JIRS
The mother of all the passage retrieval systems for multilingual question answering?

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Introduction

Information is increasing every day

It is necesary to dedicate more time to search the relevant information for the user needs

or...

¡¡USE BETTER INFORMATION RETRIEVAL SYSTEMS!!

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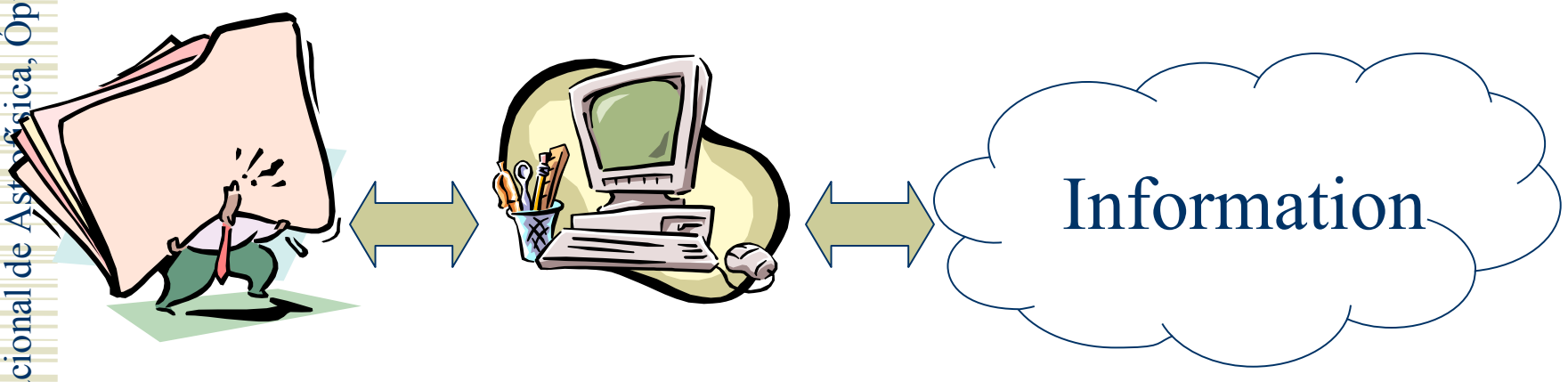
What is an IR system?

It is an application that helps users searching for relevant information.



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Question Answering Systems

??? Who is the President of Mexico?

question

Vicente Fox

answer

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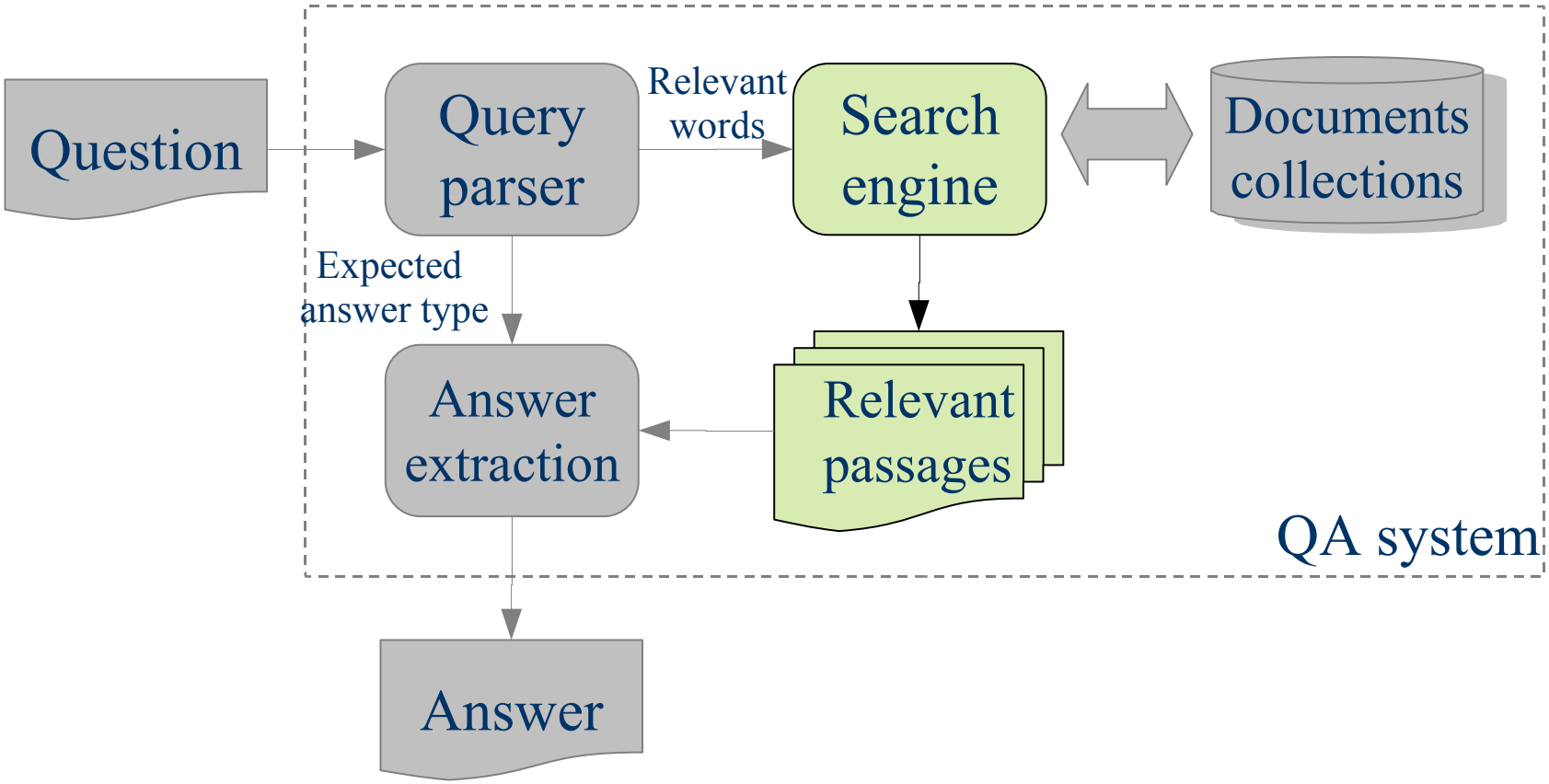
Architecture of a typically QA System



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Passage Retreival systems

- The traditional PR systems only search for key words

  What is the capital of Croatia?

Passage 1

Yesterday, the delegation visited Zagreb, the capital of Croatia, and after their stay in Sarajevo they are traveling to Belgrade.

Passage 2

Yeltsin invited Tudjman and Milosevic to the capital of Russian to find a political solution to the Croatia and Bosnia conflicts.

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Traditional PR systems II

- Only **54%** of answers can be obtained by using the top 20 passages of the Okapi Passage Retrieval System.

(Gaizauskas et al. 2003)

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N-Gram Models

- Our method of Passage Retrieval is based on searching the question structures
- We find the passage with the expression more similar to the question
- The longer n-gram of question we find in the passage, the more similarity will have the passage

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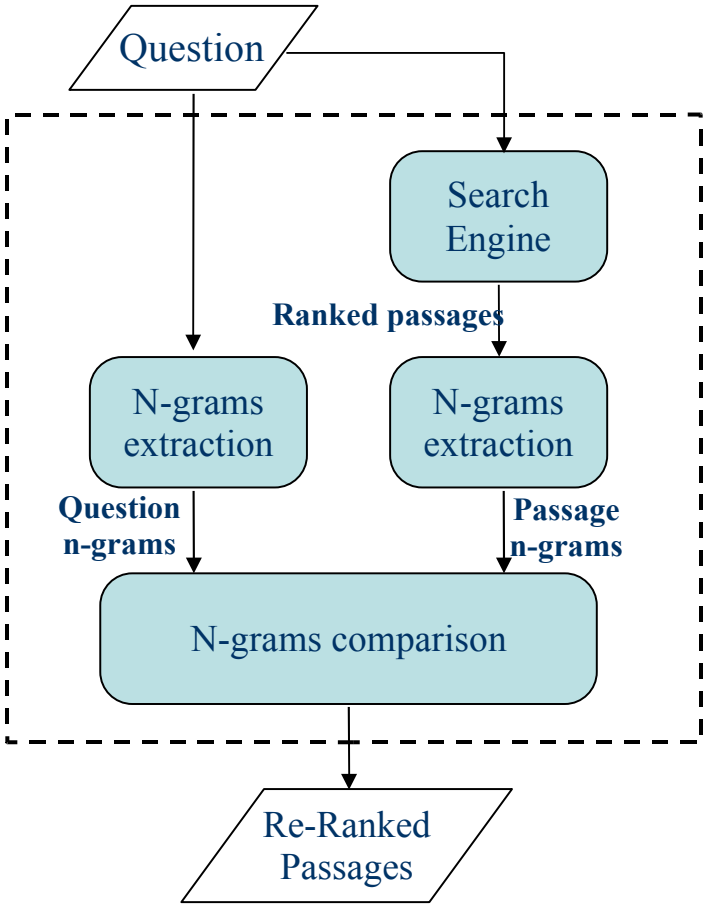
System Architecture



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Example: Question N-Grams

~~What~~ is the capital of Croatia?	1 x 5-gram
is the capital of the capital of Croatia	2 x 4-gram
is the capital, the capital of, capital of Croatia,	3 x 3-gram
is the, the capital, capital of, of Croatia,	4 x 2-gram
is, the, capital, of, Croatia,	5 x 1-gram

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Example: Passage N-Grams

Passage 1

Yesterday, the delegation visited Zagreb, the capital of Croatia, and after their stay in Sarajevo they are traveling to Belgrade.

the capital of Croatia	1 x 4-gram
the capital of	2 x 3-gram
capital of Croatia	
the capital	3 x 2-gram
capital of	
of Croatia	
the capital of Croatia	4 x 1-gram

Passage 2

Yeltsin invited Tudjman and Milosevic to the capital of Russian to find a political solution to the Croatia and Bosnia conflicts.

the capital of	1 x 3-gram
the capital	2 x 2-gram
capital of	
the capital of Croatia	4 x 1-gram

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Simple Model

- Similarity between the question and the passage is measured by:

$$sim(d,q) = \frac{\sum_{j=1}^{n} \sum_{\forall x \in Q_j} h(x, D_j)}{\sum_{j=1}^{n} \sum_{\forall x \in Q_j} h(x, Q_j)}$$

where:

$$h(x, D_j) = \begin{cases} 1 & if \ x \in D_j \\ 0 & otherwise \end{cases}$$

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Simple Model Example

What is the capital of Croatia?	
is the capital of Croatia	1
is the capital of	1
the capital of Croatia	1
is the capital	1
the capital of	1
capital of Croatia	1
is the	1
the capital	1
capital of	1
of Croatia	1
is	1
the	1
capital	1
of	1
Croatia	1
	15

Passage 1	
the capital of Croatia	1
the capital of	1
capital of Croatia	1
the capital	1
capital of	1
of Croatia	1
the, capital, of, Croatia	4
	10

0.67

Passage 2	
the capital of	1
the capital	1
capital of	1
the, capital, of, Croatia	4
	7

0.47

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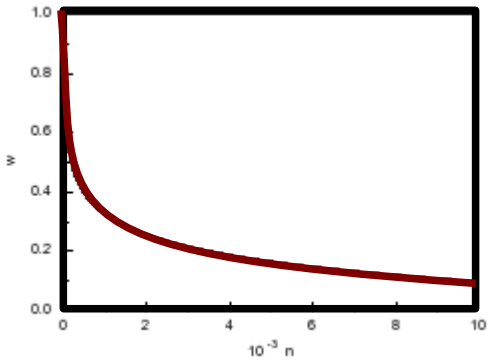
Term Weight Model

- In this model the function *h()* is changed by:

$$h(x, D_j) = \begin{cases} \sum_{k=1}^{j} w_k & if \ x \in D_j \\ 0 & otherwise \end{cases}$$

where:

$$w_k = 1 - \frac{log(n_k)}{1 + log(N)}$$



Term Weight Example

	0.1	0.1	0.3	0.1	0.4
What	**is**	**the**	**capital**	**of**	**Croatia?**

is the capital of Croatia	1
is the capital of	0.6
the capital of Croatia	0.9
is the capital	0.5
the capital of	0.5
capital of Croatia	0.8
is the	0.2
the capital	0.4
capital of	0.4
of Croatia	0.5
is	0.1
the	0.1
capital	0.3
of	0.1
Croatia	0.4
	6.8

Passage 1

the capital of Croatia	0.9
the capital of	0.5
capital of Croatia	0.8
the capital	0.4
capital of	0.4
of Croatia	0.5
the, capital, of, Croatia	0.9
	4.4

0.65

Passage 2

the capital of	0.5
the capital	0.4
capital of	0.4
the, capital, of, Croatia	0.9
	2.2

0.32

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Distance Model

- The problem of previous models is that the weight n-grams is very higher
- Long n-grams are more relevants than short n-grams although these ones have more relevant words
- The Distance Model does not search the longest n-gram
- It searches the heaviest n-grams

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Distance Model Example

Pasaje 1

0.9

Yesterday, the delegation visited Zagreb, the capital of Croatia, and after their stay in Sarajevo they are traveling to Belgrade.

$$h(x, D_j) = \begin{cases} \sum_{k=1}^{n} w_k \, d(x, x_{max}) & if \;\; x \in D_j \\ 0 & otherwise \end{cases}$$

Pasaje 2

0.3 $D = 7$

Yeltsin invited Tudjman and Milosevic to the Russian capital to find a political solution to the Croatia and Bosnia conflicts.

0.5

Distance factor: $d(x, x_{max}) = \frac{1}{1 + k \cdot ln(1 + D)}$

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Distance Model Example

0.1 0.1 0.3 0.1 0.4
What is the capital of Croatia?
is the capital of Croatia 1

1

Passage 2

Yeltsin invited Tudjman and Milosevic to the Russian capital to find a political solution to the Croatia and Bosnia conflicts. $D = 7$

Passage 1

Yesterday, the delegation visited Zagreb, the capital of Croatia, and after their stay in Sarajevo they are traveling to Belgrade.

Passage 1
the capital of Croatia **0.9**

0.9

0.9

Passage 2
capital
the Croatia

distance factor

0.3 x 0.32
0.5

0.6

0.6

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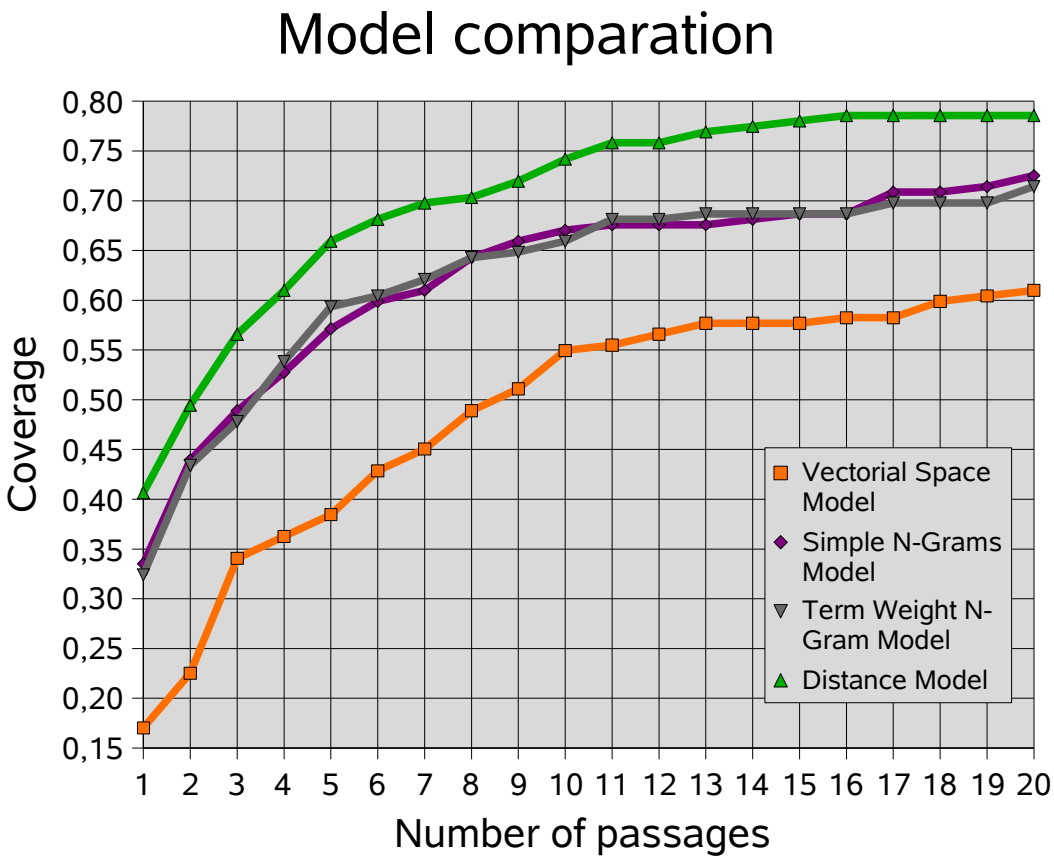
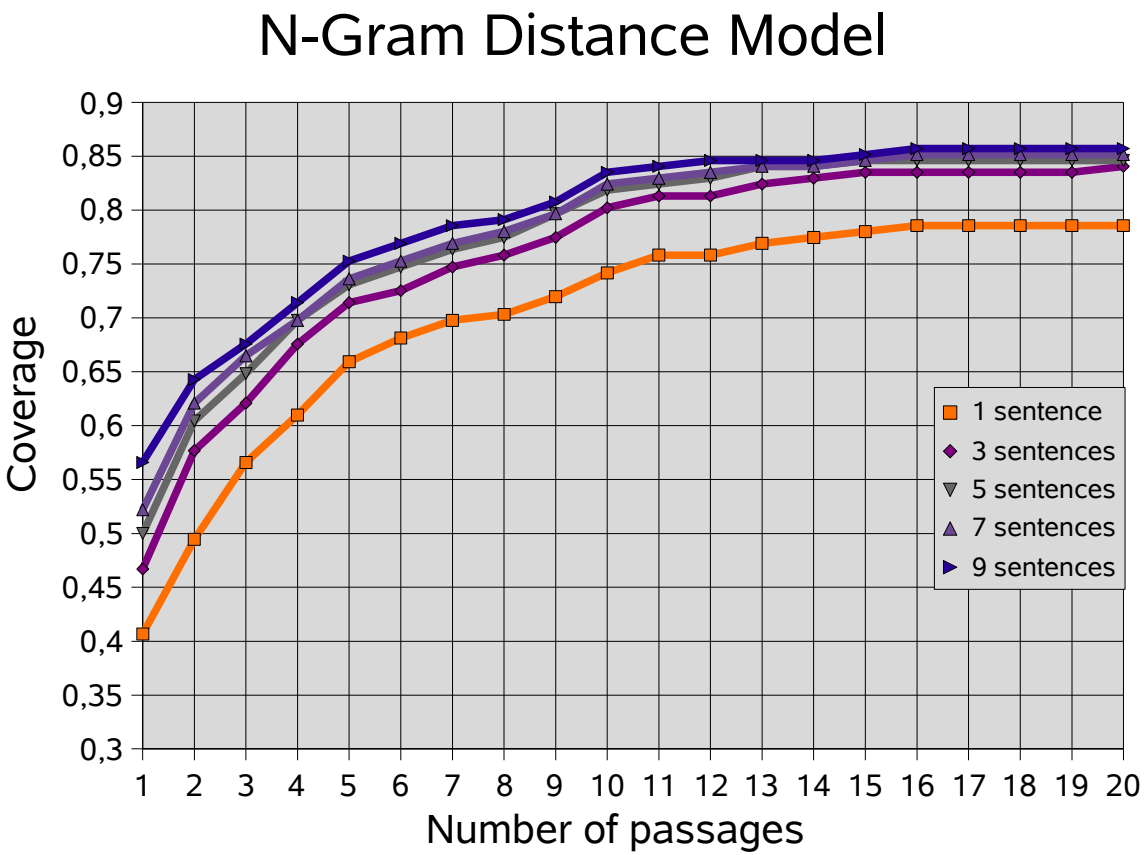
Coverage


Model comparation
Coverage
0,80
0,75
0,70
0,65
0,60
0,55
0,50
0,45
0,40
0,35
0,30
0,25
0,20
0,15
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Number of passages
Vectorial Space Model
Simple N-Grams Model
Term Weight N-Gram Model
Distance Model

N-Gram Distance Model



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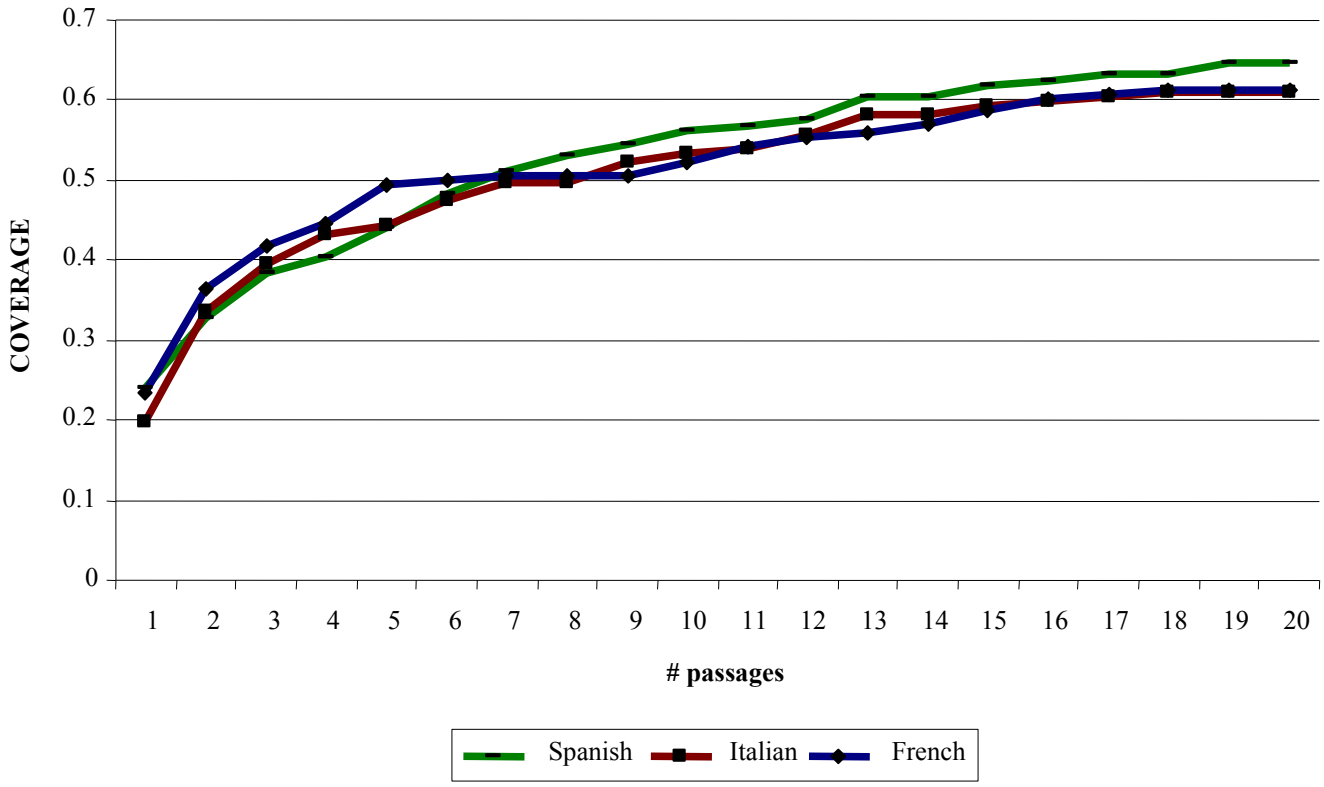
Multilingual results



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CLEF results

Español -> Español	
inao051eses	**42,00%**
tova051eses	**41,00%**
inao052eses	**39,50%**
tova052eses	**38,50%**
upv051eses	**33,50%**
alia051eses	33,00%
aliv051eses	32,50%
alia052eses	30,00%
talp051eses	29,00%
tallp052eses	27,00%
mira051eses	25,50%
mira052eses	23,00%
upv052eses	**18,00%**

Inglés -> Español	
upv051enes	**22,50%**
mira052enes	19,50%
mira051enes	19,50%

Italiano -> Italiano	
tova052itit	**27,50%**
tova051itit	**26,50%**
upv051itit	**25,50%**
upv052itit	**24,00%**
irst051itit	22,00%
irst052itit	19,00%

Francés -> Francés	
syna051frfr	64,00%
tova052frfr	**35,00%**
tova051frfr	**34,50%**
upv051frfr	**23,00%**
hels051frfr	17,50%
upv052frfr	**17,00%**
lire051frfr	16,50%
hels052frfr	16,50%
lina051frfr	14,50%
lcea051frfr	14,00%

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Conclusions

- The N-Gram Models notably improve the coverage of the PR systems
- High redundancy of the answers
- Low computational cost
- Language independent
- Our method fails when there are differences between the question and the answer

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Thank you

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- JIRS is a GNU project
- Can be downloaded at
  - http://leto.dsic.upv.es:8080/jirs

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