Corpus and Evaluation Measures for Automatic Plagiarism Detection

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Outline

Introduction

Text reuse

- The reuse (even after modification) of text.

(from [Clough et al., 2002], [IEEE, 2008], and [Bierce, 1911])

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Plagiarism

- the reuse of someone else's prior ideas, processes, results, or words without explicitly acknowledging the original author and source

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Plagiarism

- the reuse of someone else's prior ideas, processes, results, or words without explicitly acknowledging the original author and source
- to take the thought or style of another writer whom one has never, never read

(from [Clough et al., 2002], [IEEE, 2008], and [Bierce, 1911])

Introduction: Relevance

1986 In a survey over 380 students, 30% admitted cheating on their assignments [Haines et al., 1986]

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2009 Wikipedia is considered a preferred source for plagiarists [Martínez, 2009]

Introduction: Automatic Plagiarism Detection

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Approaches

- *intrinsic*
- *external*

Introduction: Intrinsic Plagiarism Detection

An expert is often able to detect plagiarism by reading a document

Insertion of text from a different author into d_q causes **style** and **complexity** irregularities

[Meyer zu Eißen and Stein, 2006], [Stamatatos, 2009]

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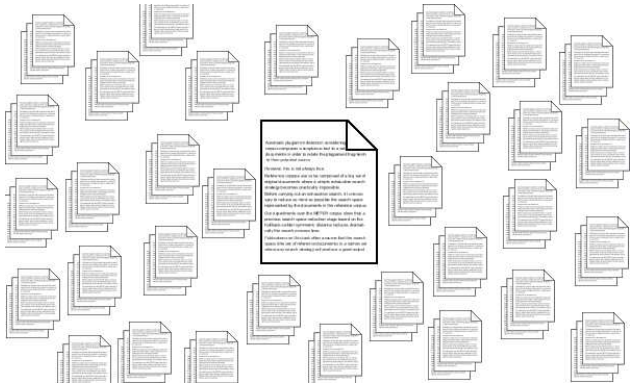
Quantification can be made by measuring…

Text readability	Gunning Fog, Flesch–Kincaid
Vocabulary richness	types/tokens ratio
Basic statistics	avg. sentence length, avg. word length
n-grams profiles	character level statistics

[Meyer zu Eißen and Stein, 2006], [Stamatatos, 2009]

Introduction: External Plagiarism Detection



Better evidence than style irregularities is if the source of a plagiarism case can be provided

It is closer to information retrieval

[Potthast et al., 2009]

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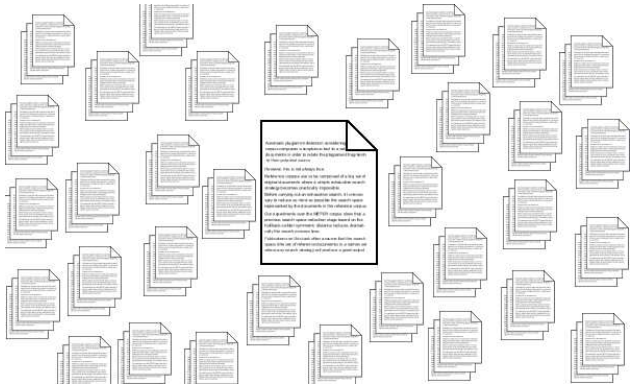

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d_q and a collection of potential source documents D are given. The task is to identify the plagiarized sections in d_q (if there are any), and their respective source sections in D

[Potthast et al., 2009]

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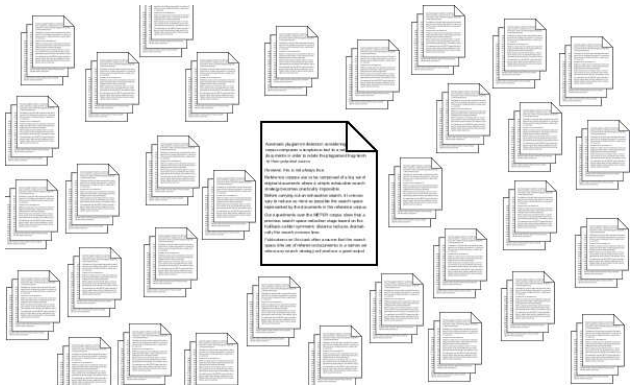

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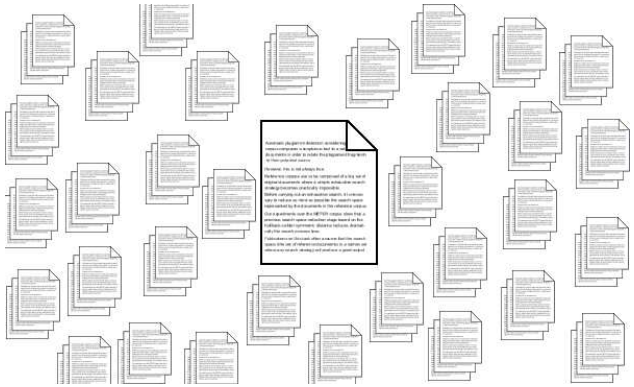
Issues that render this task difficult

- Number of potential source documents, $|D|$;
- Plagiarizing a text often implies paraphrasing, summarizing, and even translation.

[Potthast et al., 2009]

Introduction: External Plagiarism Detection



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Models

Vector Space Models	[Broder, 1997], [Maurer et al., 2006]
Fingerprinting techniques	SPEX [Bernstein and Zobel, 2004], Winnowing [Schleimer et al., 2003]

[Potthast et al., 2009]

Introduction: Drawbacks

- Plagiarism implies an ethical issue
- Nobody would like to be included in a corpus of plagiarism!
- Properly anonymizing actual cases of plagiarism is a hard task
- No standard evaluation measures have been previously defined

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- No standard evaluation measures have been previously defined
- Evaluations use to be incomparable and often not even reproducible.

Outline

PAN-PC-09

“A newly developed large-scale corpus of *artificial* plagiarism”

- 41 223 documents
- 94 202 artificial plagiarism cases
- It includes cases for intrinsic and external detection methods

http://www.webis.de/research/corpora

PAN-PC-09: Corpus Parameters

Document Length

- 50% short: 1-10 pages
- 35% medium: 10-100 pages
- 15% large: 100-1000 pages

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Suspicious-to-Source Ratio

- 50% are designated as suspicious documents D_q
- 50% are designated as source documents D

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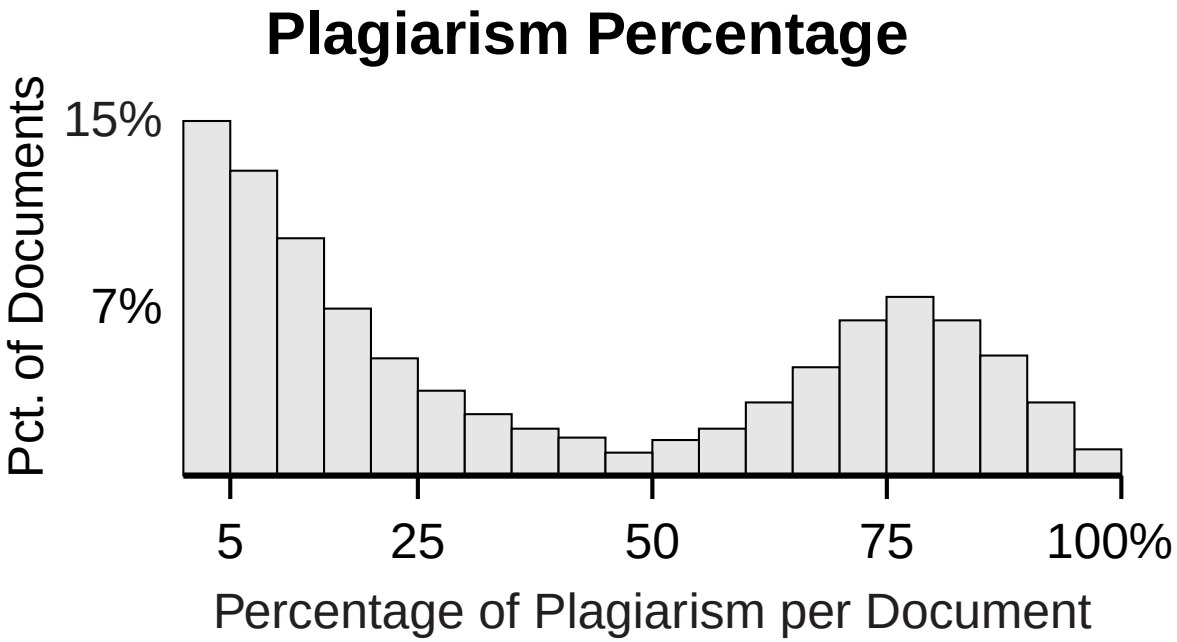

- 50% of D_q contain no plagiarism at all

PAN-PC-09: Corpus Parameters

Cases Length

- 250–750 chars; ∼50–150 words
- 1500–5000 chars; ∼300–1000 words
- 15000–25000 chars; ∼3000-5000 words

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Plagiarism Languages

- 90% are monolingual English plagiarism
- 10% are cross-language plagiarism (German or Spanish into English)

PAN-PC-09: Corpus Parameters

Cases Obfuscation

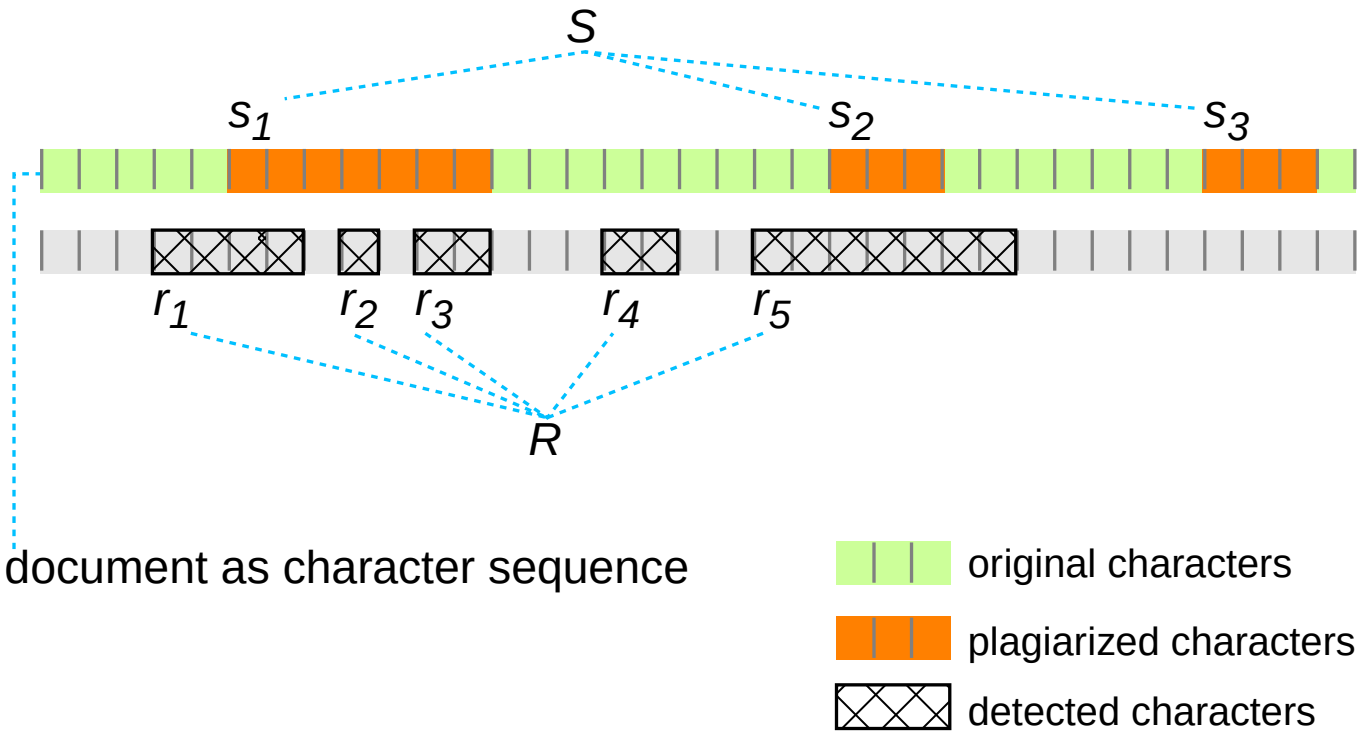
- small
- medium
- high

Paraphrasing, summarization, etc. is simulated by…

- shuffling, removing, inserting short phrases
- replacing semantically related words
- POS preserving shuffling

Outline

Evaluation Measures



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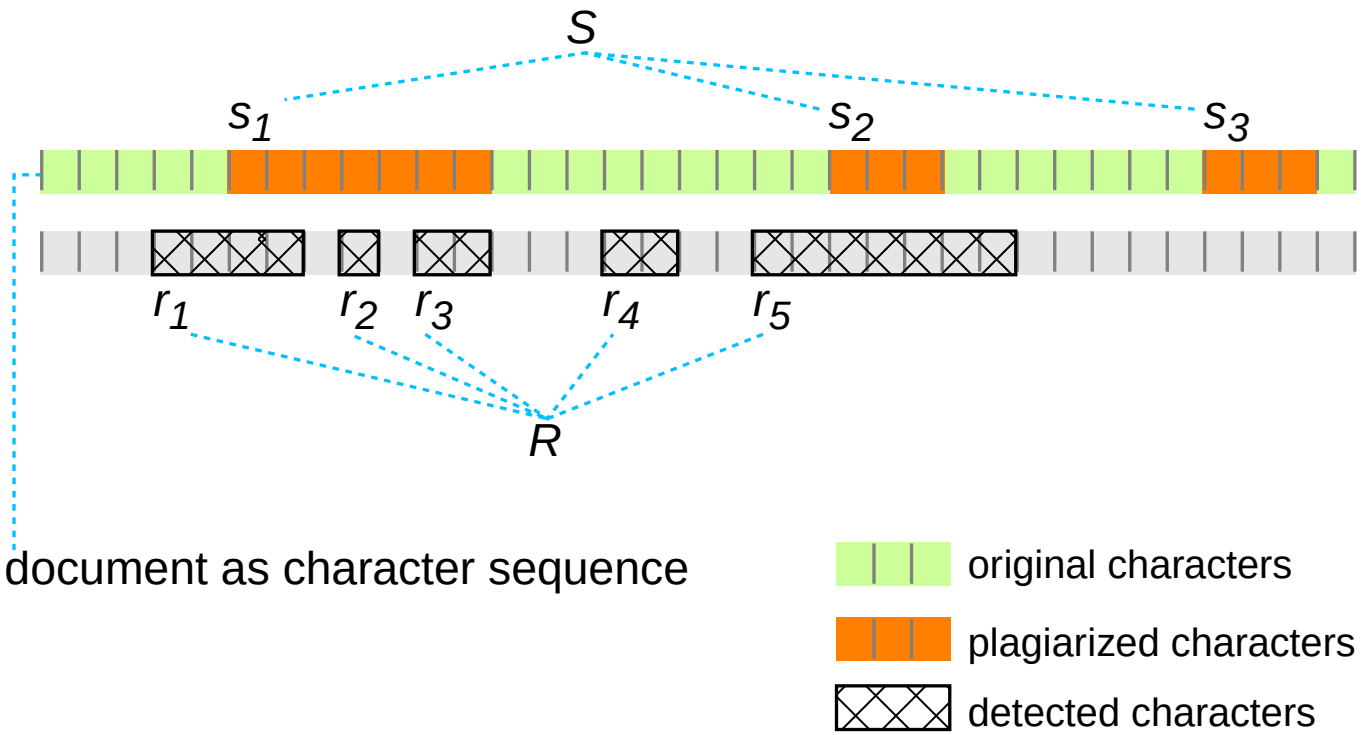
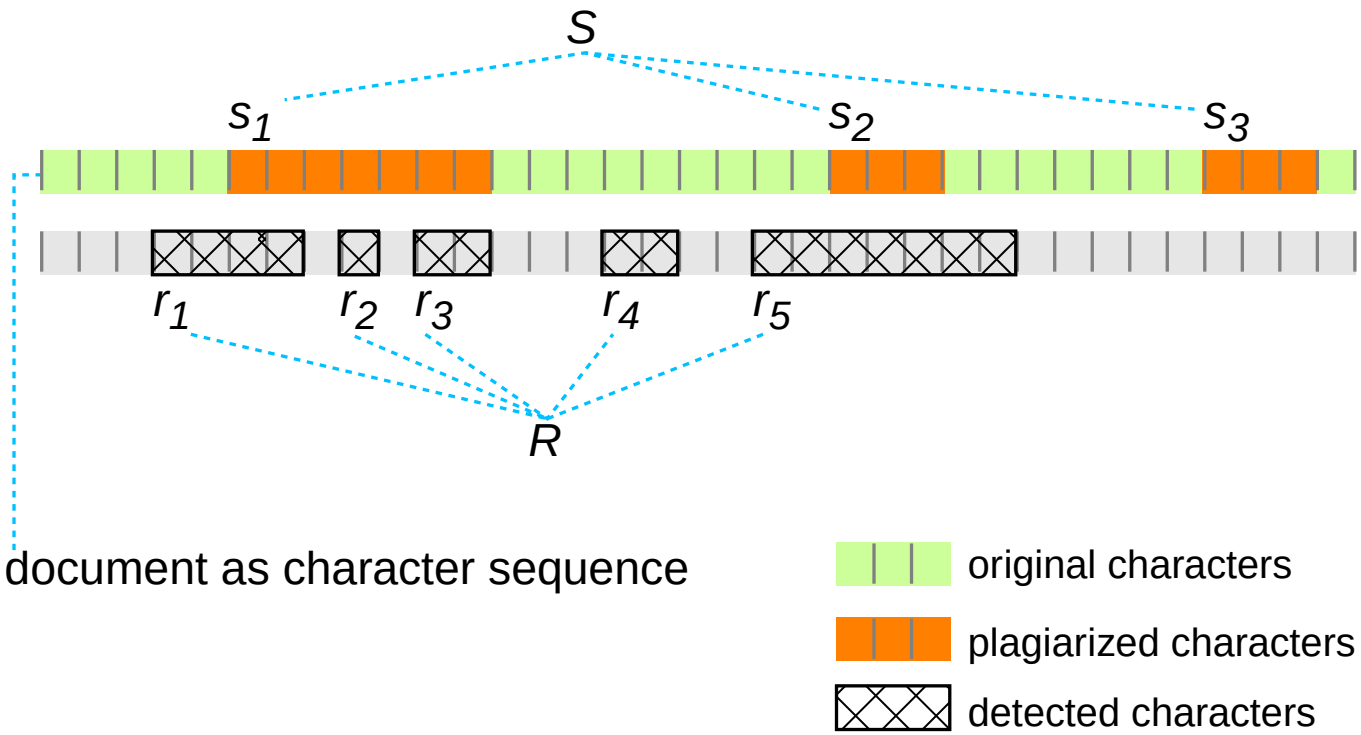


$$rec_{PDA}(S,R) = \frac{1}{|S|} \sum_{s \in S} \frac{|s \sqcap \bigcup_{r \in R} r|}{|s|}$$

($\sqcap$ computes the positionally overlapping characters)

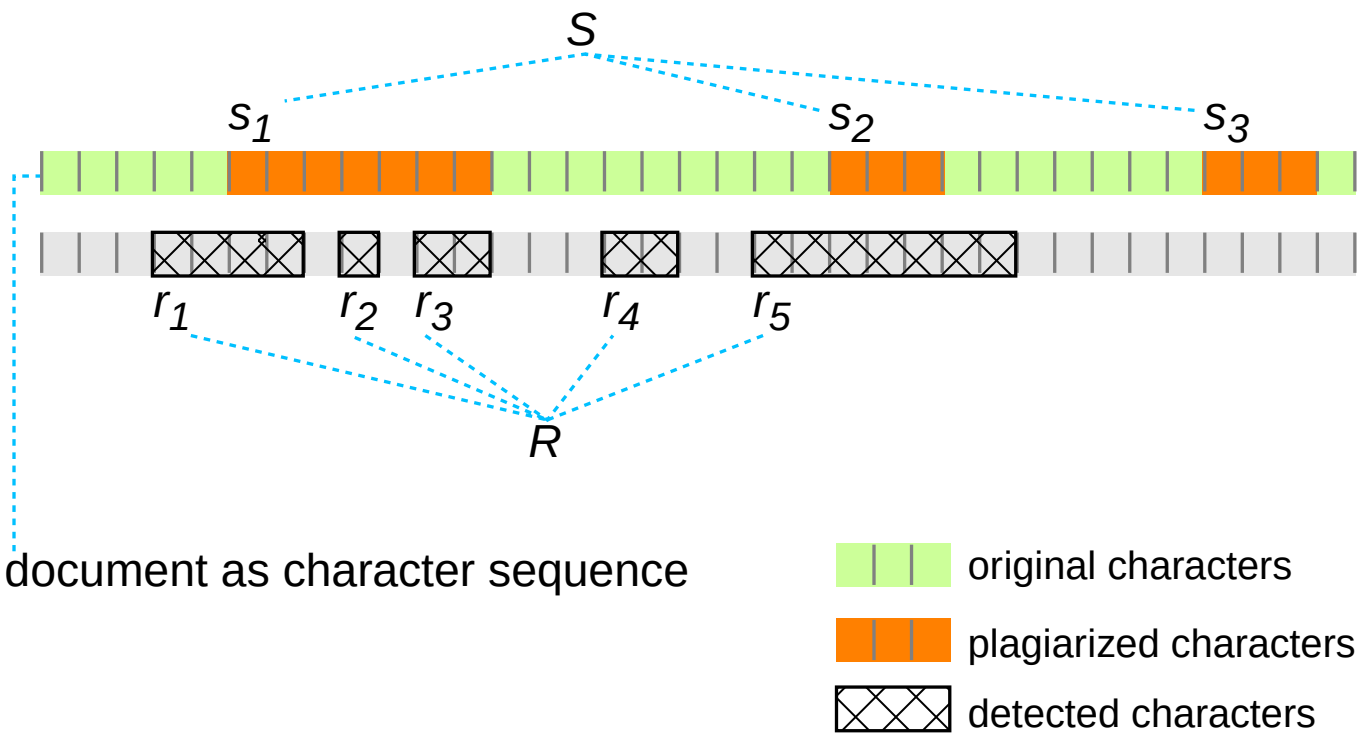
Evaluation Measures



$$prec_{PDA}(S,R) = \frac{1}{|R|} \sum_{r \in R} \frac{|r \sqcap \bigcup_{s \in S} s|}{|r|}$$

($\sqcap$ computes the positionally overlapping characters)

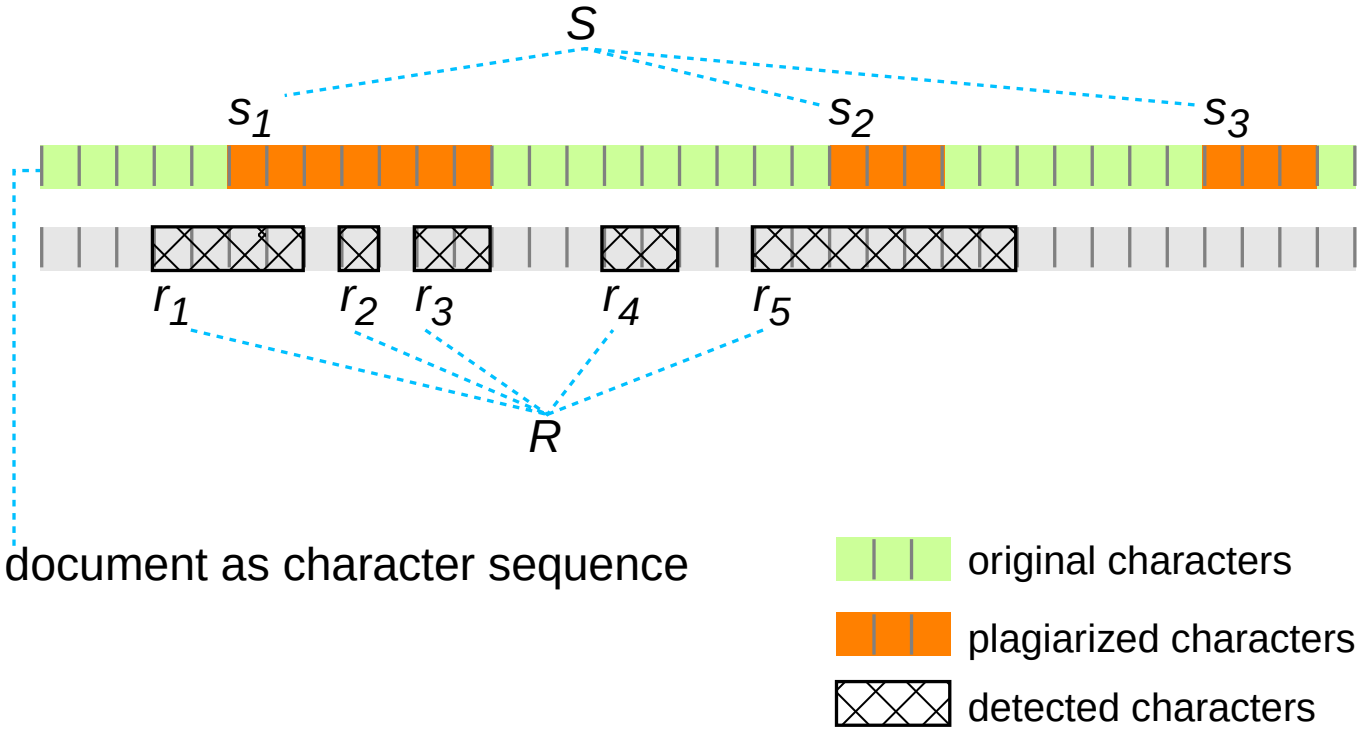
Evaluation Measures



$$gran_{PDA}(S,R) = \frac{1}{|S_R|} \sum_{s \in S_R} |C_s| \quad \in [1, |R|]$$

$$C_s = \{r \mid r \in R \ \wedge \ s \cap r \neq \emptyset\}$$
$$S_R = \{s \mid s \in S \ \wedge \ \exists r \in R: \ s \cap r \neq \emptyset\}$$

Evaluation Measures



$$overall_{PDA}(S,R) = \frac{F}{\log_2(1 + gran_{PDA})}$$

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1st Intl. Competition on Plagiarism Detection

http://www.webis.de/research/workshopseries/pan-09/competition.html

http://ceur-ws.org/Vol-502

1st Intl. Competition on Plagiarism Detection

13 research teams

Europe (8) America (3)
Asia (1.5) Africa (0.5)

Intrinsic Approaches (4 teams)

Participant	Analyzed features
Stamatatos	character n-grams
Zechner, Muhr, Kern, Granitzer	word freq. class + text frequencies
Seaward, Matwin	Kolmogorov complexity measures

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External Approaches (10 teams)

Participant	Comparison units
Grozea, Gehl, Popescu	character n-grams
Kasprzak, Brandejs, Kripac	word n-grams
Basile, Benedetto, Caglioti, Degli Esposti	length n-grams

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2nd Intl. Competition on Plagiarism Detection

17 teams registered

Europe (9) Asia (5) America (3)

http://pan.webis.de

2nd Intl. Competition on Plagiarism Detection

PAN 2010 LAB
Uncovering Plagiarism, Authorship, and Social Software Misuse

sponsored by YAHOO! RESEARCH

held in conjunction with CLEF2010 Padua

17 teams registered

Europe (9) Asia (5) America (3)

- PAN-PC-09 corpus → PAN 2010 training corpus
- PAN 2010 test corpus composed of around 40,000 documents

http://pan.webis.de

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Final Remarks

- First standardized corpus dedicated to the evaluation of automatic plagiarism detection

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- New performance measures to evaluate plagiarism detection have been proposed

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- New performance measures to evaluate plagiarism detection have been proposed
- Two weeks to submit detections for PAN 2010's competition!

Thank you!

http://pan.webis.de

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