

Answering Learners' Questions by Retrieving Question Paraphrases from Social Q&A Sites



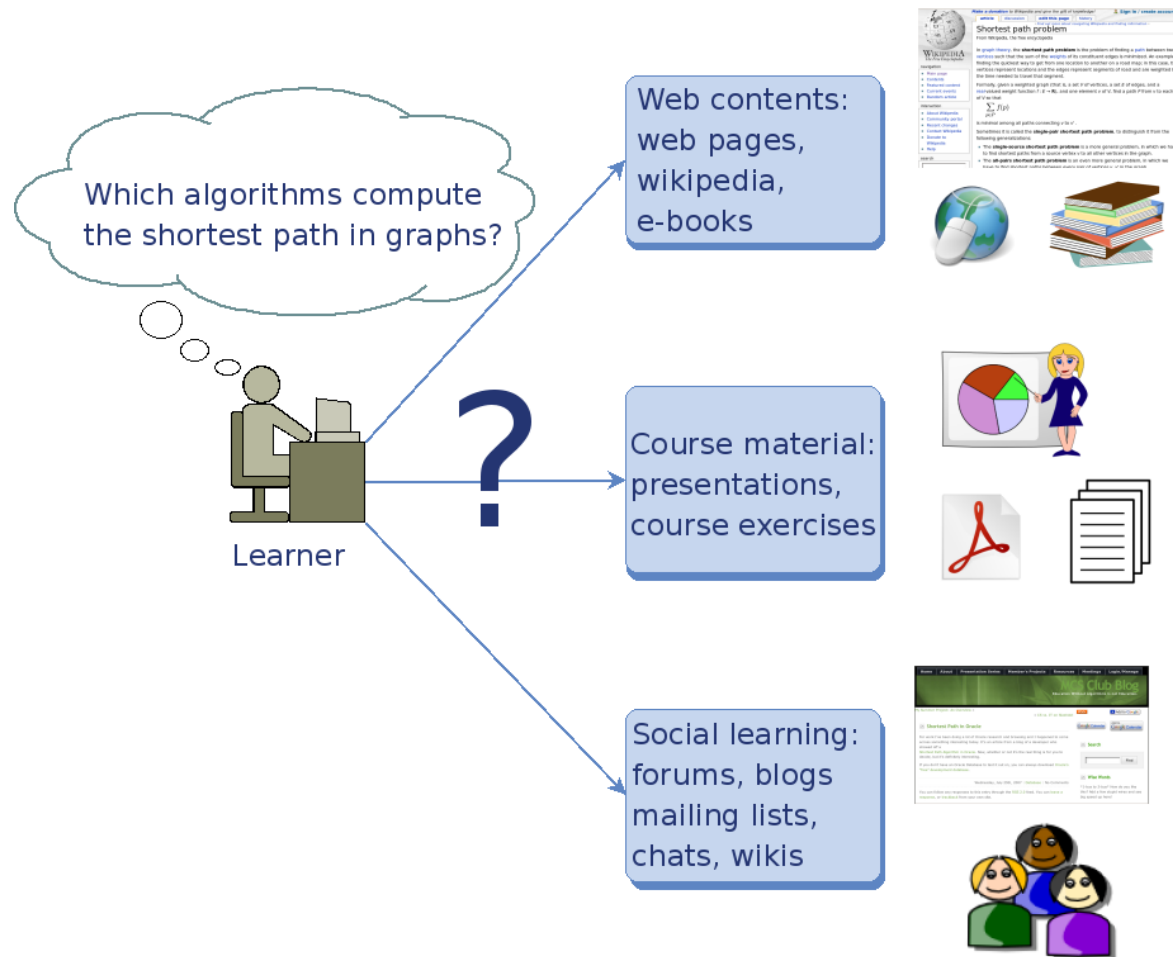
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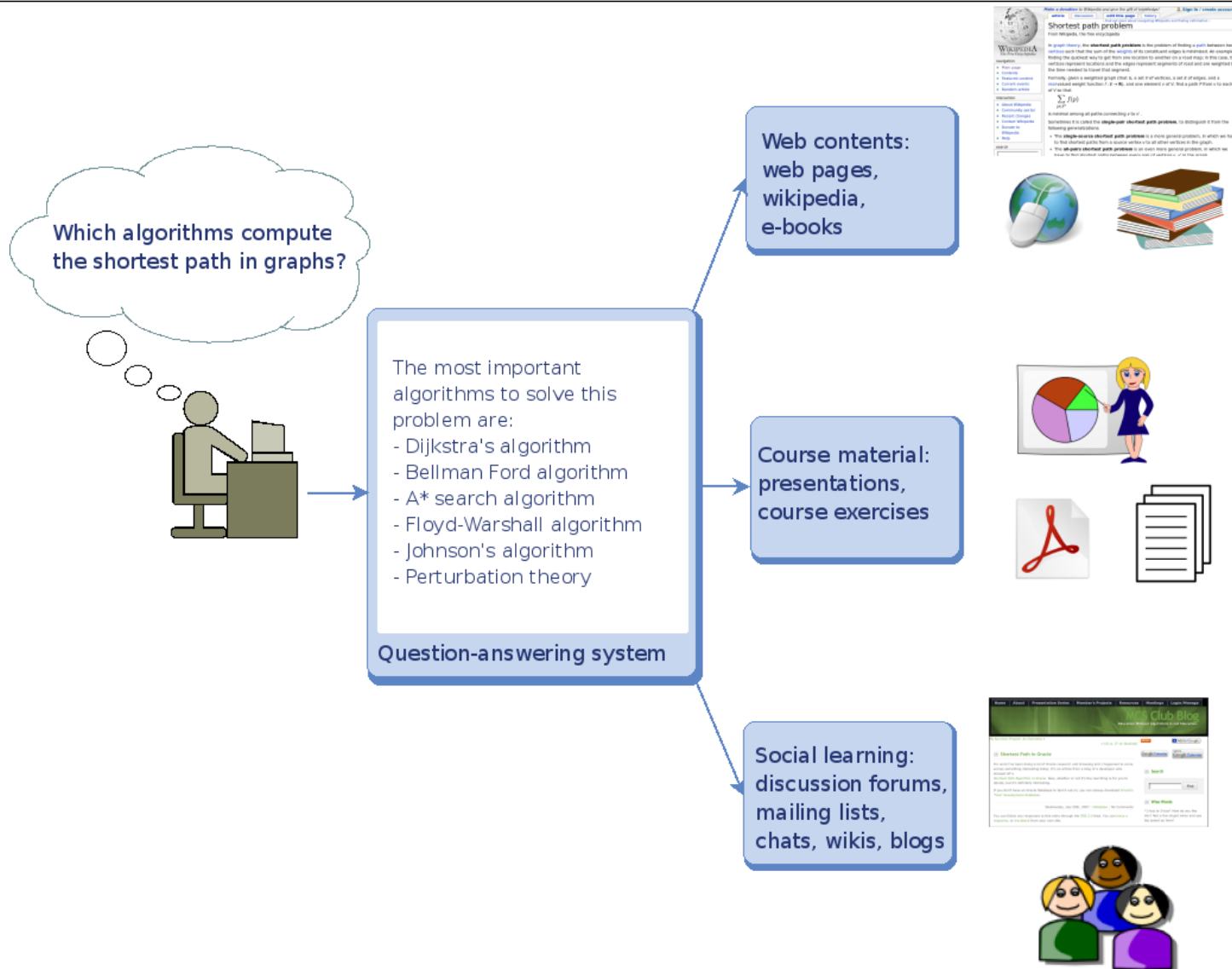
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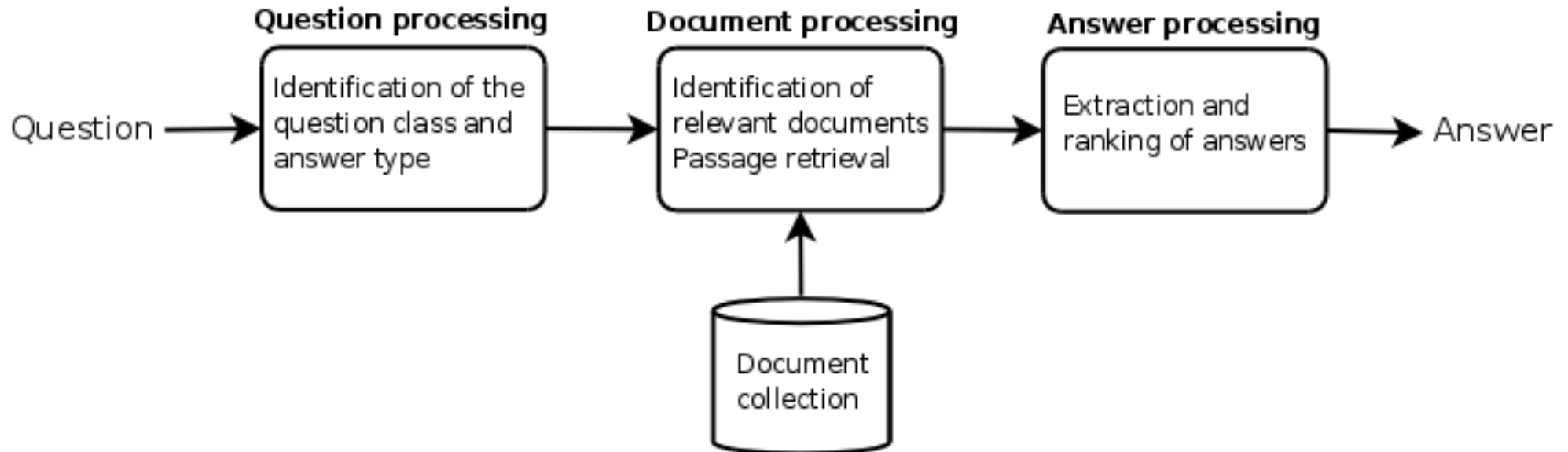
Motivation: Information Overload



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Conventional QA Systems



- Challenges in the educational domain:
 - Open-ended, explanatory or methodological questions
 - Quality of both the questions and the answers

Where to start?



- Many questions have already been asked by somebody else before
- Idea: Find already answered questions in discussion forums, FAQs, Social Q&A sites, etc.
- Problem: find an answered question which is identical in meaning to the question asked by the user

Question Answering as question paraphrase identification in Q&A repositories

What are question paraphrases?



- Question paraphrases are questions which:
 - a) have identical meanings
 - b) have the same answers
 - c) present alternate wordings
- Example:
 - How many ounces are there in a pound?
 - What's the number of ounces per pound?
 - How many oz. in a lb.?

Question and Answer repositories



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FAQs

- Questions and answers are compiled and subject to editorial control
- Example:
www.faqs.org

Ask-an-expert Services

- Provide expert answers to user questions
- Examples:
www.madsci.org
www.hhmi.org

Social Q&A sites

- Provide portals where users can ask their own questions and answer questions from other users
- Examples:
[Yahoo! Answers](#),
[WikiAnswers](#)



Ask

Enter a question here ...

What is the weight of a polar bear?

Go

Answer

For example: [What is the secret of true love?](#) | [What is the best operating system and why?](#)

Ads by Google

[Polar Bear Regions](#)

[Circus Animals](#)

[Tundra Inn](#)

[Wild Animals Photos](#)

Optional Login/Register

Username

Password

Remember me

Login

[Why Register?](#) | [Lost Password?](#)

User-generated content; read this [important disclaimer](#).

Other contributors have said "What is the weight of a polar Bear?" is the same question as "What is the average weight of a polar bear?". If you believe that these are not asking the same thing and should be answered differently, [click here](#).

Q: What is the average weight of a polar bear?

In: [Polar Bears](#)

Answer

Adult Males: 900-1500 lbs, avg = 1150; record = 2210lbs. Males are 25-45% larger than Adult Females who weigh 330-660 lbs.

Improve Answer

Discuss Question

Watch Question

First answer by ID1633228453. Last edit by [Tl1313](#). Contributor trust: 28 [[recommend contributor](#)].
Question popularity: 5 [[recommend question](#)]


1st fastest growing domain
of the top 1,500 in the U.S.
in 2007 (comScore)

Question Paraphrase Dataset



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- Extracted from WikiAnswers
- User annotated paraphrases
 - "What is the average lifespan of a polar bear?"

Our contributors said this page should be displayed for the questions below. (*Where do these come from* )

If any of these are *not* a genuine rephrasing of the question, please help out and [edit these alternates](#).

Polar bear lifespan? Average age of a bear? A polar bear's lifespan? How long do polar bears live? What is a Polar Bears lifespan? What is the polar bear lifespan? Average lifespan of a polar bear? Average lifespan for a polar bear? The Average Lifespan of a Polar Bear? What is the lifespan of a polar bear? What is a polar bears average lifespan? What is the average lifespan of a koala bear? What is the average life span of a polar bear?

Question Paraphrase Dataset



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- 1,000 **target questions** with their paraphrases
- From 100 randomly selected files in the Education category
- 7,434 paraphrases → **input questions**
- Task: retrieve the corresponding target question for each input question

Question Paraphrase Identification



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Input question

Pre-processing:

- stemming
- lemmatisation
- spelling correction

Target question

WikiAnswers

Question similarity measures

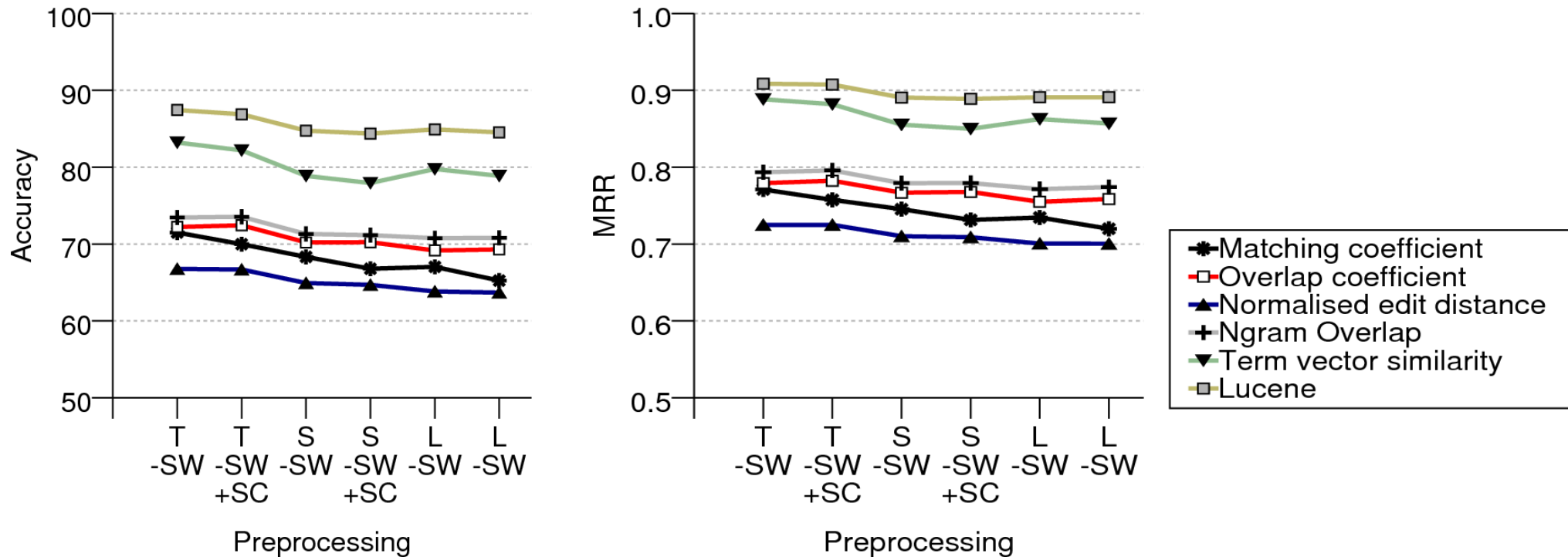
String similarity:

- matching coefficient
- overlap coefficient
- edit distance
- ngram overlap

Vector space:

- term vector similarity
- Lucene

Results



- Vector-space based methods outperform string similarity
- Morphological pre-processing and spelling correction do not ameliorate the results

Stemming and Lemmatisation



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- Positive effects
 - What are analogies for mitochondria?
 - What is an analogy for mitochondrion?
- Negative effects
 - How was [be] calculus started [start]?
 - How could you start your MA English studies?
 - Who developed calculus?

Spelling Correction



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- Positive effects
 - How do you become an anesthesiologist?
 - How many years of medical school do you need to be an anesthesiologist?
- Negative effects
 - What are the GRE score required to get into top100 US universities?
 - What are the are score required to get into top100 US universities?

Errors in the user generated gold standard



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- Target question:
What is the secret about mona lisa?
- Reformulations in WikiAnswers:
When was the first painting made?
Where did leanardo da vinci live?

Challenges in Question Paraphrase Identification in Social Q&A Sites



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- Vocabulary mismatch:
 - What events occurred in 1919?
 - What important events happened in 1919?
- Spelling errors
 - When was indoor pluming invented?
- Planned improvements:
 - Semantic relatedness metrics
 - Reliable spelling error identification and correction, including real-word spelling errors

Next steps



- Human-annotated question paraphrase gold standard
 - Question paraphrases
 - Related questions, on the same topic
 - Unrelated questions
- Automatic assessment of the quality of the answers
 - Correctness, well-formedness, readability, objectivity, relevance, utility, interestingness (Jeon et al., 2006; Agichtein et al., 2008)
- Automatic assessment of the quality of the questions
 - Interactive question answering: help learners ask good questions (Harabagiu et al., 2005; Rus et al., 2007)

Summary



- Realistic solution to the problem of automatically answering learners' questions: use repositories of already answered questions
- Method: identification of question paraphrases
- Resource: new question paraphrase dataset extracted from a social Q&A site, WikiAnswers
- Findings: vector space based measures outperform string similarity measures, morphological pre-processing and spelling correction do not improve the results
- Challenges: question quality and pre-processing

Acknowledgments



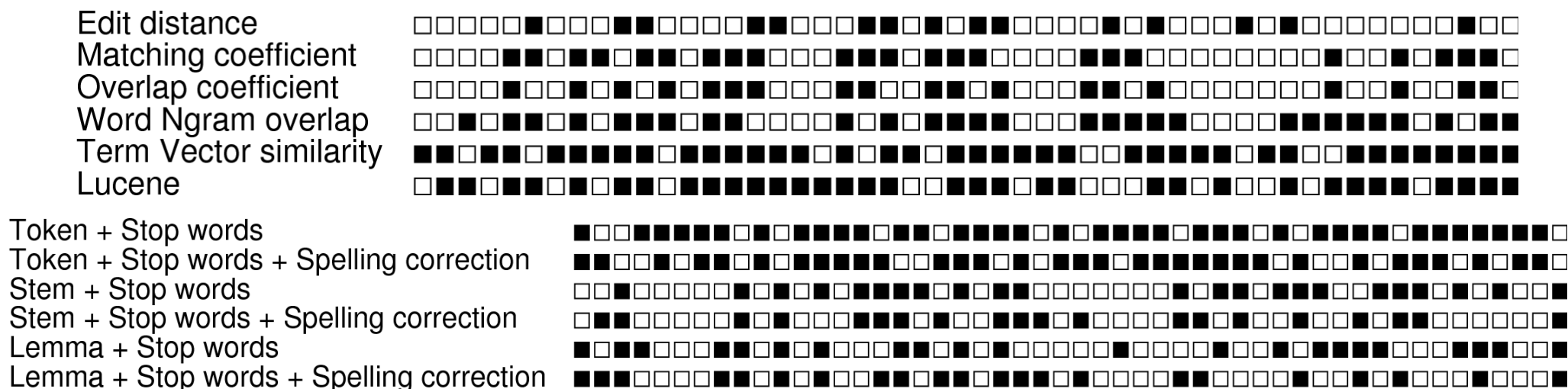
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Ubiquitous Knowledge Processing Lab

<http://www.ukp.tu-darmstadt.de>



Comparison of the methods



- Dissimilar error patterns for different pre-processing strategies and paraphrase identification methods
- Best combination: Lucene, Term Vector similarity with stemming, Ngram overlap with spelling correction
88.3% accuracy (best without combination: 87.4%)