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The Accessibility Dimension for Structured Document Retrieval

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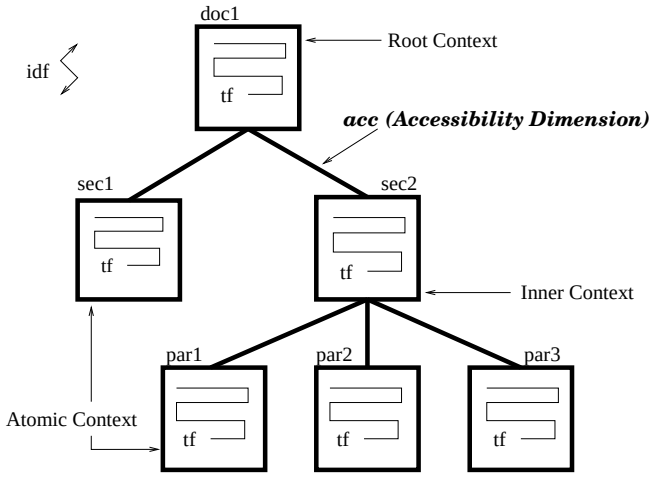
The Accessibility Dimension



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The Theory

term frequency	tf
inverse document frequency	idf
accessibility	acc
restrieval status value	RSV

$$RSV(d,q) := \sum_{t \in q} tf(t,q) \cdot tf(t,d) \cdot idf(t)$$

$$RSV(d,q) := \sum_{t \in q} tf(t,q) \cdot tf^*(t,d) \cdot P_{idf}(t)$$
$$tf^*(t,d) := (1 - \Pi_{s \in d}(1 - acc(d,s) \cdot tf(t,s)))$$

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Implementation: Probabilistic Relational Algebra (PRA)

qterm (query rep)
(sailing)

term (document rep, based on *tf*)
0.1 (sailing, doc1)
0.7 (sailing, sec1)

termspace (based on *idf*)
0.4 (sailing)

acc (structure)
0.8 (doc1, sec1)

aggregated_term_depth1 = JOIN[$2=$2](term, acc)

$0.56 = 0.7 \cdot 0.8$ aggregated_term_depth1(sailing, doc1)

aggregated_term = UNITE(term, aggregated_term_depth1)

$0.604 = 0.1 + 0.56 - 0.1 \cdot 0.56$ aggregated_term(sailing, doc1)

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Implementation: The Effect of acc

all documents about sailing

wqterm = JOIN[$1=$1](qterm, termspace)

retrieved_*tfidf* = PROJ[$3](JOIN[$1=$1](wqterm, term))

retrieved_*tfidfacc* = PROJ[$3](JOIN[$1=$1](wqterm, aggregated_term))

0.1 term(sailing, doc1), 0.7 term(sailing, sec1), 0.4 termspace(sailing)

no acc	$0.04 = 0.1 \cdot 0.4$	retrieved_*tfidf*(doc1)
	$0.28 = 0.7 \cdot 0.4$	retrieved_*tfidf*(sec1)
acc = 0.8	$0.2416 = 0.604 \cdot 0.4$	retrieved_*tfidfacc*(doc1)
	$0.2800 = 0.7 \cdot 0.4$	retrieved_*tfidfacc*(sec1)
acc = 1.0	$0.292 = 0.73 \cdot 0.4$	retrieved_*tfidfacc*(doc1)
	$0.280 = 0.7 \cdot 0.4$	retrieved_*tfidfacc*(sec1)

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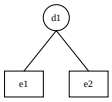
Experiments



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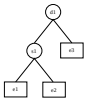

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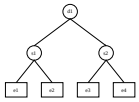

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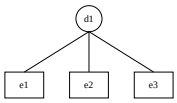

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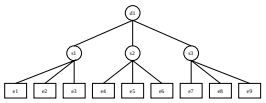

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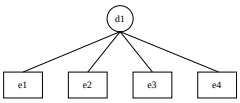

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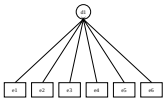

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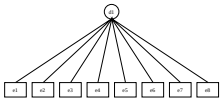

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Optimistic / Pessimistic Relevance Assessment Strategies

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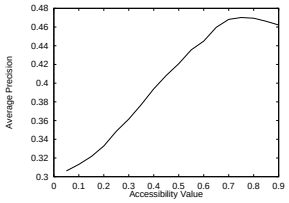
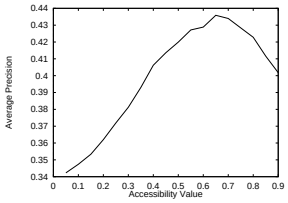
Result: Accessibility Dimension and Average Precision



(EE), opt



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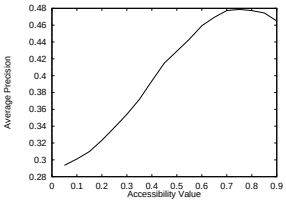

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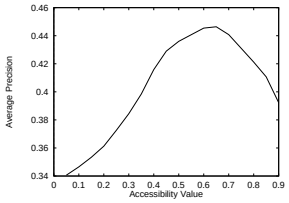

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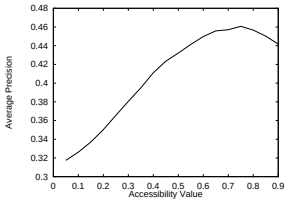
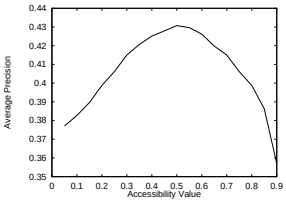


Mix, opt



Mix, pess

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Result: Accessibilty Dimension and Average Precision

collection	Optimistic relevance max. av. precision	*acc*	Pessimistic relevance max. av. precision	*acc*
(EE)	0.4702	0.75	0.4359	0.65
(EEE)	0.4719	0.6	0.4479	0.45
(EEEE)	0.455	0.55	0.4474	0.35
(EEEEEE)	0.4431	0.45	0.4507	0.25
(EEEEEEEE)	0.4277	0.35	0.4404	0.2
((EE)(EE))	0.4722	0.8	0.4556	0.6
((EE)E)	0.4787	0.75	0.4464	0.65
((EEE)(EEE)(EEE))	0.4566	0.65	0.4694	0.4
Mix	0.4608	0.75	0.4307	0.5

$$acc(d,s) = \frac{1}{\sqrt{n}}, \qquad n = ||\{s|s \in d\}||$$

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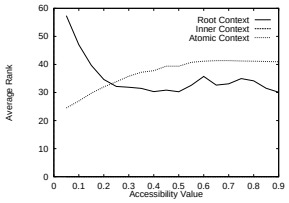
Result: Accessibility Dimension and Retrieved Contexts



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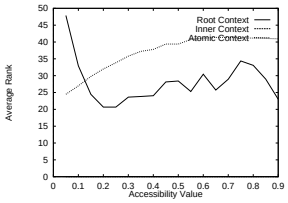

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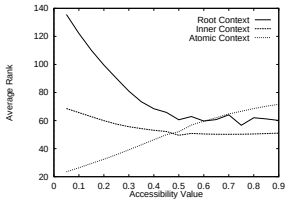

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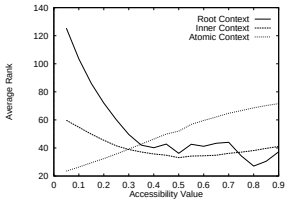

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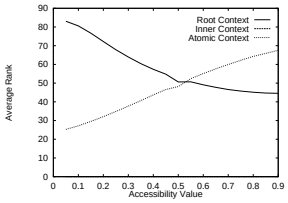

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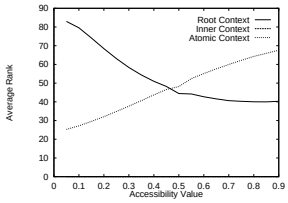

Mix, pess

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Summary and Conclusion

- Accessibility dimension: *tf-idf-acc* approach for structured document retrieval
  - *acc* depends on number of contexts and relevance assessment strategies for structured documents
  - *acc* controls retrieval of "higher" (root and inner) and "lower" (inner and atomic) contexts
- PRA (HySpirit framework) models parameter settings and aggregation strategies
- Automatic test collection building for structured document retrieval, optimistic and pessimistic relevance
- Name "accessibility" from Kripke structures

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References

1. Mounia Lalmas and Thomas Rölleke. Four-valued Knowledge Augmentation for Structured Document Retrieval, 13th International Symposium on Methodologies for Intelligent Systems (ISMIS02), Lyon, France, June 2002.
2. Norbert Fuhr and Thomas Rölleke. Probabilistic Relational Algebra for the Integration of Information Retrieval and Database Systems, ACM Transaction on Information Systems 14(1), 1997.
3. http://qmir.dcs.qmul.ac.uk
4. http://www.hyspirit.com