Multi-step Classification Approaches to Cumulative Citation Recommendation

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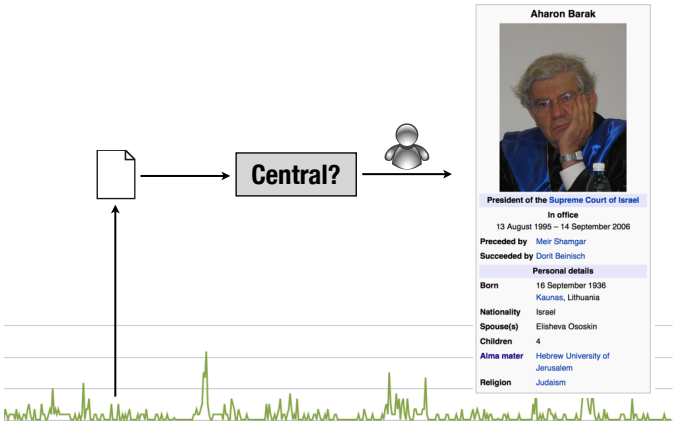
Open research Areas in Information Retrieval (OAIR) 2013 | Lisbon, Portugal, May 2013

Motivation

- Maintain the accuracy and high quality of knowledge bases
- Develop automated methods to discover (and process) new information as it becomes available

TREC 2012 KBA track



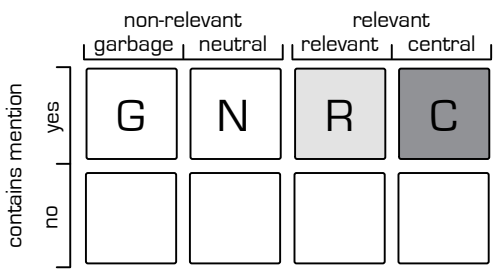
Task
Cumulative Citation Recommendation

- Filter a time-ordered corpus for documents that are highly relevant to a predefined set of entities
  - For each entity, provide a ranked list of documents based on their "citation-worthiness"

Collection and topics

- KBA stream corpus
  - Oct 2011 - Apr 2012
  - Split into training and testing periods
  - Three sources: news, social, linking
  - raw data 8.7TB
  - cleansed version 1.2TB (270G compressed)
  - stream documents uniquely identified by *stream_id*
- Test topics ("target entities")
  - 29 entities from Wikipedia (27 persons, 2 org)
  - uniquely identified by *urlname*

Annotation matrix



Scoring

Target entity: Aharon Barak

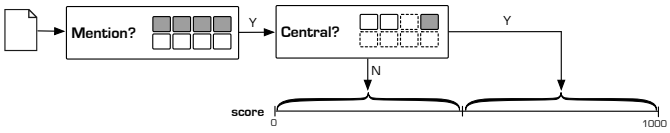
	urlname	stream_id	score	
Positive	Aharon_Barak	1328055120-f6462409e60d2748a0adef82fe68b86d	1000	
	Aharon_Barak	1328057880-79cdee3c9218ec77f6580183cb16e045	500	
	Aharon_Barak	1328057280-80fb850c089caa381a796c34e23d9af8	500	
	Aharon_Barak	1328056560-450983d117c5a7903a3a27c959cc682a	480	
	Aharon_Barak	1328056560-450983d117c5a7903a3a27c959cc682a	450	
	Aharon_Barak	1328056260-684e2f8fc90de6ef949946f5061a91e0	430	
	Aharon_Barak	1328056560-be417475cca57b6557a7d5db0bbc6959	428	
	Aharon_Barak	1328057520-4e92eb721bfbfdfa0b1d9476b1ecb009	428	Cutoff
Negative	Aharon_Barak	1328058660-807e4aaeca58000f6889c31c24712247	380	
	Aharon_Barak	1328060040-7a8c209ad36bbb9c946348996f8c616b	380	
	Aharon_Barak	1328063280-1ac4b6f3a58004d1596d6e42c4746e21	375	
	Aharon_Barak	1328064660-1a0167925256b32d715c1a3a2ee0730c	315	
	Aharon_Barak	1328062980-7324a71469556bcd1f3904ba090ab685	263	

Approach

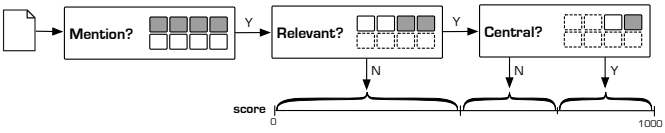
Overview

- "Is this document central for this entity?"
- Binary classification task
- Multi-step approach
  - Classifying every document-entity pair is not feasible
  - First step do decide whether the document contains the entity
  - Subsequent step(s) to decide centrality

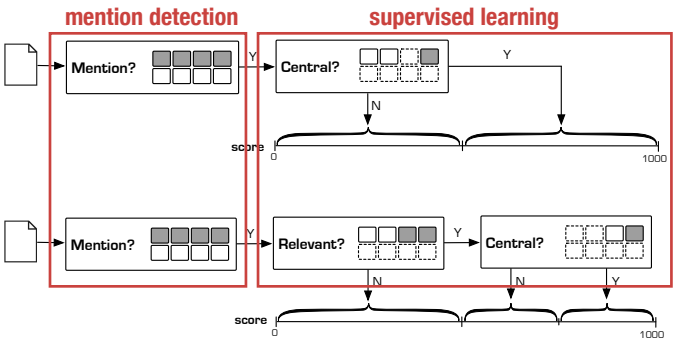
2-step classification



3-step classification



Components



Identifying entity mentions

- Goals
  - High recall
  - Keep false positive rate low
  - Efficiency
- Detection based on known surface forms of the entity
  - urlname (i.e., Wikipedia title)
  - name variants from DBpedia
  - DBpedia-loose: only last names for people
- No disambiguation

Features

1.Document (5)
- Length of document fields (body, title, anchors)
- Type (news/social/linking)

2.Entity (1)
- Number of related entities in KB

3.Document-entity (28)
- Occurrences of entity in document
- Number of related entity mentions
- Similarity between doc and the entity's WP page

Features

4.Temporal (38)
- Wikipedia pageviews
  - Average pageviews
  - Change in pageviews
  - Bursts
- Mentions in document stream
  - Average volume
  - Change in volume
  - Bursts

Results

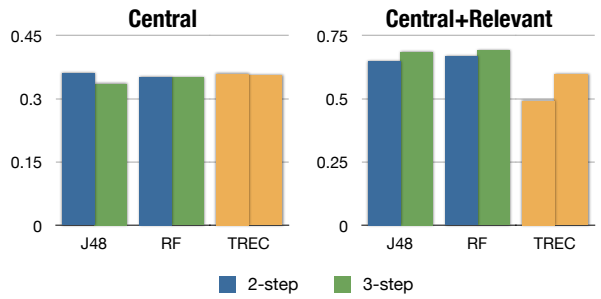
Identifying entity mentions

Results on testing period

Identification	Document-entity pairs	Recall	False positive rate
urlname	41.2K	0.842	0.559
DBpedia	70.4K	0.974	0.701
DBpedia-loose	12.5M	0.994	0.998

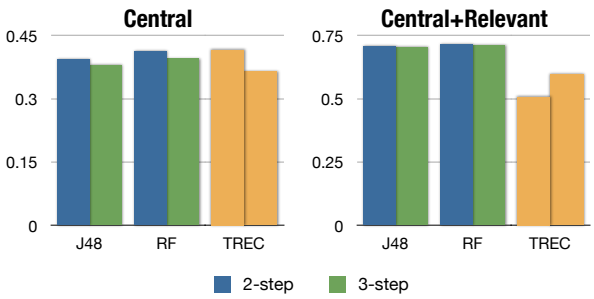
End-to-end task

F1 score, single cutoff



End-to-end task

F1 score, per-entity cutoff



Summary

- Cumulative Citation Recommendation task @TREC 2012 KBA
- Two multi-step classification approaches
- Four groups of features
- Differentiating between relevant and central is difficult

Classification vs. Ranking

[Balog & Ramampiaro, SIGIR'13]

- Approach CCR as a ranking task
- Learning-to-rank
  - Pointwise, pairwise, listwise
- Pointwise LTR outperforms classification approaches using the same set of features

http://krisztianbalog.com/files/sigir2013-kba.pdf

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Questions?

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