Supporting Exploratory People Search: A Study of Factor Transparency and User Control

Nowadays, search is part of our lives
- People usually represent information needs as query
- By issuing the query, people will get relevant documents

In some scenarios, finding the relevant people is more important than the relevant documents
- Find appropriate collaborators
- Find conference program committee members
- Find qualified job candidates
- Find experts to answer questions in QA system
- Find appropriate reviewers for paper manuscripts
- ……

The **People Search** task
Related works

- Related approaches fall into three categories
  - Find people who are contently relevant to the query
  - Find people who are socially close to the searcher
  - Or find a tradeoff between both two

- Content Relevance
  - Associate entity relevance with document relevance

- Social Closeness
  - Social Network Analysis (SNA) method
  - Common neighbors OR Degree of Separation

- Hybrid Approach
  - “Social Matching”, “Social Recommender”
Limitations of previous works

- Unable to model **diverse task contexts**
  - Finding mentors (authority) VS. Finding collaborators (social)

- Unable to personalize **user preferences**
  - Users may have different preferences even in the same task. e.g. finding PhD thesis committee members
    - Some may prefer domain experts
    - Others prefer experts who are easily to be connected

- Unable to support **exploratory people search**
  - Many people search tasks need user exploration
    - Start with vague ideas; make decisions after iterative interactions
  - Exploratory people searches are different from navigational searches (Keynote from Daniel Tunkelang in DUBMOD)
query = “recommender system”

Users’ exploration on three facets

Barry Smyth (University College Dublin, Ireland)
Relevance: [ ] Important: [ ]
Authority: [ ]
Social distance: [ ]
You --> Rosta Farzan Peter Brusilovsky --> Barry Smyth

Yehuda Koren (Yahoo! Research, Haifa, Israel)
Relevance: [ ] Important: [ ]
Authority: [ ]
Social distance: [ ]
You --> Peter Brusilovsky --> Yehuda Koren

John T. Riedl (Department of Computer Science, Minnesota)
Relevance: [ ] Important: [ ]
Authority: [ ]
Social distance: [ ]
You --> Rosta Farzan --> Robert E. Kraut --> John T. Riedl

Workspace

Task - Conference Mentor Assigning
A top conference in your research field provides a good opportunity: they can provide senior scholars to help junior researchers accomplish their current research works. Suppose that you are very interested in this opportunity and plan to submit a request form, in which you need to state your research work, and suggest FIVE candidates that you are interested in. A search tool is provided to help you accomplish this task, please explore the candidates and mark them in the system. You are also required to rank and evaluate the selected FIVE candidates. Please remember that you need to finish this task in 15 minutes. After you finish, you need to finish a post-questionnaire.

Your Selection
Remove Douglas W. Oard (University of Maryland, College Park, MD)
Remove Chenxiang Zhai (University of Illinois at Urbana-Champaign, Urbana, IL, USA)
Remove Jian Yun Nie (Département d’informatique et de recherche opérationnelle, Université de Montréal)

Go to Workspace
Our proposed method
- Represents task diversity through multiple facets
- Allows users to personalize preferences on each facet
- Users can learn and explore the importance of each facet
- System explains why each candidate is returned

Three facets
- Facet 1: Content **Relevance**
- Facet 2: **Social** Closeness
- Facet 3: **Authoritativeness**
Three Facets

- **Facet 1: Content Relevance**
  - Language model based expert search (Balog, et al. 2006)
  - Title and Abstract were indexed for document search
  - Associate document relevance to people relevance

- **Facet 2: Authoritativeness**
  - PageRank** on coauthor networks
  - Decomposed a coauthor link into two directional links
Three Facets

- **Facet 3: Social Similarity**
  - Users need to build their social profiles
  - The similarity is measured by the aggregated similarity for all connections in users’ social profiles

- **Integration**
  - Log–Linear combination with weights indicating the importance of each facet
Experiment Design

- Exploratory People Search Tasks
  - Conference Mentor Finding
    - Authoritativeness
  - New Coauthor Finding
    - Social
  - External Thesis Committee Member Finding
    - Authoritativeness OR more Social
  - Reviewer Suggestion
    - Expertise AND Less social

- Two Systems
  - Experimental system and baseline system
The Experimental system

**Task - Conference Mentor Assigning**

A top conference in your research field provides a good opportunity: they can provide senior scholars to help junior researchers accomplish their current research works. Suppose that you are very interested in this opportunity and plan to submit a request form, in which you need to state your research work, and suggest FIVE candidates that you are interested in. A search tool is provided to help you accomplish this task, please explore the candidates and mark them in the system. You are also required to rank and evaluate the selected FIVE candidates. Please remember that you need to finish this task in 15 minutes. After you finish, you need to finish a post-questionnaire.

**The Baseline system**

**Task - The Training Task**

Please find five experts in your domain, with THREE of them you (and your advisors) may be easy to build connections, and TWO of them you (and your advisors) may be difficult to build connections. You can use the "Social Similarity" slide bar to model the difficulty of building connections, use the "Authority" to find the high authority experts.
Each participant went through total four tasks
- Two tasks in baseline
- Two in experimental system
- Both System and Task sequence are ordered based on Latin Square
Participants & Datasets

- **Participants**
  - 24 PhD students in CS/IS from 8 Universities
  - Diverse research interests: information retrieval, computer graphics, GIS, information security, health informatics, et. al.
  - 10 female, 14 male
  - 67% of them searched for people at least once a week in academic search engines

- **Datasets**
  - 151,165 ACM hosted conference papers (2000–2011)
  - 209,592 unique authors
  - In computer science and information science fields
  - Title, abstract and authors of each paper
Result Analysis

Outline
- Slider Tuning Behavior
- System Effectiveness & Efficiency
- Search Behavior Analysis (Result browsing + Querying)
- User Perceptions

Slider Tuning Behaviors
- Users used the sliders consistently

<table>
<thead>
<tr>
<th></th>
<th>#sliders tuning/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Overall</td>
<td>1.20 (0.81)</td>
</tr>
<tr>
<td>2: 1st half of a search session</td>
<td>1.14 (0.92)</td>
</tr>
<tr>
<td>3: 2nd half of a search session</td>
<td>1.25 (1.12)</td>
</tr>
<tr>
<td>4: 1st task</td>
<td>1.18 (0.78)</td>
</tr>
<tr>
<td>5: 2nd task</td>
<td>1.23 (0.85)</td>
</tr>
</tbody>
</table>
**System Effectiveness**

- The average score of 5 candidates (5-point Likert scale)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average relevance</td>
<td>3.96(0.72)</td>
<td>4.13(0.72)*</td>
</tr>
</tbody>
</table>

**System Efficiency**

- Time spent on each task (unit: minutes)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>5.87(4.08)</td>
<td>5.91(4.69)</td>
</tr>
<tr>
<td>1: Conference mentor</td>
<td>6.74(2.57)</td>
<td>4.46(3.71)</td>
</tr>
<tr>
<td>2: New collaborators</td>
<td>5.68(4.42)</td>
<td>5.96(3.81)</td>
</tr>
<tr>
<td>3: Thesis committee</td>
<td>5.01(2.94)</td>
<td>7.11(6.36)</td>
</tr>
<tr>
<td>4: Reviewer suggestion</td>
<td>6.05(5.90)</td>
<td>6.08(4.64)</td>
</tr>
</tbody>
</table>

**Take-away**: users find more relevant candidates spending around the same time (no significance)
Search Behavior Analysis

- **Result Browsing Behaviors**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>#pages viewed</td>
<td>14.88(13.5)</td>
<td>17.06(12.4)</td>
</tr>
<tr>
<td>#unique candidates</td>
<td>77.7(60.9)</td>
<td>49.0(34.2)**</td>
</tr>
<tr>
<td>Time spent on each page</td>
<td>0.65(0.70)</td>
<td>0.39(0.25)**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average rank position</td>
<td>14.57(12.0)</td>
<td>61.03(59.0)**</td>
</tr>
</tbody>
</table>

- **Take-away messages**
  - Several candidates will appear repeatedly
  - Users spent more time on (re)formulating a **good representation of information needs**
  - Users tend to explore more candidates from **lower ranks**
Search Behavior Analysis

Querying

<table>
<thead>
<tr>
<th>Measures</th>
<th>Baseline</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of queries</td>
<td>4.91(5.04)</td>
<td>4.28(3.94)</td>
</tr>
<tr>
<td>Average query length</td>
<td>2.60(0.89)</td>
<td>2.43(0.75)</td>
</tr>
<tr>
<td>Reformulation pattern: new</td>
<td>0.65(0.33)</td>
<td>0.76(0.29)*</td>
</tr>
<tr>
<td>Reformulation pattern: specialization</td>
<td>0.10(0.13)</td>
<td>0.06(0.11)*</td>
</tr>
<tr>
<td>Reformulation pattern: generalization</td>
<td>0.09(0.14)</td>
<td>0.03(0.09)*</td>
</tr>
<tr>
<td>Reformulation pattern: reconstruction</td>
<td>0.17(0.20)</td>
<td>0.15(0.20)</td>
</tr>
</tbody>
</table>

Take-away message

- Specification/generalization helped users to narrow down/expand their information needs by adding/removing one or more factors.
5-point Likert scale usability questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Baseline</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: The system provides me relevant candidates</td>
<td>3.89(0.56)</td>
<td>4.46(0.64)**</td>
</tr>
<tr>
<td>Q2: The system can help me find relevant candidates efficiently</td>
<td>3.58(0.84)</td>
<td>4.42(0.71)**</td>
</tr>
<tr>
<td>Q3: The system is easy to use</td>
<td>3.77(0.90)</td>
<td>4.31(0.70)**</td>
</tr>
<tr>
<td>Q4: Overall, I am satisfied with the system in this task</td>
<td>3.15(0.99)</td>
<td>4.17(0.76)**</td>
</tr>
<tr>
<td>Q5: The display of each candidate helps me understand why I got the candidate</td>
<td>3.77(1.13)</td>
<td>4.31(0.78)**</td>
</tr>
</tbody>
</table>

Open-ended questions

- users feel more “controllable” of the system
- treat the system as “user-friendly filter”
5–point Likert scale asking facet importance
- Task 1: conference mentor; Task 2: new collaborator
- Task 3: thesis committee; Task 4: reviewer suggestions

Especially for Reviewer Suggestion
- I feel it’s ok to choose someone you know unless you are coauthors
- personally, I would prefer those non–authority people, and it is much better if we have few personal connections
Conclusion

- Users spent similar amount of time but find more relevant people
- Users consistently spent time on interacting with sliders, to get better representation of their information needs
- Users can explore those “unexpected” candidates in lower ranks

Limitations

- Ground truth is based on users’ subjective judgments
- Each task requires find FIVE candidates, which may be unnatural for some participants

Future works

- Consider more facets (automatic facets identification)
  - “whether a researcher is still active”
  - “I tend not to select people who have bad temper”
  - Physical location proximity

Better support for users’ exploration
Q & A ?
Tasks – 1

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<th>Task 1: Conference Mentor Finding</th>
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<tr>
<td>A top conference in your research field provides a good opportunity: senior scholars offer helps to junior researchers on their current research work. Suppose that you are very interested in this opportunity and plan to submit a request form, in which you need to include your research statement; and suggest FIVE appropriate mentors in their database in whom you are interested. A search tool is provided to help you accomplish this task. Please explore the candidates and mark them in the system. You are also required to rank and evaluate the selected candidates after you finish the task.</td>
</tr>
</tbody>
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<table>
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<th>Task 2: New Collaborator Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suppose you (and your advisors) are planning to write a project proposal for a funding agency (e.g. NSF, Google Grant). In addition to your current coauthors, you want to find appropriate new collaborators to enhance the diversity of your team. A search tool is provided to help you identify potential collaborators. You need to find FIVE candidates and mark them in the system. You are also required to rank and evaluate the selected candidates after you finish the task.</td>
</tr>
</tbody>
</table>
Tasks – II

Task 3: External Thesis Committee Member Finding

You need to form a committee for your doctoral dissertation, with at least one external committee member from other departments or other universities. You understand that not everyone will be willing to be a committee member, and you don’t want to put all your hopes on one person. Your strategy is to find FIVE appropriate candidates and contact them one-by-one until someone accepts. A search tool is provided to help you accomplish this task. Please explore the candidates and mark them in the system. You are also required to rank and evaluate the selected candidates after you finish the task.

Task 4: Reviewer Suggestion

Suppose that you are planning to submit a paper manuscript to a journal. The journal editors ask you to suggest FIVE appropriate researchers that might be able to review your paper. Fortunately, the journal provides a search tool to help you explore the reviewers. You are asked to use this tool and mark the candidates in the system. You need to find FIVE candidates. You are also required to rank and evaluate the selected candidates after you finish the task.
PeopleExplorer