Directing exploratory search with interactive intent modelling

Samuel Kaski

LSOLDM2013, Sept 25

Some problems in information seeking

1. Context bubble
2. Underspecified, uncertain and evolving information need
3. Laziness
    - in giving relevance feedback
    - in pre-specifying filtering criteria
4. Interfaces do not fully support users' navigation behavior: Jump + local search

Some problems+solutions in information seeking

1. Context bubble
   - exploration/exploitation tradeoff
2. Underspecified, uncertain and evolving information need
   - interactive on-line-learning interfaces
3. Laziness
   - in giving relevance feedback
   - in pre-specifiying filtering criteria
   - no pain, no gain (but maximize gain/pain by making navigation more natural)

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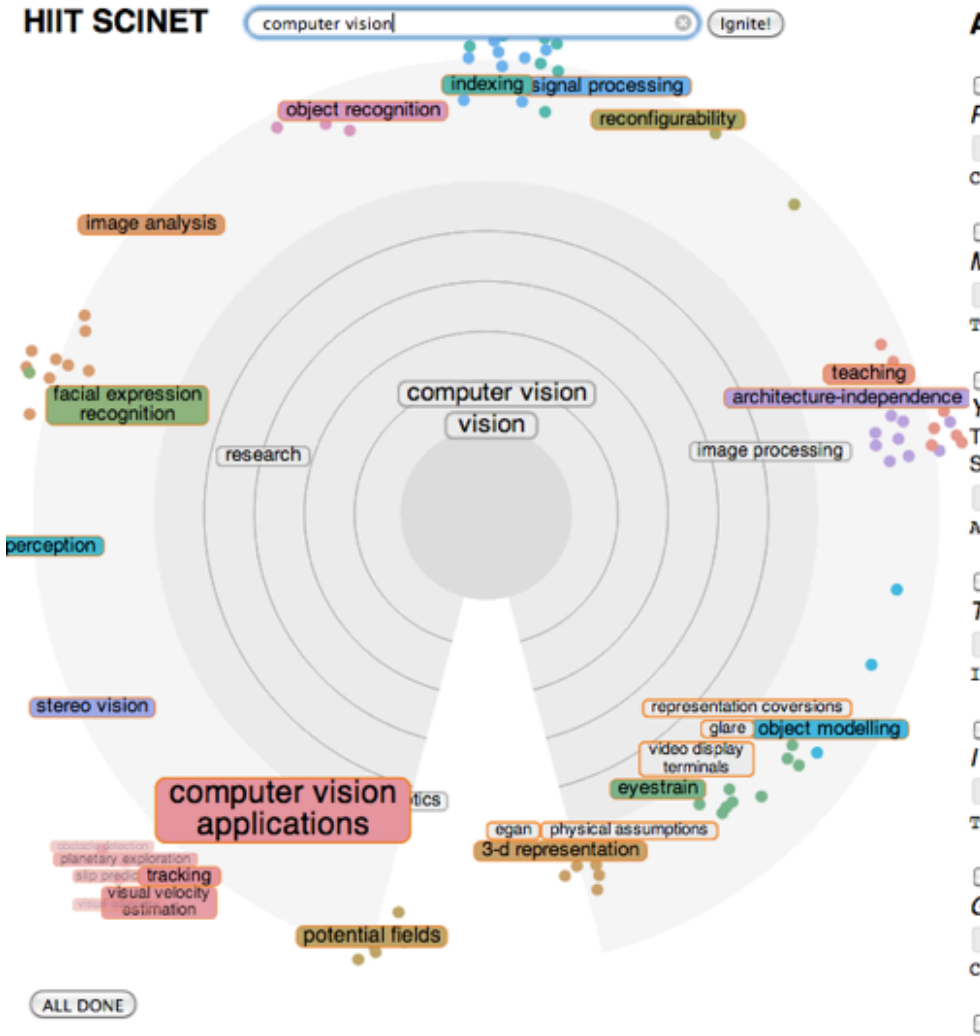
Intent Radar of SciNet



Articles [show bookmarked (0)]

(Computer) vision without sight
Roberto Manduchi, James Coughlan (Communications of the ACM, 2012-01-01)
computer vision | vision
`Computer vision holds the key for the bl...`

Computer vision in the interface
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CURRENT ISSUES IN COMPUTER VISION

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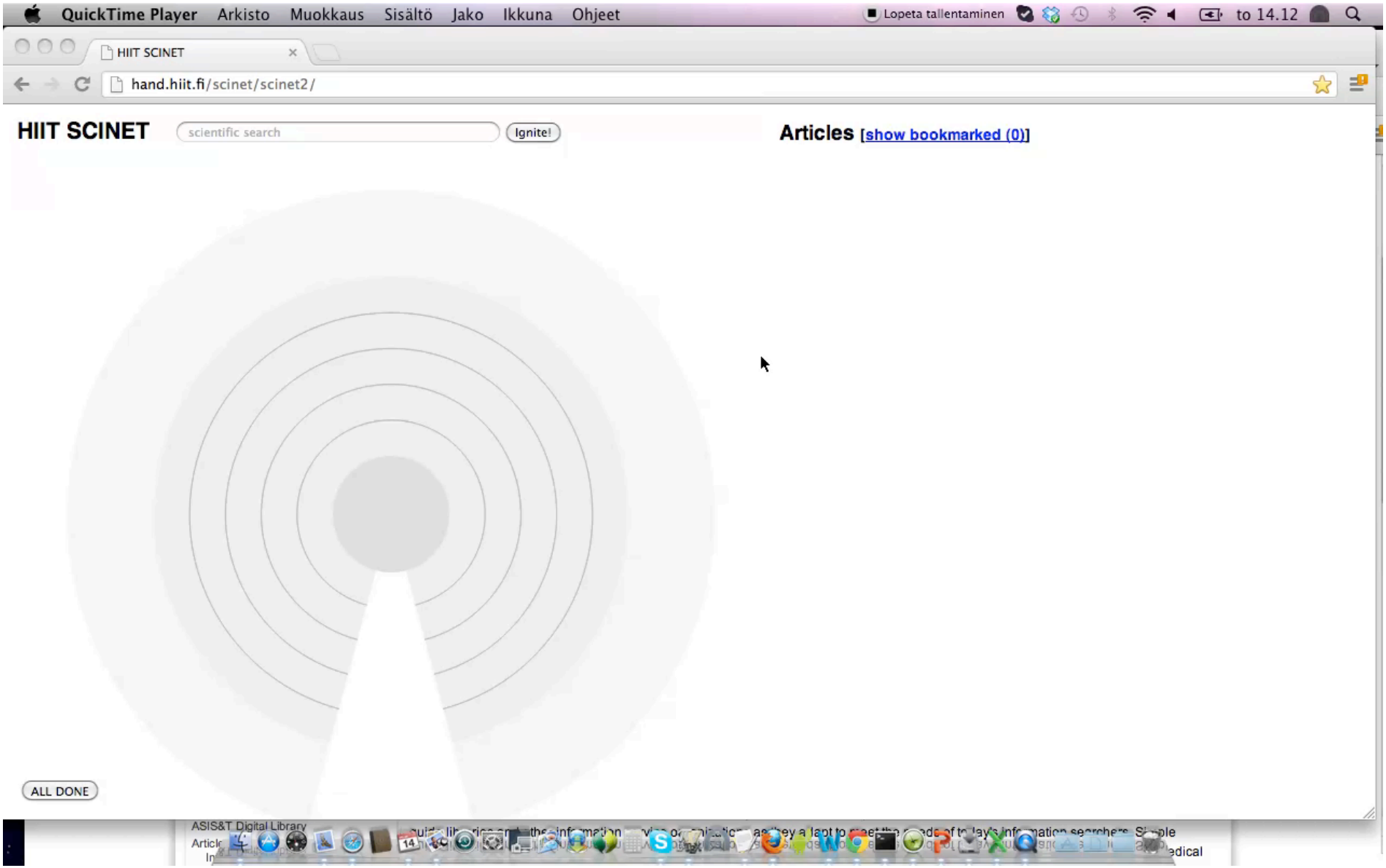
Glowacka et al., IUI 2013, Ruotsalo et al., CIKM 2013



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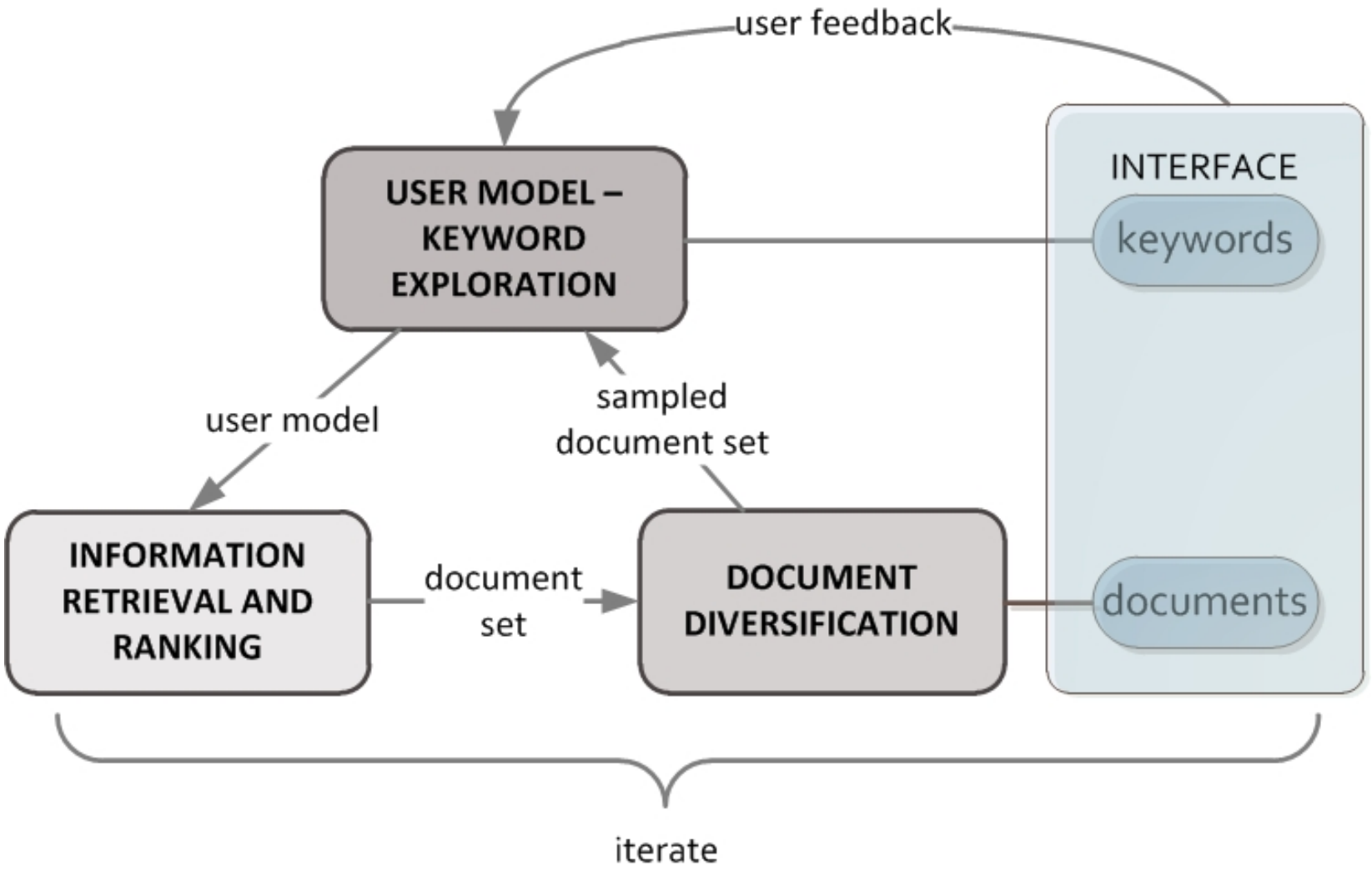
Our solution in a nutshell

- Model the user's interests on-line
- Exploration-exploitation tradeoff when suggesting new
- Interactive visualization of the estimated interests
  - for the user to navigate
  - for the system to collect "feedback"

Under the hood; data flow



Learning user intents/interests

Assume: Interests = keywords

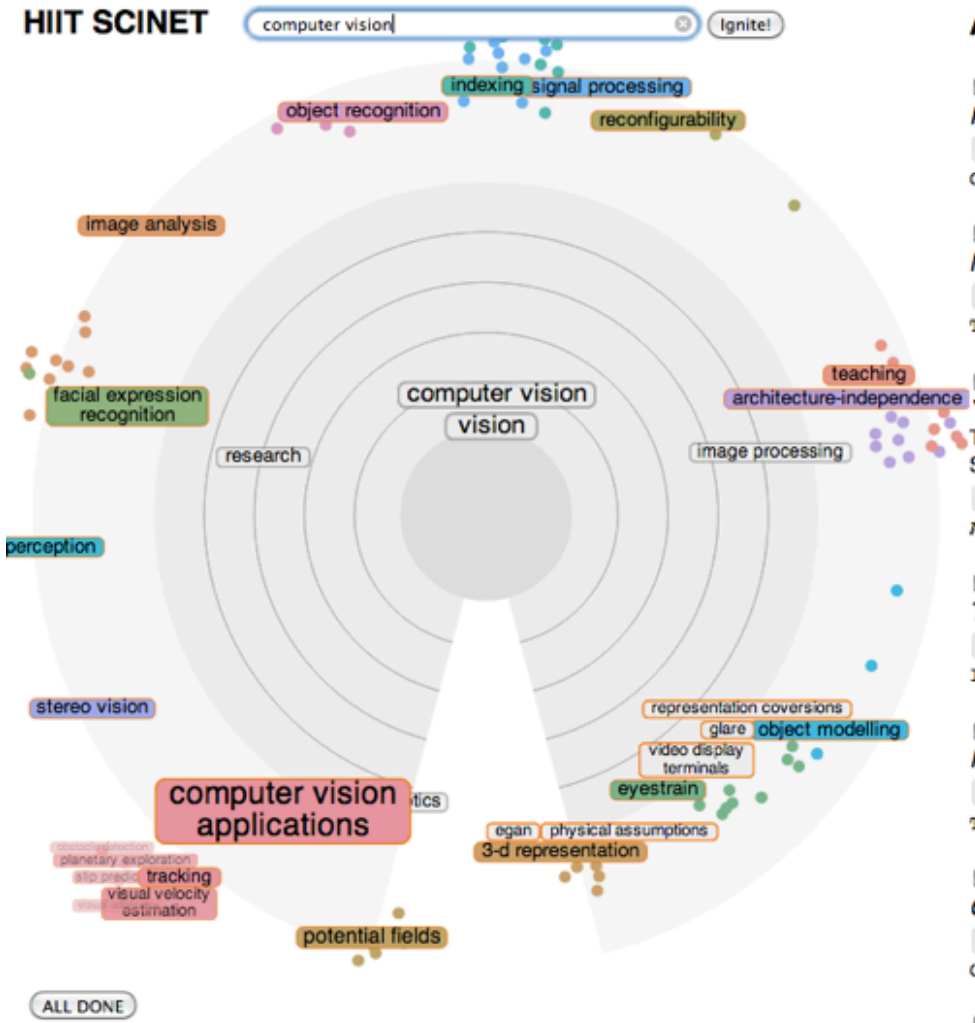
Represent *i* th keyword by $\mathbf{k}_i$, where the *j*th dimension is 1 if keyword *i* occurs in document *j* ("bag of documents"; plus tf-idf)

Assume relevance feedback is a linear function,

$$\mathbb{E}[r_i] = \mathbf{k}_i^\top \mathbf{w}$$

Exploration-exploitation: Show the user keywords *i* with the highest upper confidence bound (LinRel, Auer 2002): $\hat{r}_i + \alpha\sigma_i$

Interactive visualization to gather feedback



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- **CURRENT ISSUES IN COMPUTER VISION**

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Glowacka et al., IUI 2013

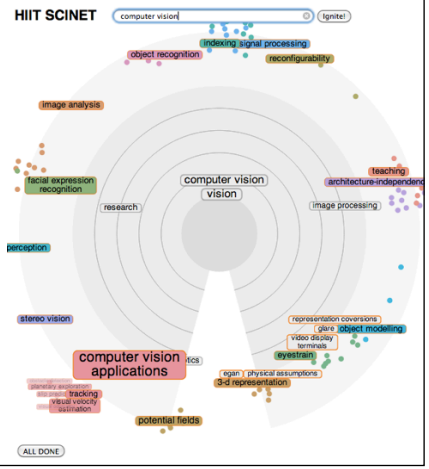

GO HERE
TO REACH X
GO HERE
TO REACH Y

Which labels to give to the choices?

- That is, what would the user get after choosing keyword *i* ?
- "Lookahead-labeling" algorithm:
  - tentatively give feedback to *i*
  - estimate the new relevance profile

$$\hat{r}(\text{all earlier feedback}, i)$$

  - on the brim of the display, show keywords according to this profile



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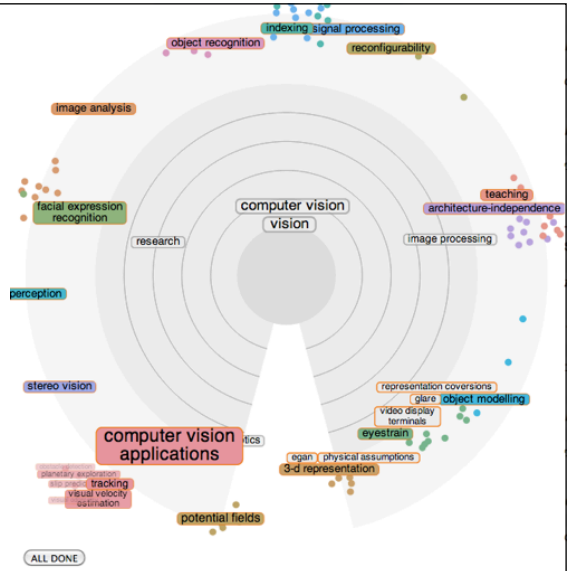
Layout, “Intent Radar”



Radius: relevance

Angle: similarity

Optimize the angles by nonlinear dimensionality reduction to 1D

- Choose a feature representation.
  - Here: relevance across the alternative futures
- Apply a suitable MDS method.
  - Here: NeRV (Venna et al., JMLR 2010)

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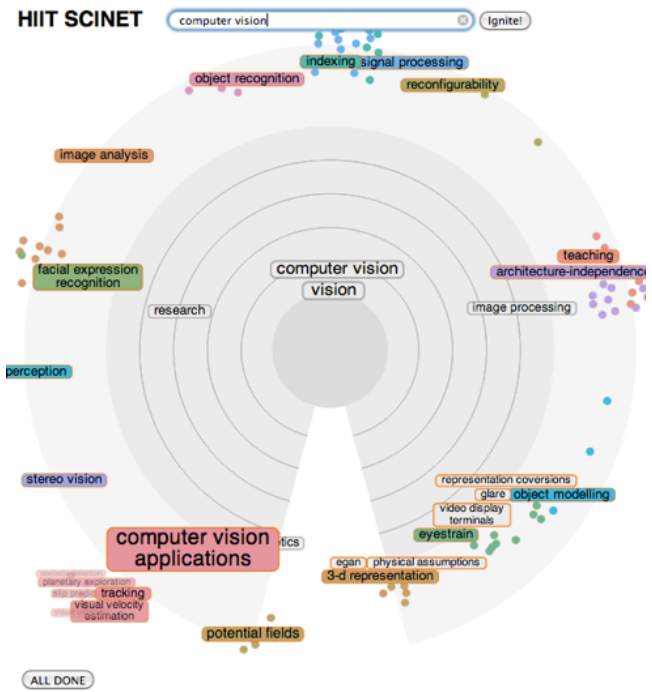
Retrieval

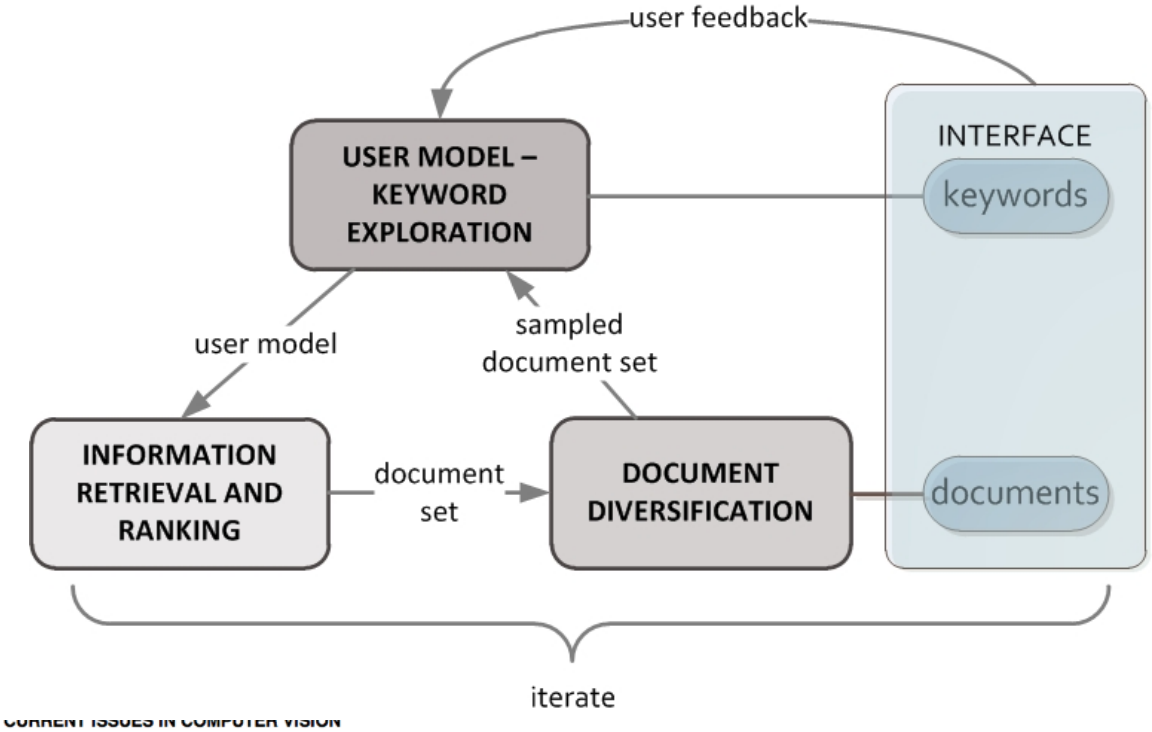
Principle: Rank documents by the likelihoods they give to the keywords assessed relevant by the user model

Use a simple and scalable language model: multinomial unigram model

(Include suitable smoothing to cope with small counts, and additional diversification of the retrieved results.)

Summary



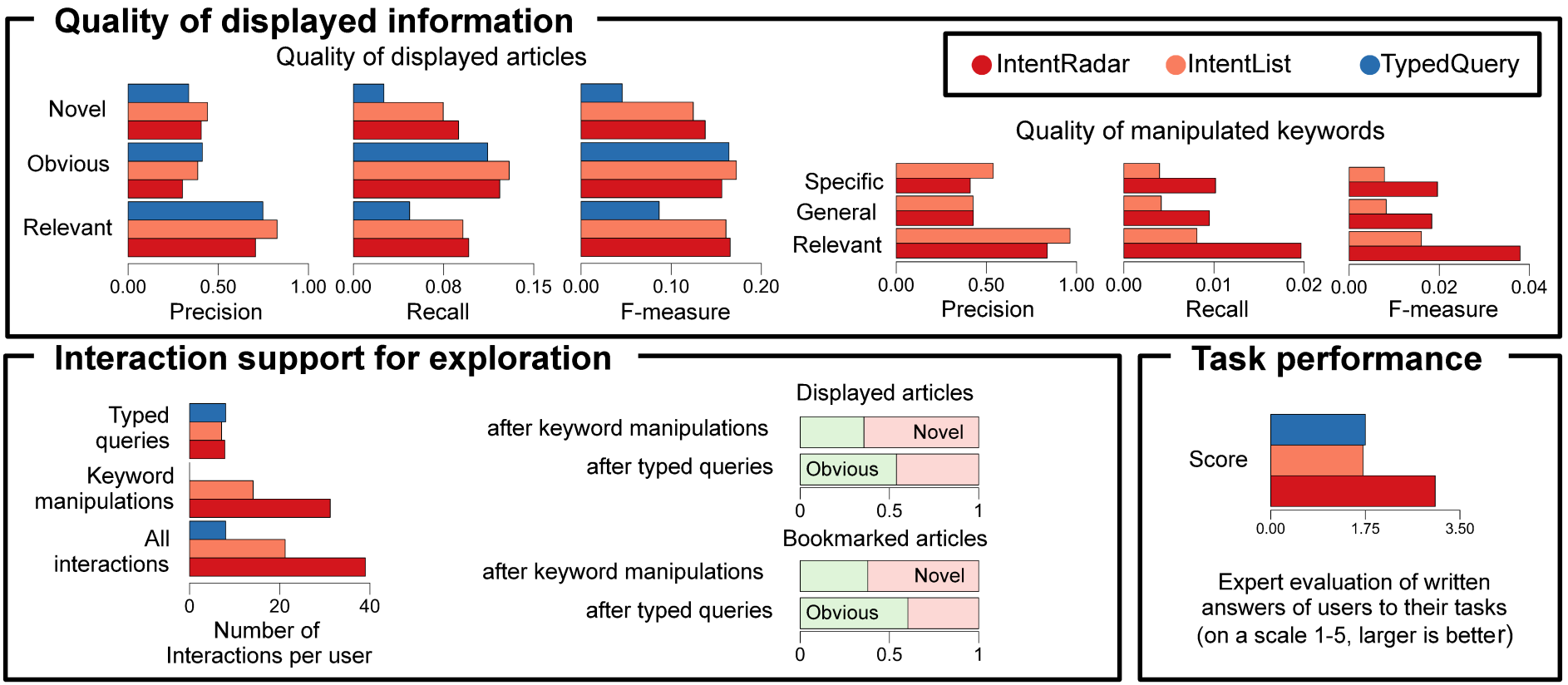


Many of the particular modelling choices are not crucial. They are a decent compromise between speed and expressive power.

Sample experiments in Information seeking

- At the moment 60,000,000 scientific abstracts
- User's task: Scientific writing scenario; collect material for an essay on a given topic (semantic search or robotics)
- Ground truth: Expert evaluations
- 30 users

Information seeking results



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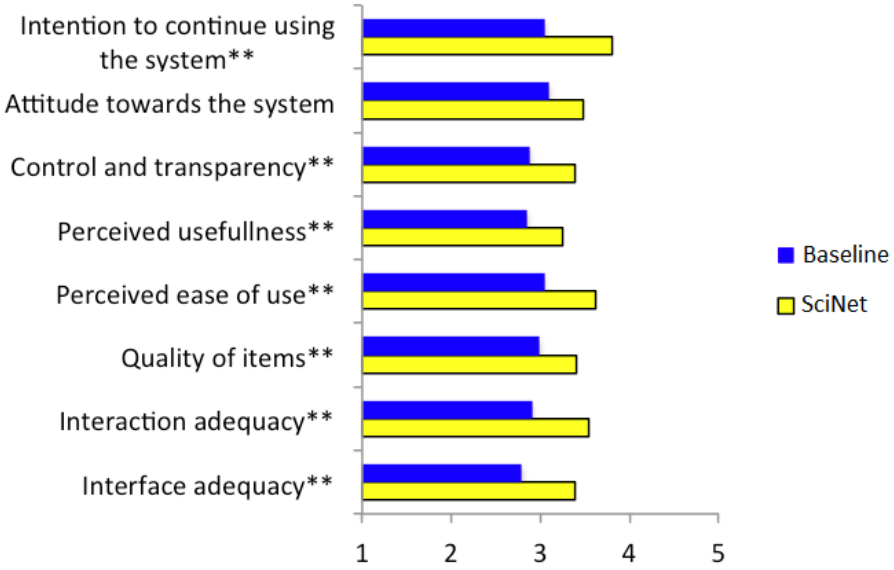
Information seeking results



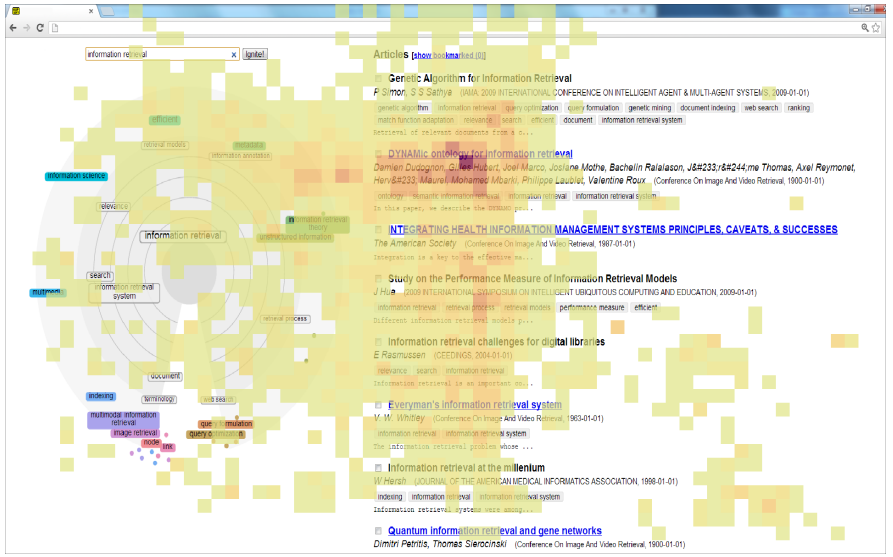


Figure: Subjective user assessments, initial eye tracking experiments

Conclusions

For exploratory search tasks, an interface with interactive intent modelling outperforms pure typed-query searches.

We introduced a system that combines

- dynamic/online modelling of user interests
- exploration-exploitation tradeoff
- “intent radar” visualization of the estimated current and future
- navigation by interacting with the estimates

References

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T. Ruotsalo, K. Athukorala, D. Glowacka, K. Konyushkova, A. Oulasvirta, S. Kaipiainen, S. Kaski, and G. Jacucci. Supporting exploratory search tasks with interactive user modelling. In *Proceedings of ASIST 2013, the 76th ASIS&T Annual Meeting*, accepted for publication.

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