Automatic Detection of Linguistic Quality Violations

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Bachelor Thesis Defense
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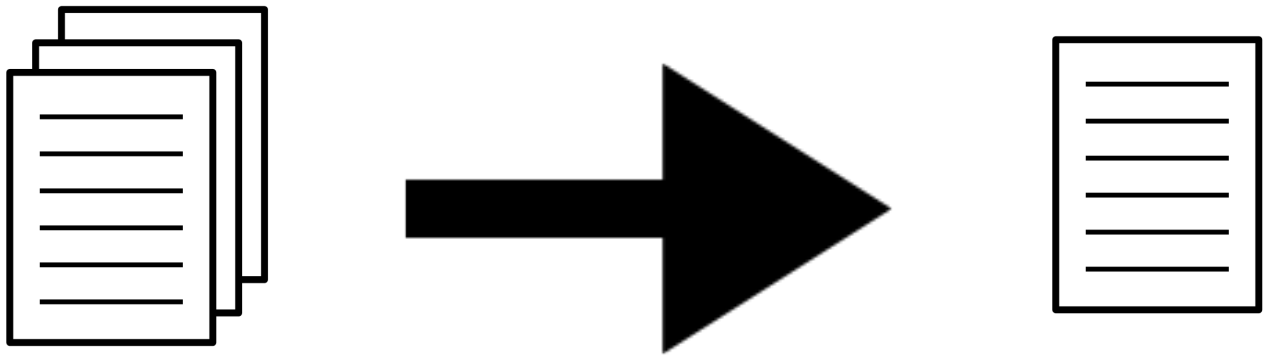
21.08.2014

Automatic Summarization



Automatic Summarization

- **Single-Document:** One document
- **Multi-Document:** Multiple documents on the same topic

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- **Extractive:** New summary from source sentences

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	Single-document	Multi-document
Abstractive		
Extractive		

Linguistic Quality Violations

Summarization systems should produce coherent and grammatical output.

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Summarization systems don't produce coherent and grammatical output.
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- It's hard.

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$\Rightarrow$ LQVSumm (Friedrich et al., 2014)

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- Entity level:
  - definite noun phrase without reference to previous mention
  - pronoun with missing antecedent
  - acronym without explanations
  - ...

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- Entity level:
  - definite noun phrase without reference to previous mention
  - pronoun with missing antecedent
  - acronym without explanations
  - ...
- Clause level:
  - **incomplete sentence (INCOMPLSN)**
  - **inclusion of datelines (INCLDATE)**
  - **other ungrammatical form (OTHRUNGR)**
  - no semantic relatedness (NOSEMREL)
  - **redundant information (REDUNINF)**
  - no discourse relation (NODISREL)

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- 1935 summaries (TAC part)
- few occurences of some types
- corpus preprocessing with CoreNLP (Manning et al., 2014)
- unit of annotation (clauses vs. sentences)
- OTHRUNGR has different violation subtypes (annotated by us)

Development and Test Sets

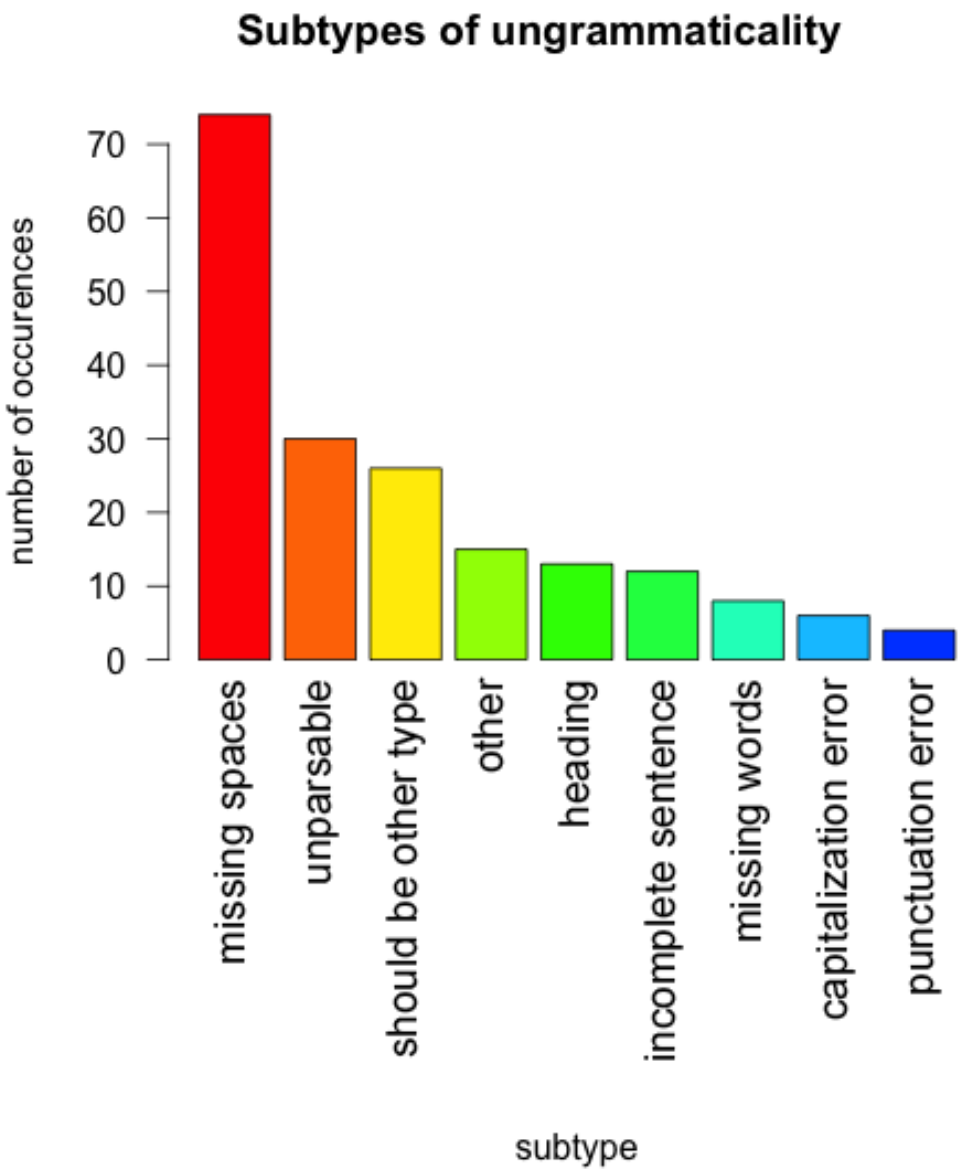
2 development sets:

- *dev-1*: 20% (D1101-D1108, 351 summaries)
- *dev-2*: 20% (D1109-D1116, 352 summaries)

1 test set:

- *test*: 60% (D1117-D1144, 1232 summaries)

Ungrammaticality (OTHRUNGR+INCOMPLSN) on *dev-2*



Detecting missing spaces

"A strong earthquake measuring 7.8 magnitude struck **Wenchuancounty** *of Sichuan Province on Monday, leaving at least* **12,000people** *died and thousands more injured."*

"Virginia Tech reported a campus shooting Monday and told **studentsto** *stay inside their residences and away from windows."*

"A gunman opened fire on classrooms at Virginia Tech University **onMonday** *morning, killing at least 30 people before turning his* **gunon** *himself in the bloodiest school shooting in US history."*

UnknownTokens

Idea:
Sentence contains violation iff any word $\notin$ known tokens

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known tokens?

- Source documents available? $\rightarrow$ all tokens in source documents = **UnknownTokens-source**
- Otherwise $\rightarrow$ **UnknownTokens-general**

UnknownTokens-general

- Tokens from (parts of) Gigaword = **UnknownTokens-gw**

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- + Wikipedia = **UnknownTokens-gw+heur+ner+wiki**

= **UnknownTokens-general**

UnknownTokens: Evaluation on *dev-2*

	Missing spaces		
	P	**R**	**F**
UT-source	95.9	94.6	95.2

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UT-gw+heur+ner	35.5	97.3	52.0

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UT-gw+heur+ner+wiki	**70.3**	96.0	**81.2**

Learning a classifier to detect ungrammatical sentences

RandomForest (Breiman, 2001) to train decision trees

Features:

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Features:

- classification from **UnknownTokens**
- perplexity scores from language model trained on Gigaword
- number of words
- 3 features from HPSG parser output (Packart, 2011; Copestake, 2002):
  - number of readings
  - RAM usage
  - status

RandomForest: Evaluation on *test*

10-fold cross validation:

	Precision	**Recall**	**F-Score**	**Accuracy**
Baseline (Most frequent class)	-	0	-	77.7
RandomForest	**72.8**	49.1	**58.6**	**84.5**

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Ablation Study:

Feature	Decrease in F-Score
Parser Readings	5.7
Number of Words	2.2
Language Model Perplexity	1.4
Parser RAM	1.3
UnknownTokens Output	0.8
Parser Status	0.4

Datelines (INCLDATE)

BLACKSBURG, Virginia 2007-04-16 18:34: 44 UTC *A gunman opened fire in a dorm and classroom at Virginia Tech on Monday, killing at least 30 people in the deadliest shooting rampage in U.S. history.*

BERLIN, May 13(Xinhua) *The German government announced on Tuesday that it is to provide 500, 000 euros(around 770, 000 U.S. dollars) in aid for earthquake victims in Sichuan Province of China.*

00 a.m.*People are panicking.*

Detecting Datelines

Regular expression:

```
UTC|
^\d{4}-\d{2}-\d{2}|
^[A-Z]{3,}|
^(Jan|Feb|Mar|Apr|May|Jun|Jul|Aug|Sep|Oct|Nov|Dec)
```

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Evaluation on *test*:

Precision	Recall	F-Score
86.0%	89.7%	87.8%

Redundancy (REDUNINF)

Cyclone *Sidr, described as the worst storm in years to hit low-lying and disaster-prone* **Bangladesh**, *crashed into the southwestern coast* **Thursday** *night* **before sweeping north** *over* **the capital Dhaka.**

The **cyclone** *hit the southwestern coast of* **Bangladesh** *on* **Thursday before sweeping north** *to* **the capital Dhaka.**

Unigrams

Mary saw the 5 “elephants”. She saw the horses.

Unigrams

$$\{Mary, saw, the, 5, elephants\}, \{She, saw, the, horses\}$$

- Remove non-alphanumeric characters and split into set of words

Unigrams

$$|\{saw, the\}| = 2$$

- Remove non-alphanumeric characters and split into set of words
- Cardinality of intersection between sets

Unigrams

$$score = \frac{2}{|\{She, saw, the, horses\}|} = 0.5$$

- Remove non-alphanumeric characters and split into set of words
- Cardinality of intersection between sets
- Normalize by maximum overlap

Unigrams

$$0.5 > \textit{threshold}\ ?$$

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Variations: **Bigrams**, **Combined**

Unigrams

$$0.5 > \textit{threshold}\ ?$$

- Remove non-alphanumeric characters and split into set of words
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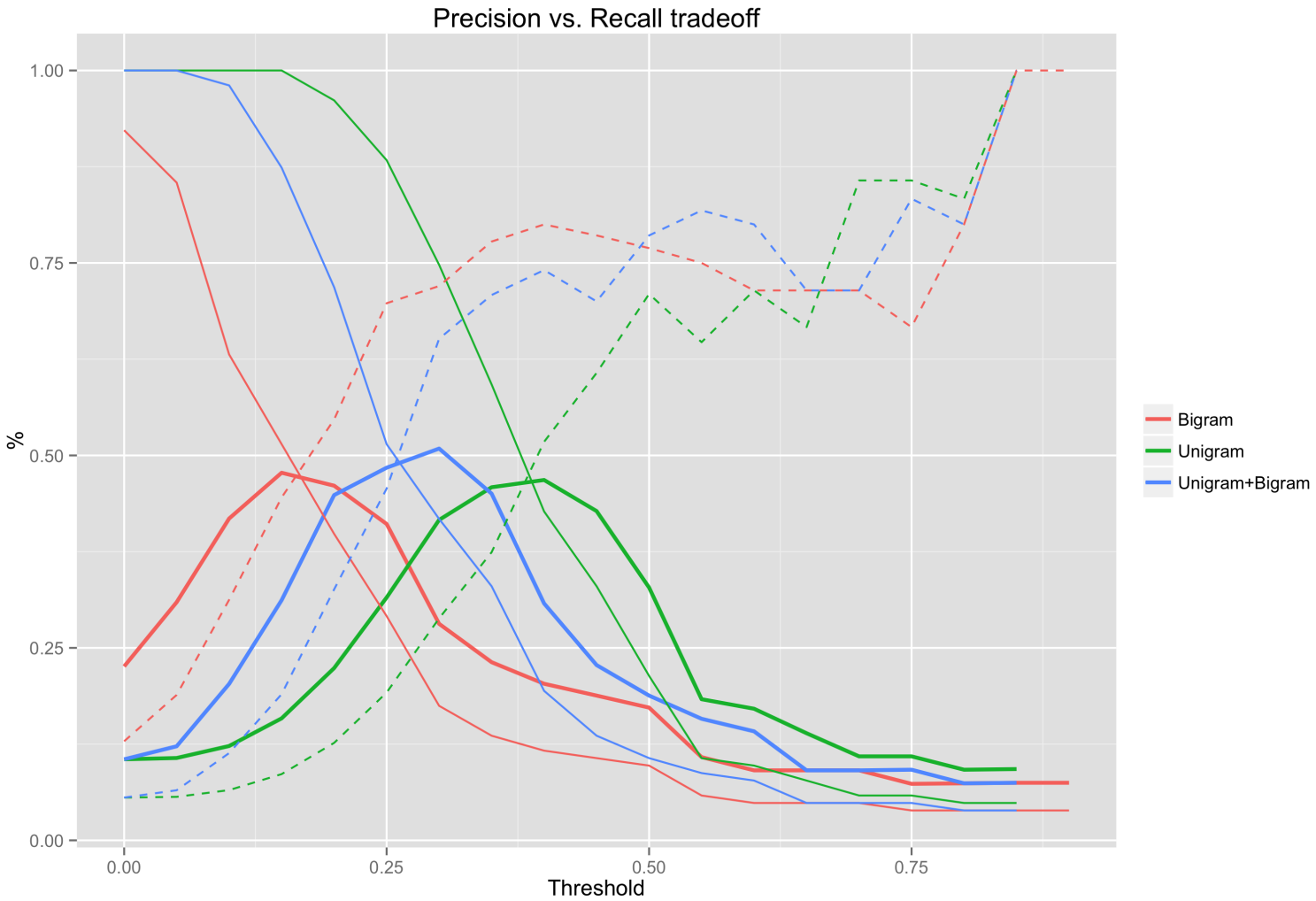
Variations: **Bigrams**, **Combined**

Threshold?

Finding a threshold

dev-1+2



Evaluation of **Unigrams**, ... on *test*

	Unigrams	**Bigrams**	**Combined**
Threshold	0.5	0.4	0.4

	Precision	Recall	F-Score
Baseline	4.5%	**100%**	8.7%
Levenshtein	15.8%	17.3%	3.1%
Unigrams	**58.0%**	28.2%	**37.0%**
Bigrams	55.6%	14.5%	22.9%
Combined	56.8%	24.3%	34.0%

Redundancy: False Negatives

According to a survey by the State **Food and Drug** *Administration, 65 percent of the respondents worried about the food* **safety** *situation in China.*

Food and drug safety *has become a major concern of Chinese people.*

Conclusion

Best methods:

	Precision	Recall	F-Score
Ungrammaticality	72.8	49.1	58.6
Datelines	86.0	89.7	87.8
Redundancy	58.0	28.2	37.0

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Adapted annotation scheme, better for automatic processing

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Adapted annotation scheme, better for automatic processing

Tool will be made available to annotate with our methods

Future Work

Other violations

- pronouns: coreference resolution
- acronyms: finding full form near first unexpanded form
- mentions & noun phrases: NER + ?
- no semantic relatedness: semantic parsing? Wordnet distance?
- no discourse relation: discourse parsing, does connective match relation?

Future Work

Ungrammaticality

- detection methods for other subtypes

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Ungrammaticality

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Redundancy

- include contextual information
- include source document information
- semantic approaches

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- detection methods for other subtypes

Redundancy

- include contextual information
- include source document information
- semantic approaches

Corpus

- annotate a corpus with subtypes, sentence based
- evaluate methods on other data sets/corpora/domains

References

Breiman, L. (2001). Random forests. *Machine learning*, 45(1):5–32.

Copestake, A. (2002). *Implementing typed feature structure grammars*, volume 110. CSLI publications Stanford.

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Manning, C. D., Surdeanu, M., Bauer, J., Finkel, J., Bethard, S. J., and McClosky, D. (2014). The Stanford CoreNLP natural language processing toolkit. In *Proceedings of 52nd Annual Meeting of the Association for Computational Linguistics: System Demonstrations*, pages 55–60.

Owczarzak, K. and Dang, H. T. (2011). Overview of the TAC 2011 summarization track: Guided task and AESOP task. In *Proceedings of the Text Analysis Conference (TAC 2011), Gaithersburg, Maryland, USA, November*.

Packart, W. (2011). ACE: the Answer Constraint Engine. `http://sweaglesw.org/linguistics/ace/`. Accessed: 2014-08-20.

Bonus Slide: Full **UnknownTokens** Evaluation

	Missing spaces			No missing spaces		
	P	**R**	**F**	**P**	**R**	**F**
Baseline	0.0	0.0	0.0	94.8	**100**	97.3
$\mathbf{UT_{gw}}$	15.0	**98.7**	26.0	**99.9**	69.1	81.7
$\mathbf{UT_{gw+heur}}$	30.5	97.3	46.5	99.8	87.8	93.4
$\mathbf{UT_{gw+heur+ner}}$	35.5	97.3	52.0	99.8	90.3	94.8
$\mathbf{UT_{gw+heur+ner+wiki}}$	70.3	96.0	81.2	99.8	97.8	98.8
$\mathbf{UT_{source}}$	**95.9**	94.6	**95.2**	99.7	99.7	**99.7**

Bonus Slide: **RandomForest**: Evaluation of all classes

	Precision	**Recall**	**F-Score**
Ungrammatical	72.8	49.1	58.6

Bonus Slide: **RandomForest**: Evaluation of all classes

	Precision	**Recall**	**F-Score**
Ungrammatical	72.8	49.1	58.6
Not ungrammatical	86.6	94.7	90.5
Weighted Average	83.5	84.5	83.4