Helping Course Developers Discover Learning Objects:
An Empirical Comparison of Recommendation Strategies

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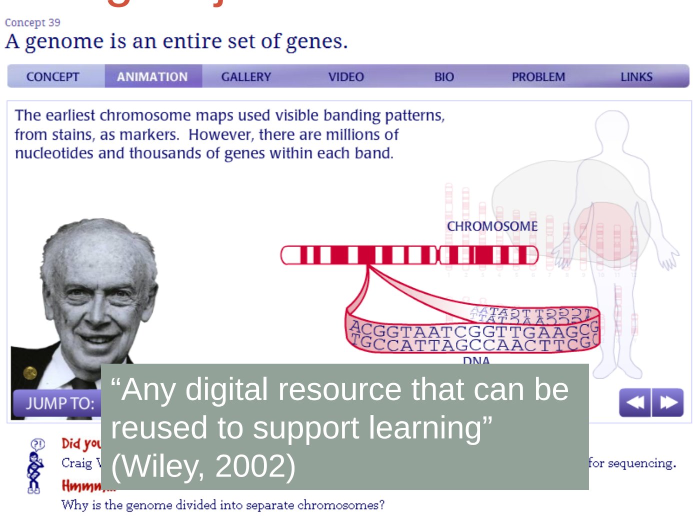
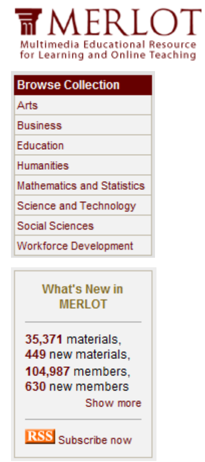
Learning Objects



"Any digital resource that can be reused to support learning" (Wiley, 2002)

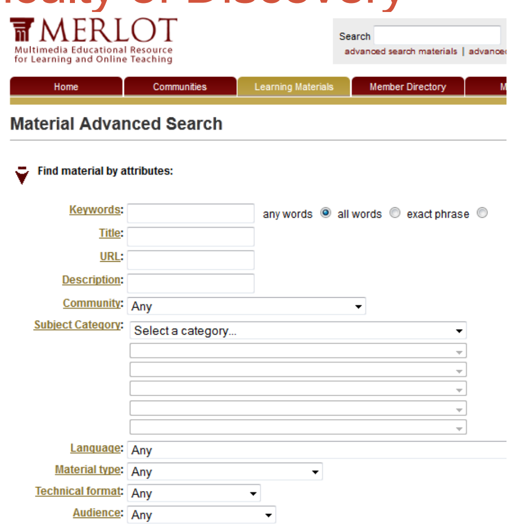
Problem: Learning Objects Are Underutilized

- Wide availability
  - 270,000 LOs in 8 large public repositories (Ochoa & Duval, 2009)
- Limited adoption
  - Only 20% reused, most only once (Ochoa, 2008)
  - “While large amounts of money have been invested in these resources [learning objects], educators have been slow to adopt them” (Cohen, 2010).

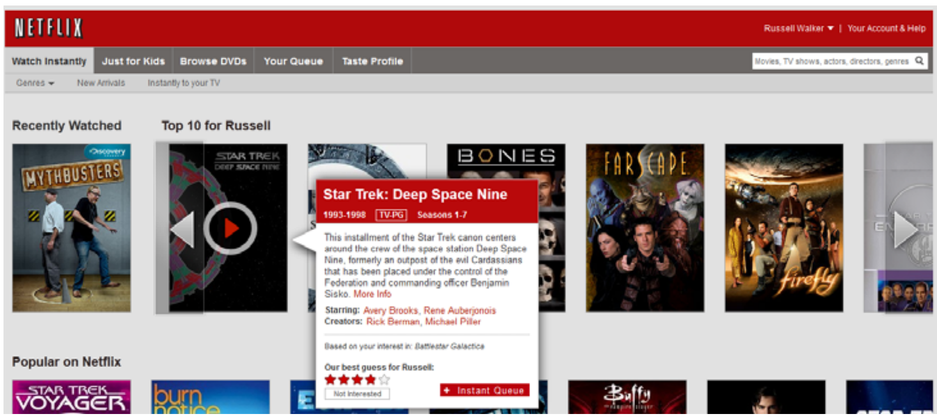


One Reason: Difficulty of Discovery

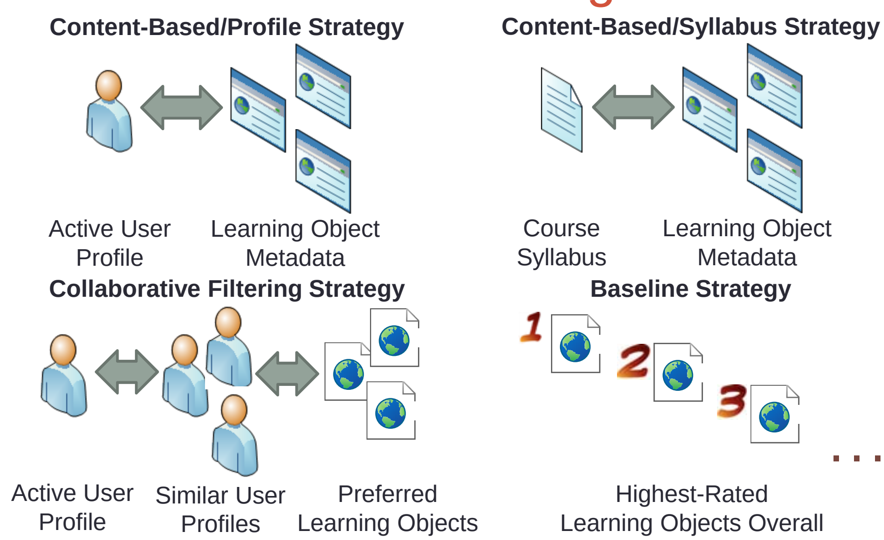
- Poor query formulation by users (Najjar, 2008)
- Search tools “not user friendly” (Najjar, 2008)
- “Immature” search tools (Ochoa, 2008)



A Possible Solution: Recommender Systems

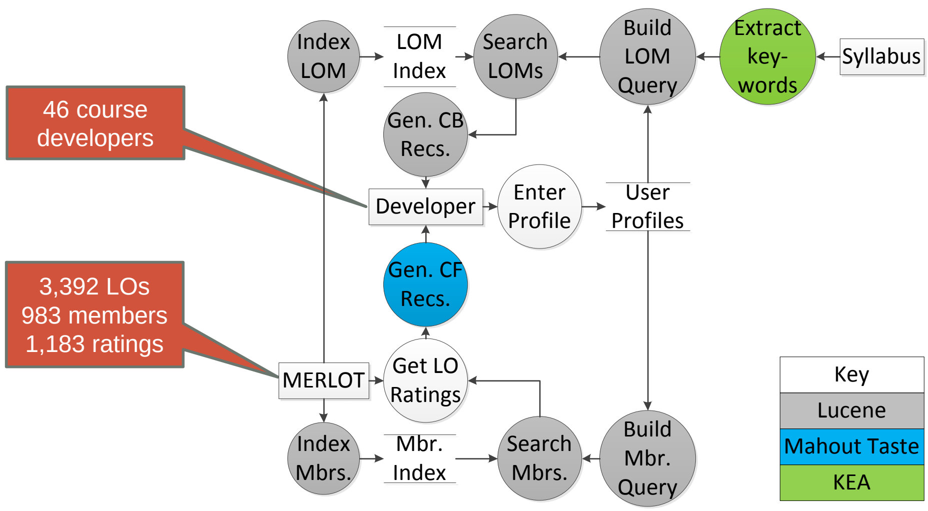


Recommendation Strategies

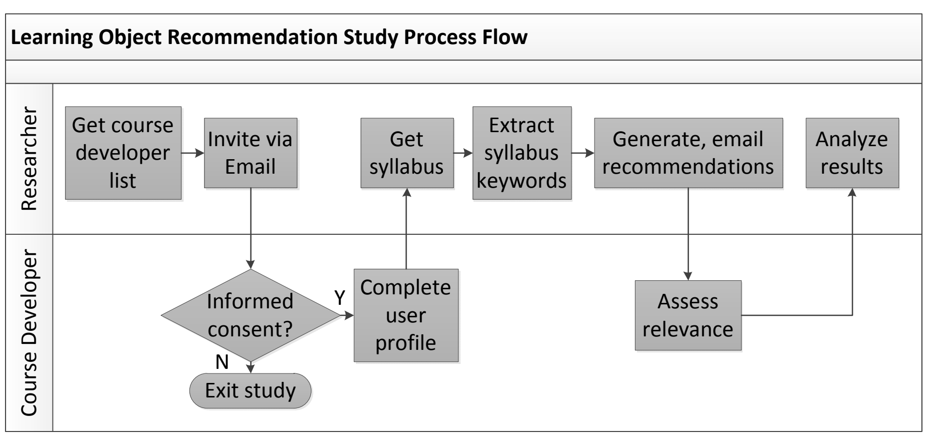


(Koren, Bell, & Volansky, 2009; Symeonidis et al., 2006; Tang & McCalla, 2009; Tungare et al., 2006)

Implementation of Strategies



Evaluation Methods

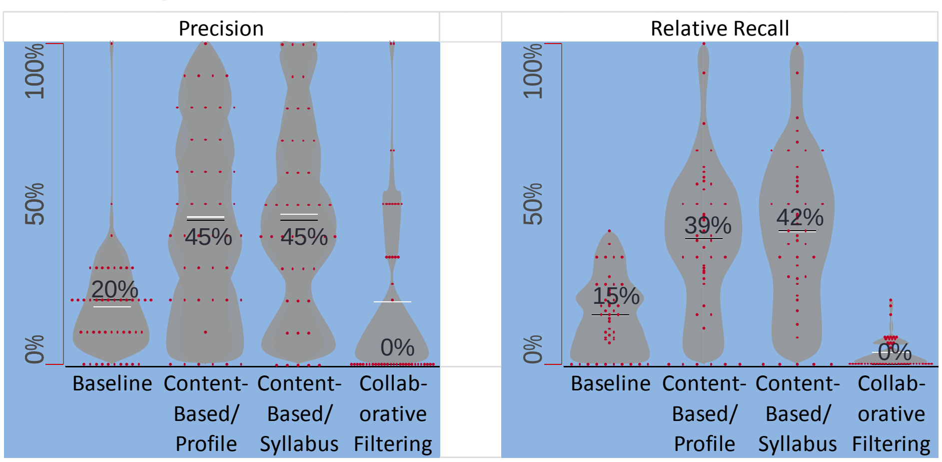


Evaluation Metrics

- Precision
  - $P = \dfrac{\text{relevant recommended objects}}{\text{all recommended objects}}$
  - Probability that a given recommended object will be relevant
- Recall (not used)
  - $R = \dfrac{\text{relevant recommended objects}}{\text{relevant objects in data set}}$
  - Probability that a given relevant object will be recommended
- Relative Recall
  - $RR = \dfrac{\text{relevant recommended objects (one system)}}{\text{relevant recommended objects (all systems)}}$
  - Comparative proxy for recall in large data sets

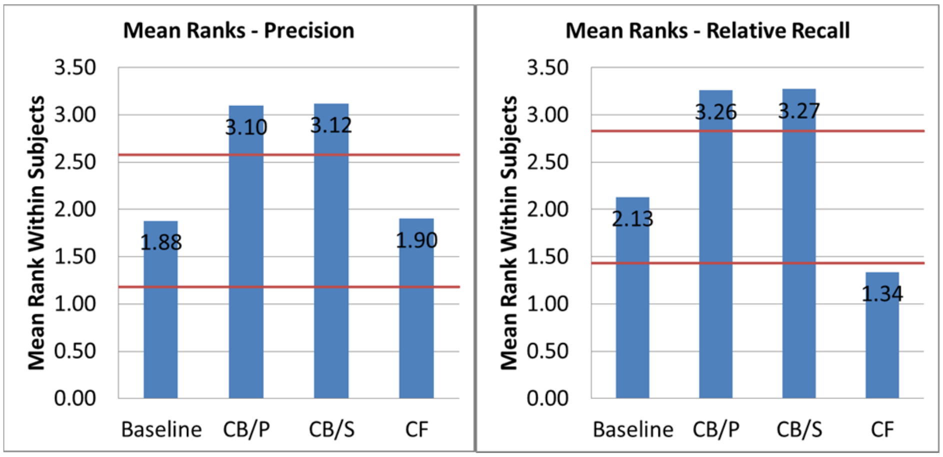
(Herlocker, Konstan, Terveen, & Riedl, 2004; Robinson & Wusteman, 2007)

Results: Beanplots of Precision and Relative Recall



Black horizontal line = median; white horizontal line = mean; gray outline = density trace. (For a detailed description of beanplots, see Kampstra, 2008.)

Results: Within-Subjects Mean Ranks



CB/P = Content-Based/Profile; CB/S = Content-Based/Syllabus; CF = Collaborative Filtering. Rank 1 = lowest performance, 4 = highest performance. Red horizontal lines indicate baseline ± Nemenyi critical distance for *p* = .05 significance level.

Discussion

- Conclusions
  - Content-based strategies appear promising
  - Recommendations with little or no additional user input may be feasible
  - Collaborative filtering performed surprisingly poorly
- Limitations
  - Single repository
  - Single subject category
  - Single institution
- Next Steps
  - Replicate in other data sets, subjects, and institutional settings
  - Further develop content-based strategies
  - Investigate reasons for poor collaborative filtering performance

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