

Axiomatic term-based Personalized Query Expansion using a Bookmarking System

Philippe MULHEM
Nawal OULD AMER
Mathias GERY



Outline

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Introduction

- Core idea
 - Axiomatic IR has proven its interest
 - Propose a simple axiom for personalized IR focusing on “what should append”
 - Apply to existing personalized IR (with/without social terms relationships)
 - Study its effects on retrieval effectiveness on several social configurations

Related works – Axiomatic IR

- Axioms: to explain the behavior of elements, to compare theoretically models, to improve models
- Initial work of [Fang, Tao & Zhai 2004]
 - 7 heuristics: about tf, idf, document length
- Extensions for term-term relationships, pseudo-relevance feedback
- [Fang, Tao & Zhai 2011] improves BM25 model using modifications driven by the axioms
- Are these axioms compatible with IR personalization ?

Related works – Personalized IR

- Personalization based on many parameters
 - User profile and activities [Biancalana & al. 2013]
 - Co-occurrence of tags, query expansion
 - Social network [Vosecky and Leung 2014]
 - LDA, query expansion
- Hard to assess theoretically what is happening

Proposed axiomatic approach

- Definition of one simple axiom
 - A document that talks about the term in a one term query must be retrieved before other documents

– Profile Query Expansion Constraint (PQEC):

- Assume that a query $q=\{w\}$, a document d from a corpus D so that $c(w, d) > 0$, and a user u with a profile $\text{Profile}(u)$.

If $\exists w' \in \text{Profile}(u)$ so that $R_u(w, w')$ and $c(w', d) > 0$, then for any $d' \in D$ so that $c(w, d') \neq 0$ and $c(w', d') = 0$, then

$$RSV(d, q_u) \geq RSV(d', q_u) \text{ with } q_u = q \cup \{w'\}$$

– It conflicts with existing Axioms of IR !

Proposed axiomatic approach

- Retrieval based on a “classical” personalized IR [Bouajenek et al. 2013]:

$$RSV(d, q, u) \propto RSV(d, q_u) = \lambda.P(q_u | \sigma d) + (1 - \lambda).P(q_u | \tau d)$$

with

σd content of d , τd tags of d

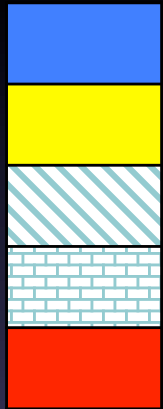
$$q_u = q \cup \{w' \mid w' \in W, w \in q, R_u(w, w')\}$$

$P(.|.)$: classical Dirichlet IR Language Model

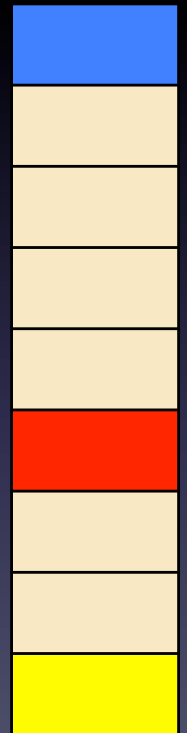
Proposed axiomatic approach

- Post-processing ensuring PQEC validation:

1. RSV(d,q)
=> $L_i = [\langle d,s \rangle]$



2. RSV(d,q \setminus q_u)
=> $L_e = [\langle d,s \rangle]$



3. 4. Fuse L_i and L_e
and rank results



Personalized Query Expansion

- Based on a relationship R_u that denotes relations between terms for a user u .
- Two definitions of R_u , using a tagging $R(d, u, w)$
 - $R_{u-local}(w, w') \Leftrightarrow \exists d \in D, R(d, u, w) \wedge R(d, u, w')$
 - $R_{u-social}(w, w') \Leftrightarrow \exists u' \in u_{sn}, R_{u'-local}(w, w')$
(with u_{sn} : social neighborhood of user u)

Experiments

- Test collection
 - Bibsonomy corpus
 - 309 Kdocs, 241 Kdocs tagged, 4.9 Kusers, 1.5 Mtags
 - Topics: 200 single term queries [Bouajenek et al. 2010]
 - Classical IR evaluation measures: MAP, P@5, P@10
 - Specific measures
 - PQEC@10: how many docs in top-10 validate PQEC
 - Prof_{overlap}: overlap between extended query and Profile(u)
- System
 - Terrier, LMDir morel default parameters

Experiments

- Configurations
 - Baseline (1) : no query expansion
 - Frameworks (2)
 - Classical, Adapted (with PQEC validation)
 - Local user profile (1)
 - Social neighbors (3)
 - Very dense, dense and sparse neighborhoods
 - Social neighbors profiles ($2 * 2 - 1 = 3$)
 - Filter social neighbors according to q: yes/no
 - Filter of profiles of neighbors according to q: yes/no

Total: $1 + 2 * (1 + 3 * 3) = 21$ runs

Experiments - results

	framework	u_{sn}	$Profile(u', q)$	PQEC@10	$Prof_{overlap}$	MAP
Local user profile	adapted	\emptyset	$Profile(u)$	1.0	1.0	0.4950
	classical	\emptyset	$Profile(u)$	0.0521	"	0.4639
Baseline	classical	\emptyset	\emptyset	/	0.0	0.2934
* Very dense neighborhoods	adapted	filtered	filtered	1.0	0.3086	0.5528
	classical	filtered	filtered	0.0646	"	0.5205
	adapted	filtered	unfiltered	1.0	1.0	0.4950
	classical	filtered	unfiltered	0.0521	"	0.4639
	adapted	unfiltered	unfiltered	1.0	1.0	0.4950
	classical	unfiltered	unfiltered	0.0521	"	0.4639
Dense neighborhoods	adapted	filtered	filtered	1.0	0.2508	0.4015
	classical	filtered	filtered	0.0608	"	0.3946
	adapted	filtered	unfiltered	1.0	0.6770	0.4779
	classical	filtered	unfiltered	0.0410	"	0.4497
	adapted	unfiltered	unfiltered	1.0	0.8695	0.4413
	classical	unfiltered	unfiltered	0.0224	"	0.4269
Sparse neighborhoods	adapted	filtered	filtered	1.0	0.2286	0.3923
	classical	filtered	filtered	0.1020	"	0.3799
	adapted	filtered	unfiltered	1.0	0.6300	0.3559
	classical	filtered	unfiltered	0.0757	"	0.3708
	adapted	unfiltered	unfiltered	1.0	0.8150	0.3960
	classical	unfiltered	unfiltered	0.0804	"	0.3755

Conclusion

- Interest of defining axioms, even in simple cases
 - PQEC is not compatible with classical other IR axioms
- Filtering users at query-time leads to better results – to be studied more
- Elements to refine (term-term), profile...
- Formal study on the conflicts of PQEC with existing IR (non personalized) axioms to be done