USING TEXT SEGMENTATION ALGORITHMS FOR THE AUTOMATIC GENERATION OF E-LEARNING COURSES

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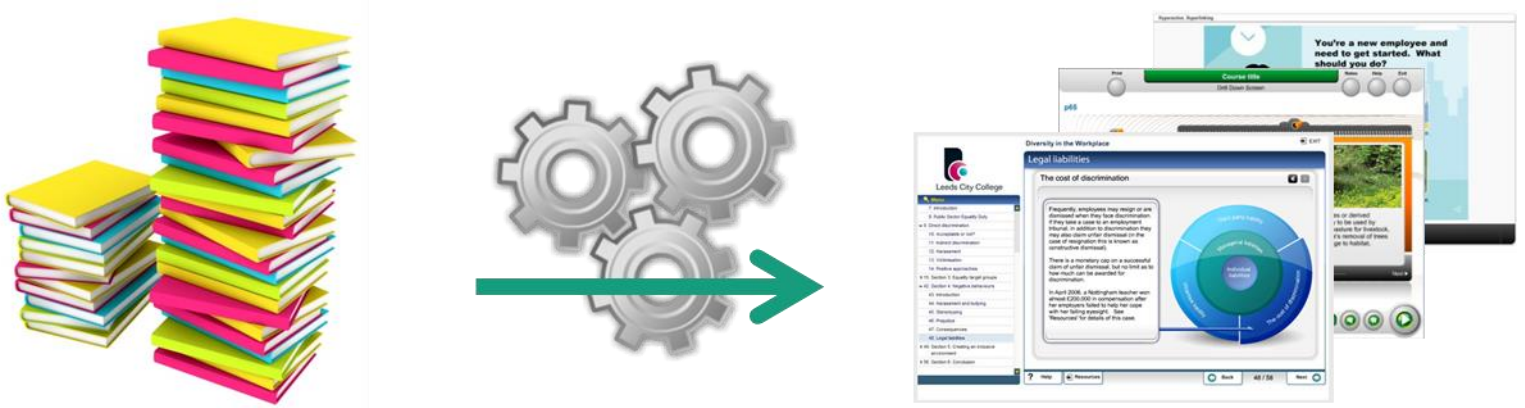


Agenda

- Introduction & Motivation
- Text Segmenters Application and Experimental Setup
  - Test Corpus
  - Segmentation Algorithms
  - Performance Measures
- Evaluation Results
- Conclusion

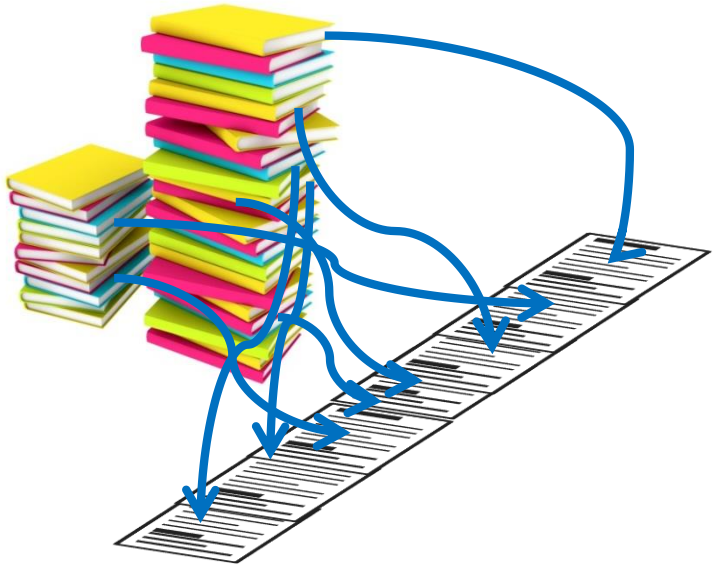
Vision & Research Question

Reduce time consuming effort of e-learning course creation – generate courses automatically

When, where and how successful can text segmentation algorithms be applied?

Motivation

Our 2-Level E-Learning Course Structure: Concept Containers (CC) and Knowledge Objects (KO)



Course = {CC_1, CC_2, ..., CC_n}

Chapters

CC_1 = {KO_1,KO_2,... ,KO_n}

Pages

KO_1 =

- *How to project texts on two-level course structure?*
- *How can we evaluate the usability of text segmentation algorithms for that task?*

Setup Overview

Source

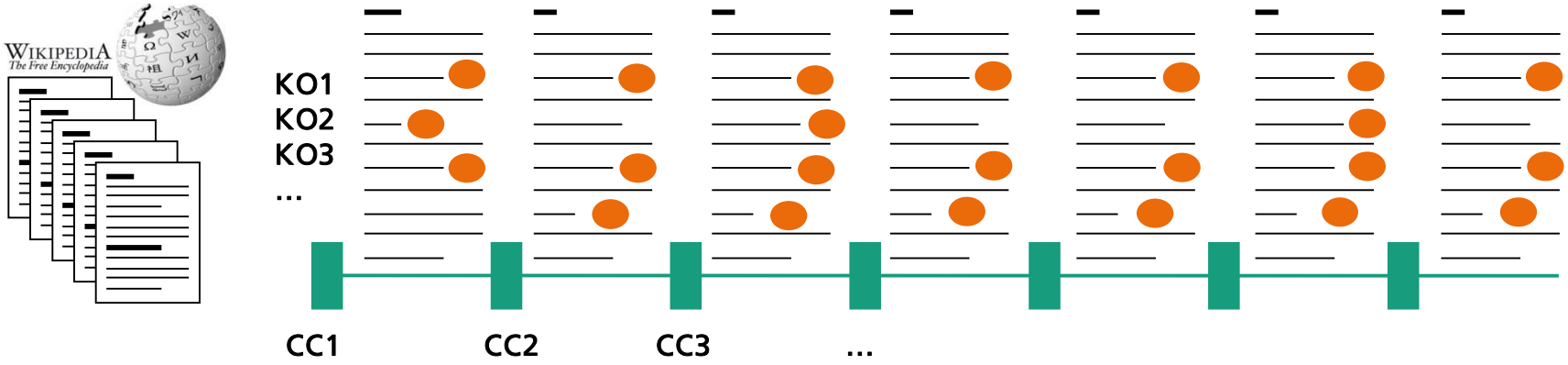
Test Corpus

Segmentation Algorithms

Performance Measures

Corpus

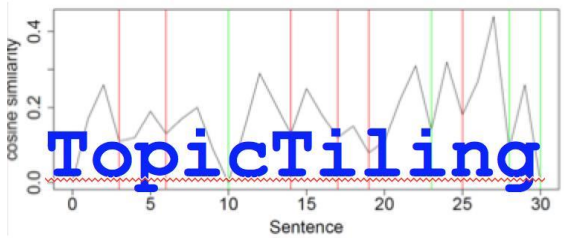
- Samples of unstructured text
- Sections from 530 featured Wikipedia articles, 6 categories
  - Ground truth on Macro and micro level to measure segmentation performance
- Macro level low coherence, micro level high coherence
- 1200 macro samples, 8231 micro samples



Segmentation Algorithms

```
while(noSuccess)
{
        tryAgain();
        if(Dead)
                break;
}
```

- Macro Level | Topics | *ConceptContainers*

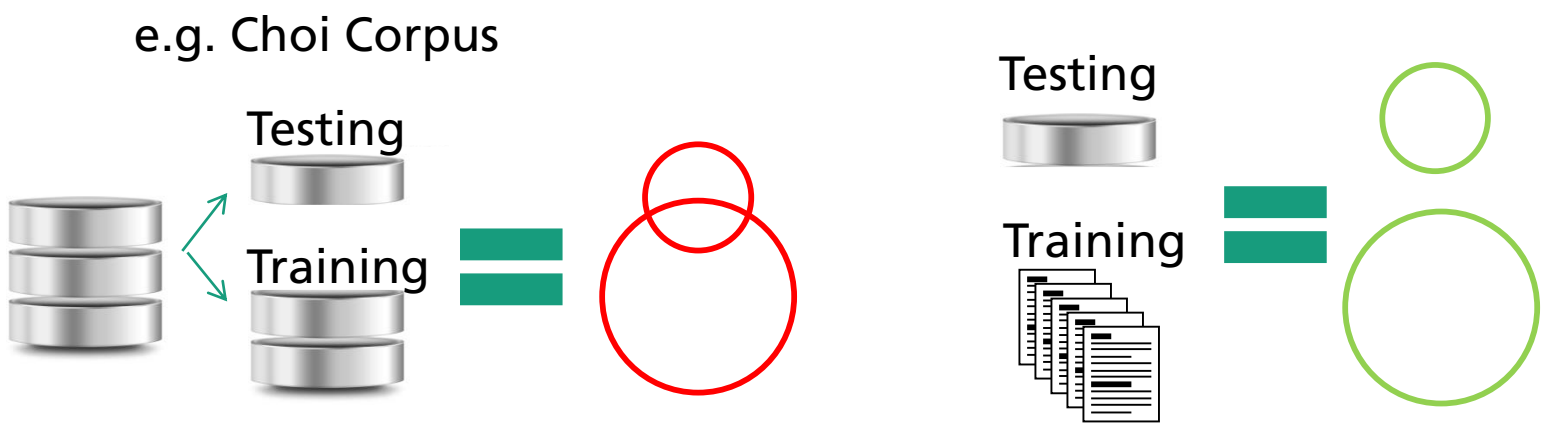
→ 

(Riedl & Biemann, 2012)

- Micro Level | Units | *KnowledgeObjects*

→BayesSeg (Eisenstein & Barzily, 2008)

Training & Testing - LDA based segmentation algorithms



Consequences for the number of folds (k) used in cross validation:

k	Test Set Size (Macro)	Training Set Size
10	#samples = 120 10%	139±7 featured Articles (26% of all articles) ☹
20	60 5 %	267±8 featured Articles (51% of all articles)
30	40 3 %	338±7 featured Articles (64% of all articles) ☺

Performance Measures

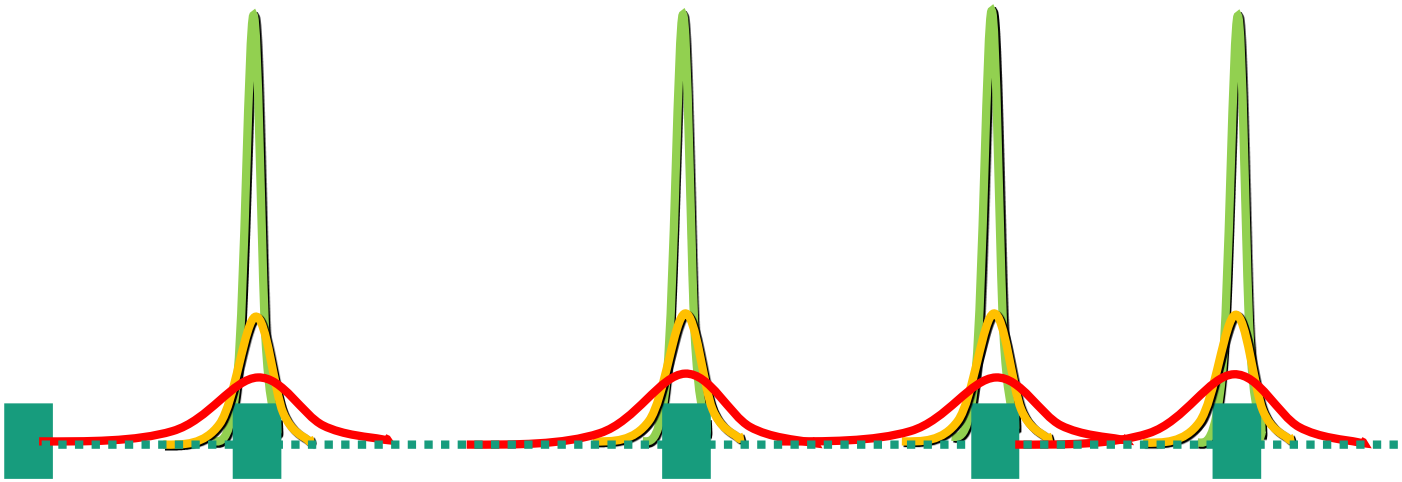
- Different metrics to measure segmenter performance
- Penalty metrics
  - Probability Metric (Doug et al. 1998)
  - Window Diff (Pevzner & Hearst, 2002)
- Rewarding metric
  - Boundary Similarity (Fournier & Inkpen 2013)

- Problem: What does 0.2 mean?

?

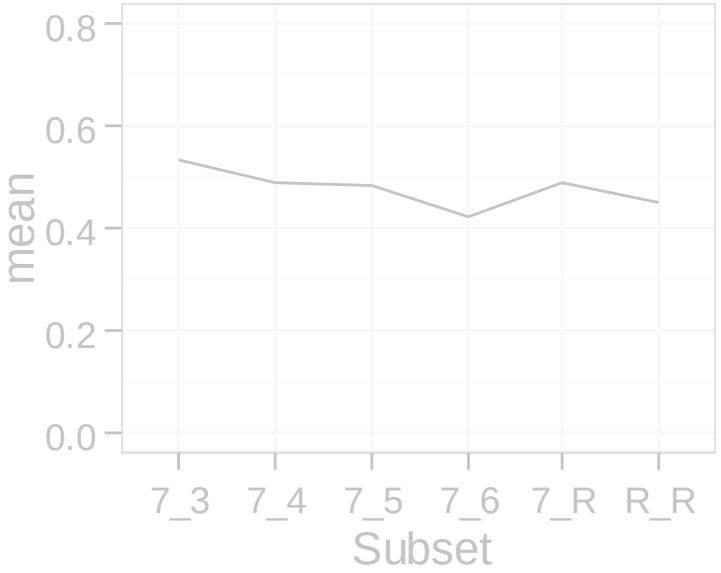
Scalable Segmentation Performance – a new baseline

Distance from true boundary	Standard deviation in % of avg. number of sentences
very close	$\sigma \in (0, 5]$
close	$\sigma \in (5, 15]$
large	$\sigma \in (15, 30]$

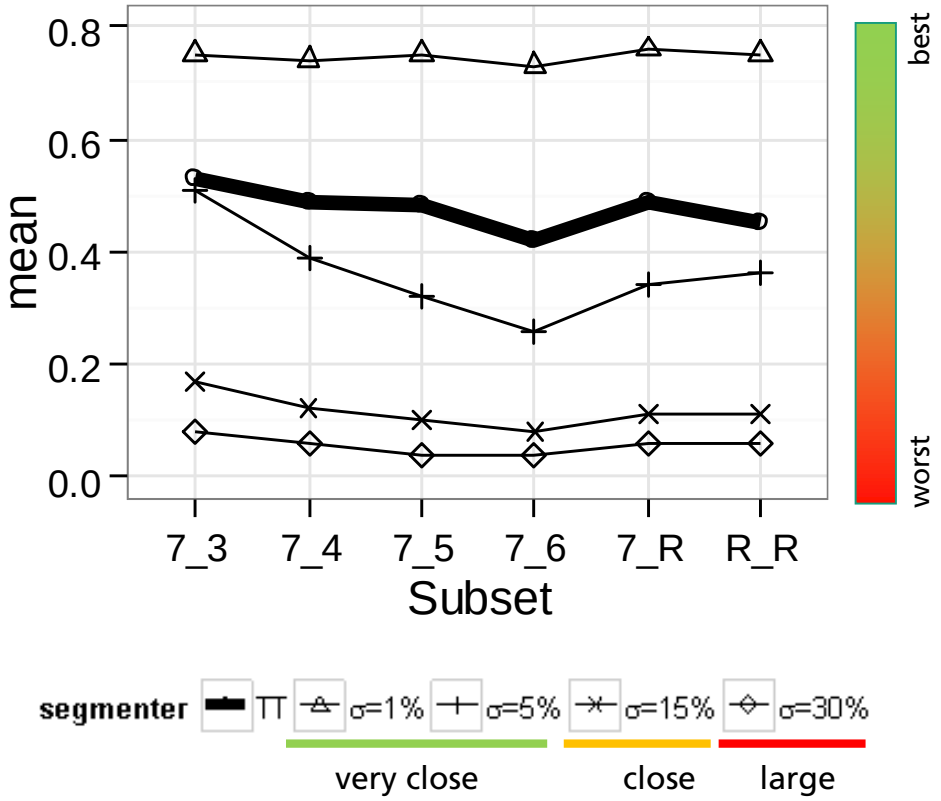


Results for TopicTiling on Macro Dataset

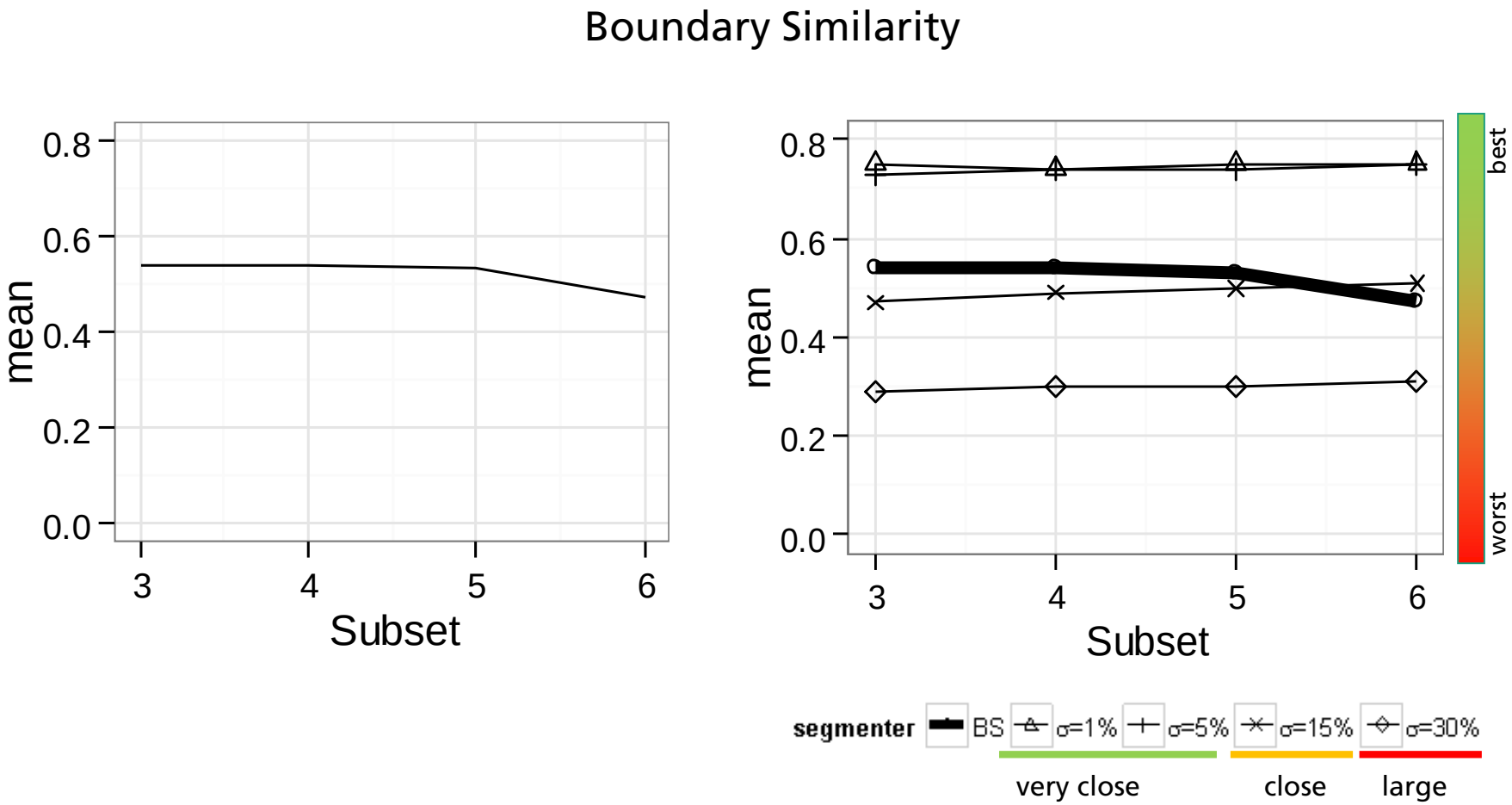
Boundary Similarity



With random segmenter as baseline:



Results for BayesSeg on Micro Dataset



Conclusion

- 2-level CC/KO block structure is extracted from unstructured text
- CC/KO structure forms basis for learning objects
- Good results on both levels in relation to own baseline
- Increased interpretability with presented baseline approach

Future Work:

- Comparison of other segmenters with RS on benchmark dataset, to gain unified overview
- Create full e-learning corpus based on real courses for further evaluation

Discussion

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Related Work

- Model-based; content-generation for e-learning courses based on existing course material (Sathiyamurthy & Geetha, 2011)
  - hierarchical domain ontology
  - pedagogical ontology
  - LDA based segmentation

- Adaptation of existing courses to the learner or instructional plans
  - Particle swarm based content organization (Lin et al., 2009)
  - Large-scale course generation (Tan et al., 2010)

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