Recommendation accuracy	Good topics
Ontological	11%	97%
Unstructured	9%	90%
	2% better	7% better

10% = 1 per set

Ontological User Profiling in Recommender Systems

- **Experimentation**

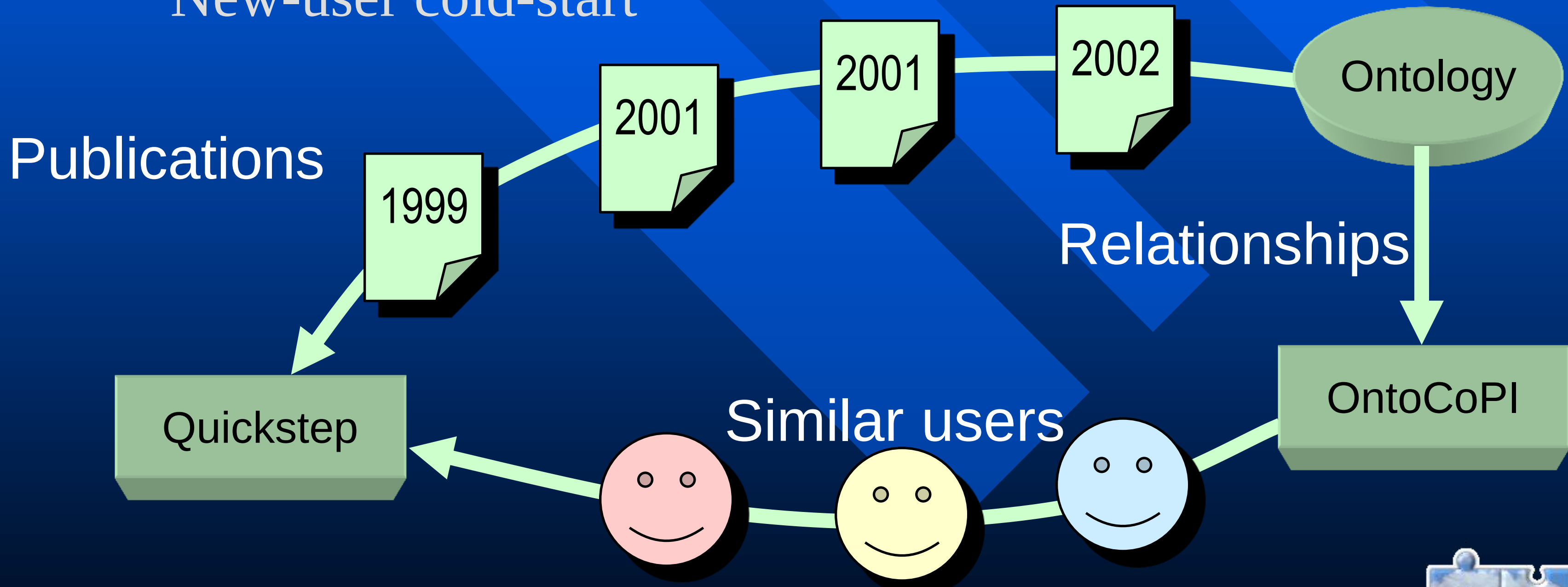
Bootstrapping [Quickstep, OntoCoPI]

External ontology

Publications and personnel data (AKT ontology)

New-system cold-start

New-user cold-start



- **Experimentation**

Bootstrapping [Quickstep, OntoCoPI]
- External ontology
- Publications and personnel data (AKT ontology)
- New-system cold-start
- New-user cold-start

	Profile precision	Profile error rate
New-system	35%	6%
New-user	84%	55%

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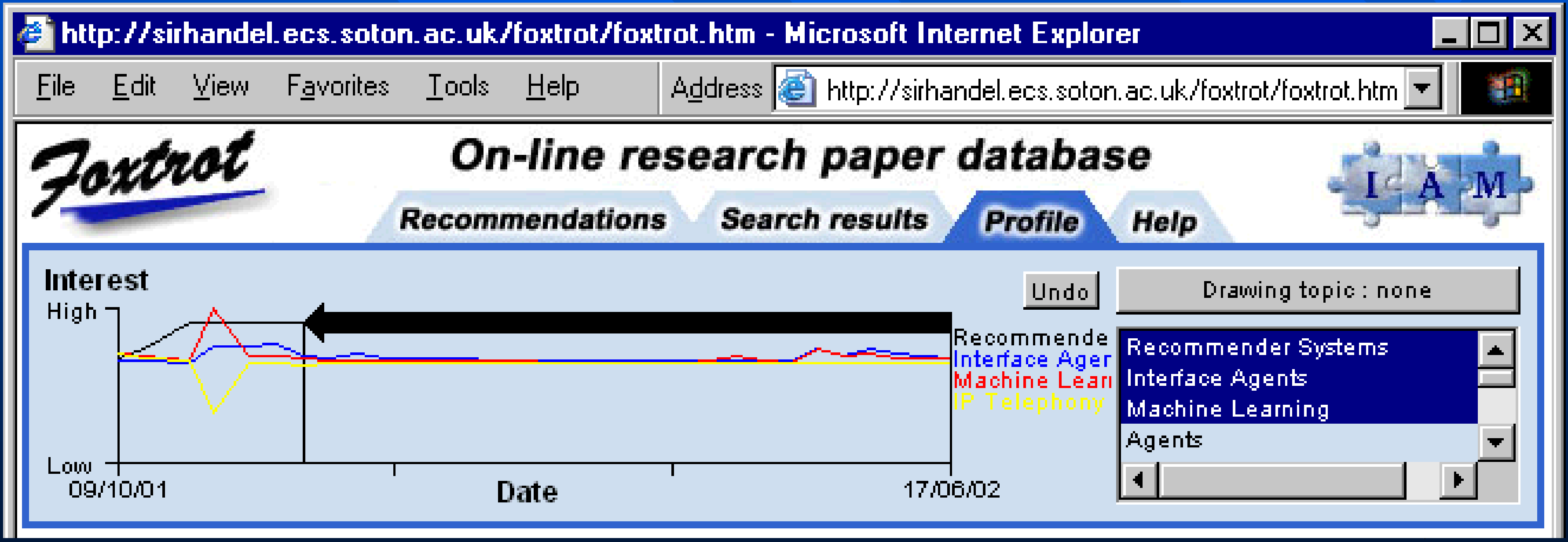
- **Experimentation**

Profile visualization [Foxtrot]
    Time/Interest visualized
    Users could draw their own profiles on the graph
    Profile feedback thus acquired



Ontological User Profiling in Recommender Systems

- **Experimentation**

Profile visualization [Foxtrot]

Time/Interest visualized

Users could draw their own profiles on the graph

Profile feedback thus acquired

	Recommendation accuracy	Profile accuracy
Profile feedback	2-5%	20-35%
Relevance feedback	1%	18-25%
	2-5% better	10% better

10% = 1 per set

Ontological User Profiling in Recommender Systems

- **Future work**

  More ontological relationships
  - Project membership, Related research areas, Common technology, etc.

  Task profiling
  - Users often multi-task
  - Task modelling will allow more than just general profiles

  Agent metaphor
  - Multi-agent system with other users agents
  - Trade personal information
  - Buy in external ontological information

- **Conclusions**

Ontological user profiling works

- Couples inference and machine learning techniques
- Allows use of external ontologies
- Profiles are understood by users

Applicable to more than just recommender systems

- Other domains
- Other technologies