Automatic Detection of Linguistic Quality Violations

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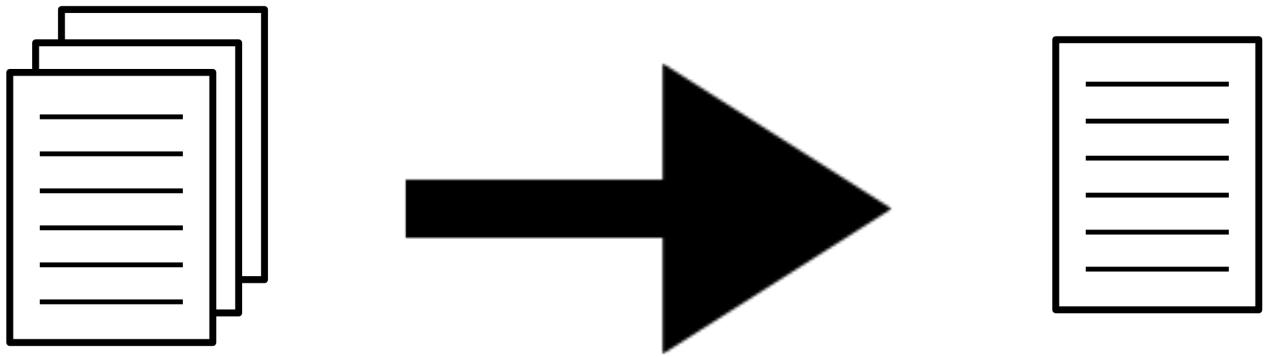
Automatic Summarization



Automatic Summarization

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- **Multi-Document:** Multiple documents on the same topic

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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.
Why?

- It's hard.

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

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Annotated results of TAC 2011 Guided Summarization task (Owczarzak and Dang, 2011)

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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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Annotated results of TAC 2011 Guided Summarization task (Owczarzak and Dang, 2011)

- 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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- unit of annotation (clauses vs. sentences)
- OTHRUNGR has different violation subtypes

Development and Test Sets

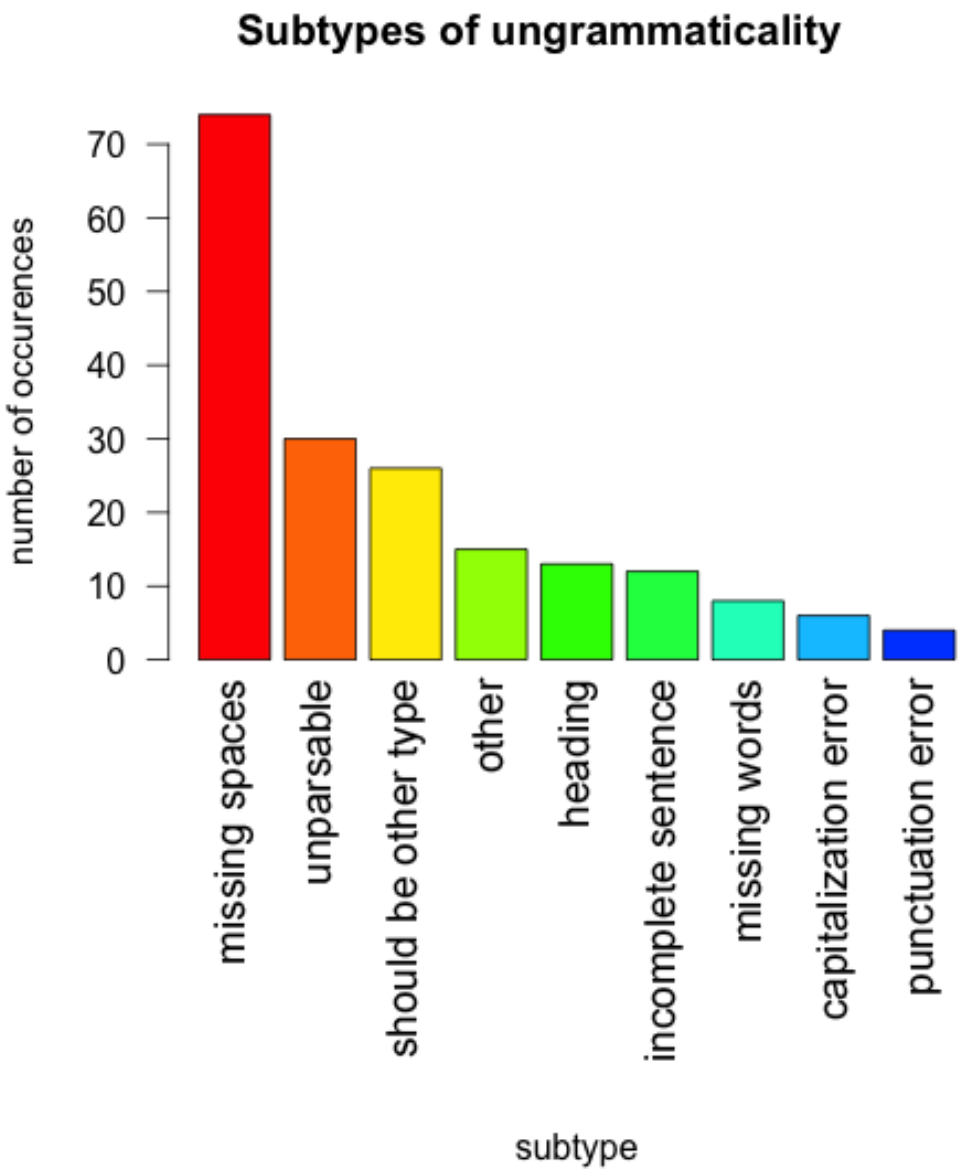
2 development sets:

- *dev-1*: 20% (D1101-D1108)
- *dev-2*: 20% (D1109-D1116)

1 test set:

- *test*: 60% (D1117-D1144)

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 = $\textbf{UnknownTokens}_{\textbf{source}}$
- Otherwise $\rightarrow$ $\textbf{UnknownTokens}_{\textbf{general}}$

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- Tokens from (parts of) Gigaword = $\mathbf{UnknownTokens}_{\mathbf{gw}}$

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- + Wikipedia = $\textbf{UnknownTokens}_{\textbf{gw+heur+ner+wiki}}$

UnknownTokens: Evaluation on *dev-2*

	Missing spaces		
	P	**R**	**F**
UT$_{\text{source}}$	95.9	94.6	95.2

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	Missing spaces		
	P	**R**	**F**
$\mathbf{UT_{source}}$	95.9	94.6	95.2
$\mathbf{UT_{gw}}$	15.0	**98.7**	26.0

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UnknownTokens: Evaluation on *dev-2*

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$\mathbf{UT_{gw+heur+ner+wiki}}$	**70.3**	96.0	**81.2**

RandomForest

RandomForest (Breiman, 2001) to train decision trees

Features:

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- classification from **UnknownTokens**

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RandomForest (Breiman, 2001) to train decision trees

Features:

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

RandomForest: Evaluation on *test*

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

Ablation Study:

Feature	Decrease in Accuracy
UnknownTokens Output	0.3369
Language Model Perplexity	1.2091
Number of Words	0.7334
ACE RAM	1.0901
ACE Readings	1.3478
ACE Status	0.1982

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)

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.*

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 sentence length

Unigrams

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

- Remove non-alphanumeric characters and split into set of words
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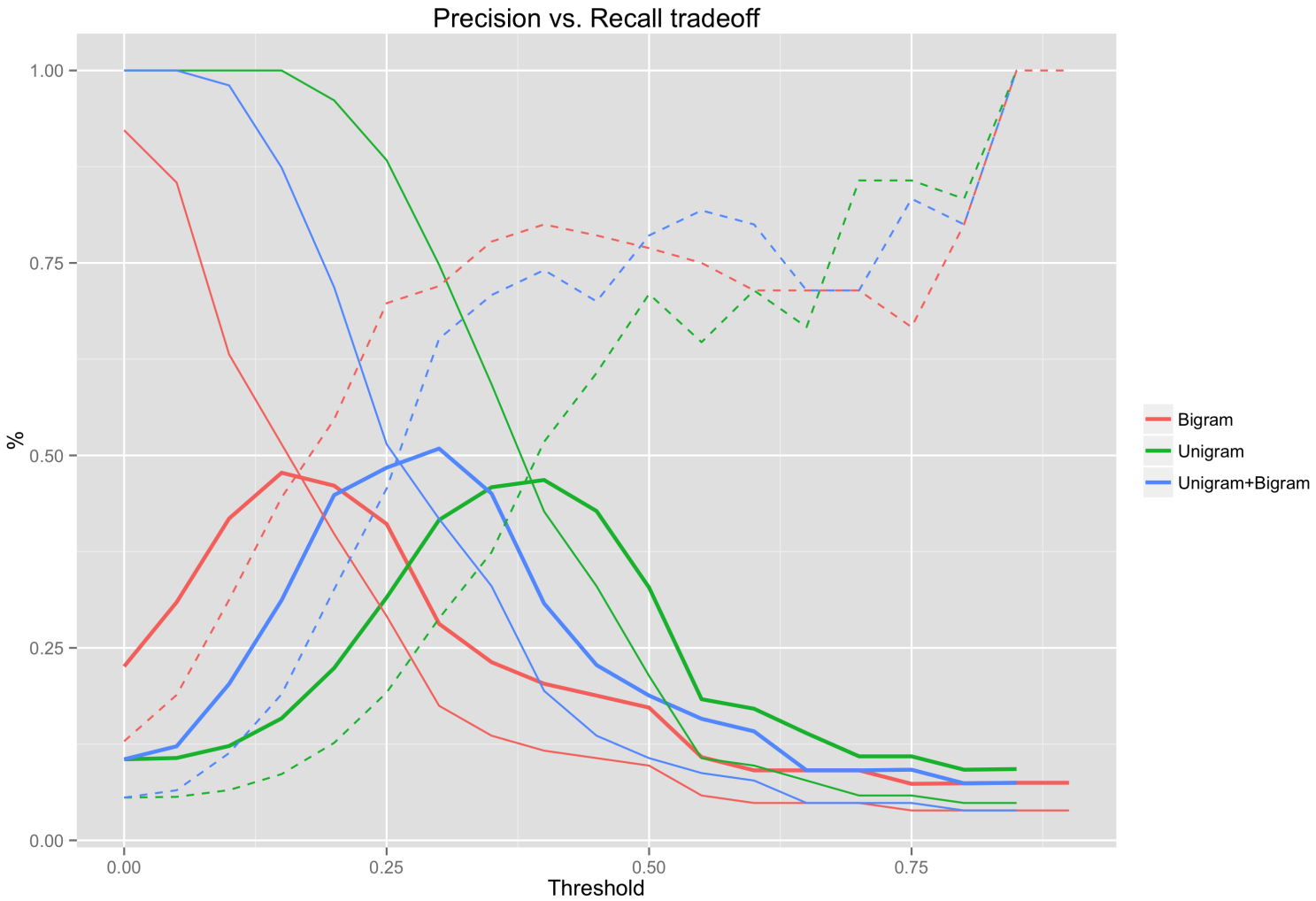
- Classify with threshold

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%

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

- detection methods for other subtypes

Redundancy

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

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Ungrammaticality

- 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

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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