Collaborative Exploratory Search
“Collaborative” search is overloaded

<table>
<thead>
<tr>
<th>Synchronous</th>
<th>Asynchronous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative</td>
<td>Chi et al</td>
</tr>
<tr>
<td>Exploratory Search</td>
<td>“Search Trails”</td>
</tr>
<tr>
<td>(FXPAL)</td>
<td>(Xerox PARC)</td>
</tr>
<tr>
<td>Real-time awareness</td>
<td>Web 2.0</td>
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<tr>
<td>and continual update</td>
<td>Wisdom of Crowds</td>
</tr>
<tr>
<td>context systems</td>
<td>Collaborative</td>
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<tr>
<td>(e.g. Nokia, Imity)</td>
<td>Filtering</td>
</tr>
<tr>
<td></td>
<td>Personalization</td>
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</tbody>
</table>

Explicit | Implicit
"Collaborative" search is overloaded

- **Synchronous**
  - Collaborative Exploratory Search (FXPAL)
  - Collaborative Exploratory Search

- **Explicit**
  - Fischler-DiamondTouch: Collaborative Video Searching on a Table (Smeaton et al, 2005)
  - Interfaces for Collaborative Exploratory Web Search: Motivations and Directions for Multi-User Designs (M. Morris, 2007)

Algorithmically-Mediated

Intelligent Interfaces Only
Collaborative Exploratory Search

• Synchronous
  – Collaborating users use the system at the same time

• Explicitly Shared goals
  – Collaborating users share the information need

• Algorithmically-mediated
  – System combines users’ inputs in various ways
    • Not just keyword pooling
  – System generates results based on users’ roles
    • Terms, ranked lists, etc.
System overview

MediaMagic  Shared Display  RSVP

Input Coordinator  Output Coordinator

Algorithmic Collaboration Module

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RSVP Queue Priority

Weighted Borda Count fusion

\[ \text{rank}_{\text{doc}} = \sum_{q} \text{score}_{\text{doc},q} \cdot w_{\text{seen},q} \cdot w_{\text{rel},q} \]

\[ \text{score}_{\text{doc},q} = N_{\text{retrieved},q} - \text{rank}_{\text{doc}} \]

\[ w_{\text{seen},q} = \frac{N_{\text{seen},q}}{N_{\text{unseen},q}} \]

\[ w_{\text{rel},q} = \frac{N_{\text{rel},q}}{N_{\text{nonrel},q}} \]
Shared Display
Suggested Query Term
Weighted frequency fusion

\[
\text{rank}_{\text{term}} = \sum_{q} \text{score}_{\text{term},q} \cdot \text{w}_{\text{seen},q} \cdot \text{w}_{\text{rel},q}
\]

\[
\text{score}_{\text{term},q} = \text{TF}_{\text{retrieved},q}
\]

\[
\text{w}_{\text{seen},q} = \frac{N_{\text{seen},q}}{N_{\text{unseen},q}}
\]

\[
\text{w}_{\text{rel},q} = \frac{N_{\text{rel},q}}{N_{\text{nonrel},q}}
\]
Example
TRECvid Experiments

• 3 ½ Systems, 4 Users
  a. MMA: Single MediaMagic user (full capabilities)
  b. MMV: Single MediaMagic user (no text)
  c. MMA+V: Post hoc simulated MMA+MMV combination
    – Duplicates (both rel and nonrel) removed
  d. COLL: Collaborative search
TRECvid Experiments

• Problem: Learning effect?
  – All COLL runs done first
  – All MMA runs done second
  – All MMV runs done third
Results: Mean Average Precision

MAP

FXPAL_CO15  FXPAL_CO  FXPAL_MMA  FXPAL_CO11  FXPAL_MMV  FXPAL_CO07

Single user, text
Single user, Video only
Collaborative search, 7 minutes

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Additional Metrics

• Examine Recall and Precision separately

• Examine the manually-selected shot set
  – What actually happened during the run?
Precision

\[
\frac{TP}{TP + FP}
\]

• COLL is:

1.47% relative improvement over MMA

-3.42% relative improvement over MMV

15.4% relative improvement over MMA+V

Legend explaining MMA,etc
Recall

• COLL is: \[
\frac{TP}{\#totalrel}
\]

101.1% relative improvement over MMA

43.3% relative improvement over MMV

-10.7% relative improvement over MMA+V
• COLL outperforms MMA and MMV
• COLL is about the same against MMA+V
  – What does this suggest?
  – Why bother working collaboratively?
  – Let’s examine closer
% improvement in precision

COLL over MMA
COLL over MMV
% improvement COLL over MMA+V

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Tentative Conclusion:

Collaborative Search (at least in our current implementation) offers its best improvements when there are fewer relevant documents to be found.
Normalizing by Shots Viewed

• Our RSVP system needed another design iteration (missed opportunity)

• Average number of shots viewed:
  – MMA: 2,123
  – MMV: 2,601
  – MMA+V: 4,184
  – COLL: 2,614

Work smarter not harder?
Precision

Precision, with counts normalized by the number of seen shots, does not change

\[
\frac{TP}{\# \text{seen}} \quad \frac{FP}{\# \text{seen}} = \frac{TP}{TP + FP}
\]
Recall

- COLL is:

\[
\frac{TP}{\# \text{seen}} \quad \frac{\# \text{seen}}{\# \text{totalrel}}
\]

- 73.9% relative improvement over MMA (101.1%)
- 38.5% relative improvement over MMV (43.3%)
- 44.1% relative improvement over MMA+V (-10.7%)
% improvement in recall

COLL over MMA  COLL over MMV
% improvement in recall

Kernel density smoothing

COLL over MMAV
Future Work

• Still like the idea of miner vs. prospector
  – But need to give the miner more ability to “steer”
  – And achieve higher throughput
• Also investigate other collaboration roles
• Also investigate types of queries in which different roles work better. Can we know this a priori?