SINAI at CLEF 2004: Using Machine Translation resources with mixed 2-step RSV merging algorithm

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SINAI at CLEF 2004

- Multilingual CLEF task
- Only queries are translated: merging algorithms are required
- Main interest: testing Machine Translation(MT) with mixed 2-step RSV merging algorithm.

- 2-step RSV calculus requires that given a word of the original query, its translation to the rest of languages must be known.
- MT translates the whole of the phrase better than word for word, we can't use MT with 2-step RSV merging algorithm directly.
- We propose an straightforward and effective algorithm to align the original query and its translation at term level.

Content

- How 2-step RSV merging algorithm works?
- An algorithm to align parallel text at term level based on MT
- Experimentation framework
- Results
- Global pseudo-relevance feedback
- Conclusions a future work

2-step RSV method

Conflict of Interest in Italy?

Conflicto intereses Italia

Conflitto interessi Italia

Conflits intérêt Italie

Spanish IR

Italian IR

French IR

#1 (conflicto, conflitto, conflits)
#2 (intereses, interessi, intérêt)
#3 (Italia, Italia, Italie)

Spanish, Italian, French retrieved documents

STEP 1

STEP 2

Indexing *concepts* (#1,#2,#3)

***Concept* IR**

Multilingual list of Ranked documents

Spanish		Italian		French		*Concept*	
Term	*df*	Term	*df*	Term	*df*	Id.	*df*
conflicto	1000	conflitto	1500	conflits	1250	#1	1000+1500 +1250=3750
intereses	5000	interessi	6000	Intérêt	4000	#2	5000+6000 +4000=15000
Italia	3500	Italia	6000	Italie	4500	#3	3500+6000 +4500=14000

An algorithm to align at term level a phrase and its translations by using machine translation resources

P_{en} → Pesticides in baby food

STEP 1

Machine Translation

P_{sp} → Pesticidas en alimento para niños

STEP 2

Unigrams (P_{en}) = {Pesticides, baby, food}
Bigrams (P_{en}) = {Pesticides baby, baby food}

STEP 3

U (P_{sp}) = {Pesticidas,alimento,bebés}
B (P_{sp}) = {Pesticidas bebés, alimento para niños}

...

...

STEP 4

Non Stopwords Stemmed

P_{sp} → Pesticida alimento niño
U (P_{sp}) = {Pesticida,alimento,bebé}
B (P_{sp}) = {Pesticida bebé, alimento niño}

STEP 5

To Align Unigrams

Pesticida **alimento** niño, {Pesticida, **alimento**, bebé}

Pesticide baby food, { Pesticide , Food , baby}

...

...

STEP 6

To Align Bigrams

Pesticida **alimento niño**, {Pesticida bebé, **alimento niño**}

Pesticide baby food, {Pesticide baby, **baby food** }

An algorithm to align at term level a phrase and its translations by using machine translation resources

Spanish	German	French	Italian
91%	87%	86%	88%

Percentage of aligned non-empty words (CLEF2001+CLEF2002+CLEF2003 query set, Title+Description fields, Babelfish machine Translation)

Finnish	French	Russian
100%	85%	80%

Percentage of aligned non-empty words (CLEF2004 query set, Title+Description fields, MT for French and Russian. MDR for Finnish)

Mixed 2-step RSV:Queries partially aligned

- Raw [illegible] 2-step RSV:

$$RSV_i [illegible] V_i^{align} + (1-\alpha) \cdot RSV_i^{nonalign}$$

Conflicto de intereses en Italia

Aligned terms

Dinamic 2-step RSV index

RSV$^{\text{aligned terms}}$

573

SP123

- Log[illegible]egression:

$$Prob[D_i [illegible] ank_i, rsv_i^{align}, rsv_i^{nonalign}] = \frac{e^{\alpha+\beta_1 \cdot \ln(rank_i)+\beta_2 \cdot rsv_i^{align}+\beta_3 \cdot rsv_i^{nonalign}}}{[illegible] \ln(rank_i)+\beta_2 \cdot rsv_i^{align}+\beta_3 \cdot rsv_i^{nonalign}}$$

Non- aligned terms

RSV$^{\text{not aligned terms}}$

39

Monolingual index (Spanish)

Experimentation framework – language dependent features

	English	Finnish	French	Russian
Preprocessing	stop words removed and stemming			
Additional preprocessing		compounds words to simple words		Cyrillic→ASCII
			Query aligment at word level algorithm based on MT	
Translation approach		FinnPlace MDR	Reverso MT	Prompt MT

Experimentation framework – language independent features

- ZPrise IR engine
- OKAPI probabilistic model (fixed at b = 0.75 and k1 = 1.2 for every language and for the 2-step RSV index)
- Neither blind feedback nor query expansion (no improvement except of French)

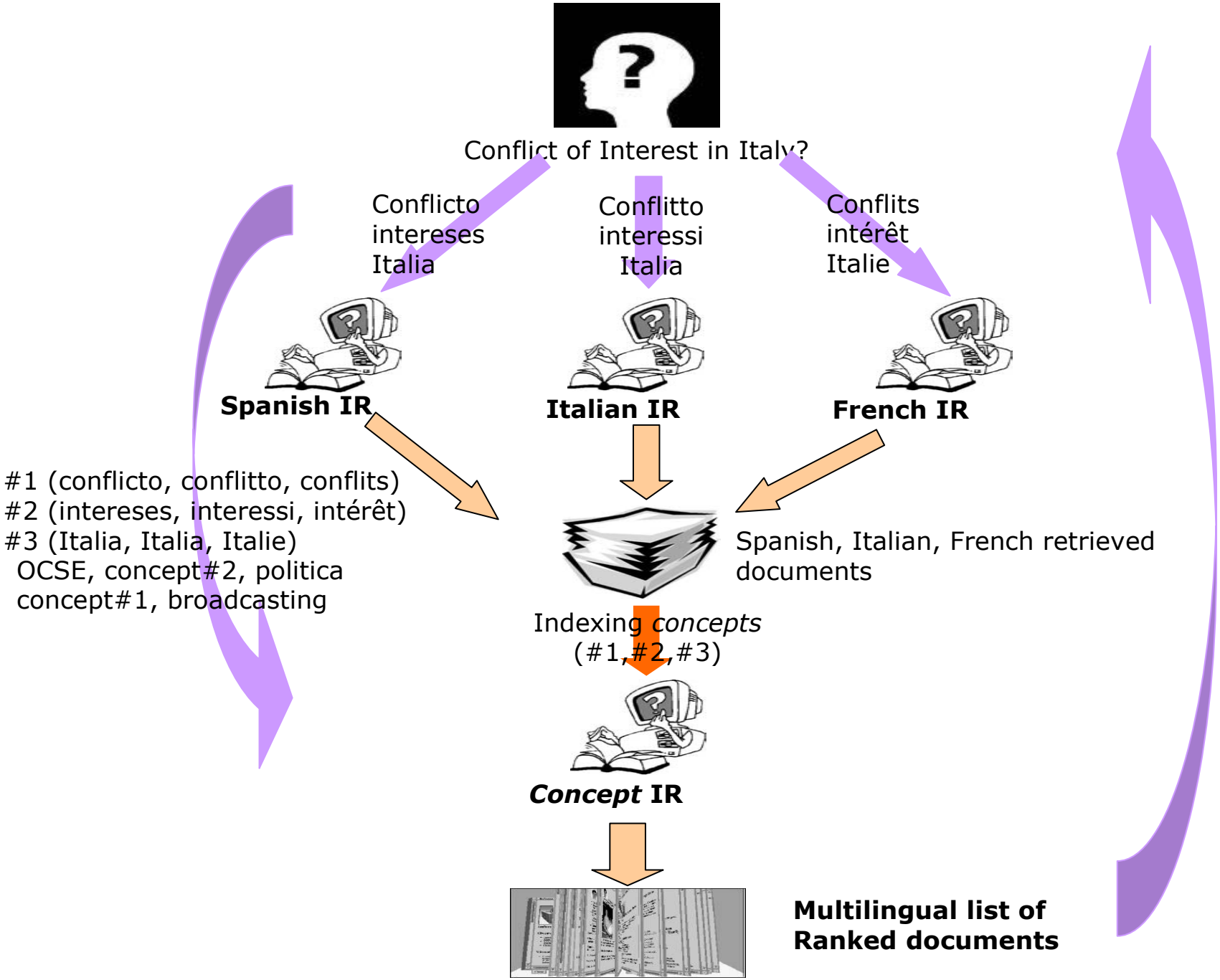
Results

Merging strategy	Experiment	AvgPrec
Round robin	unofficial	0.220
Raw scoring	unofficial	0.280
Formula 2 (logistic regression)	UJAMLRL	0.277
Formula 1 (raw mixed 2-step RSV)	**UJAMLRSV2**	**0.334**
Formula 3 (logistic regression and 2-step RSV)	UJAMLRL2P	0.333
Formula 4 (logistic regression and 2-step RSV)	UJAMLRL3P	0.301

Global pseudo-relevance feedback

- The idea:
  - Since 2-step RSV creates a only index for all collections and it returns a only multingual list of documents, why don't apply PRF with such index?

- The implementation:
  1. Merge the document rankings using 2-step RSV.
  2. Apply blind relevance feedback to the top-N documents ranked into the multilingual list of documents.
  3. Add the top-N more meaningful terms to the query.
  4. Expand the concept query with the selected terms.
  5. Apply again 2-step RSV over the ranked lists of documents, but by using the expanded query instead of the original query.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OCSE, concept#2, politica
concept#1, broadcasting
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Global pseudo-relevance feedback

Merging strategy	AvgPrec	
	without global BRF	with global BRF
Formula 1 (raw mixed 2-step RSV)	0.334	0.331
Formula 3 (logistic regression and 2-step RSV)	0.333	0.332
Formula 4 (logistic regression and 2-step RSV)+global BRF	0.301	0.309

- But global PRF doesn't work:
  - Usually, blind relevance feedback is poorly suited to CLEF document collections.
  - We use the expanded query to apply 2-step RSV re-weighting the documents retrieved for each language, but the list of retrieved documents does not change (it only changes the score of such documents).

Conclusions and future work

- 2-step RSV merging algorithm works well with Machine Translation!
- We propose a new word-level aligment algorithm based on MT
- In the future:
  - Partially aligned queries → integration of two scores for documents must be improved by using other algorithms (normalized versions of raw mixed 2-step RSV, SVM and neural and bayesian networks...)
  - Global PRF idea must be more investigated