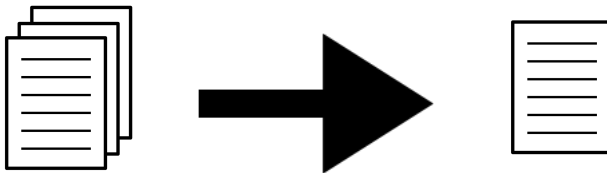


Automatic Detection of Linguistic Quality Violations

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Bachelor Thesis Defense
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Automatic Summarization



Automatic Summarization

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

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- ▶ **Abstractive:** Internal semantic representation + generation
- ▶ **Extractive:** New summary from source sentences

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	Single-document	Multi-document
Abstractive		
Extractive		

Summarization systems should produce coherent and grammatical output.

Summarization systems **don't produce coherent and grammatical output.**

Why?

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⇒ LQVSumm (Friedrich et al., 2014)

Annotated automatically created summaries from TAC 2011
Guided Summarization task (Owczarzak and Dang, 2011)

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- ▶ Entity level:
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 - ▶ 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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- ▶ few occurrences of some types

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- ▶ 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

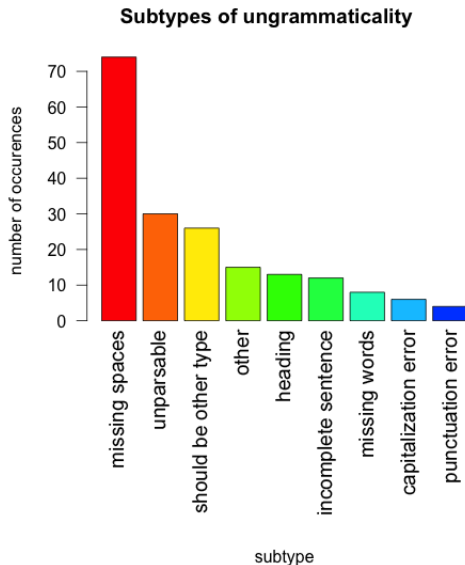
2 development sets:

- ▶ *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.”*

Unknown Tokens

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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 - ▶ + NER (Finkel et al., 2005) =
UnknownTokens-gw+heur+ner
 - ▶ + 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

UnknownTokens: Evaluation on *dev-2*

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	P	R	F
UT-source	95.9	94.6	95.2
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UnknownTokens: Evaluation on *dev-2*

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UnknownTokens: Evaluation on *dev-2*

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UT-gw+heur+ner	35.5	97.3	52.0
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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Learning a classifier to detect ungrammatical sentences

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 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
UnknownTokens Output	0.8
Language Model Perplexity	1.4
Number of Words	2.2
Parser RAM	1.3
Parser Readings	5.7
Parser Status	0.4

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%

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.

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

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

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

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

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

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

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

$0.5 > \textit{threshold} ?$

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

$0.5 > \textit{threshold} ?$

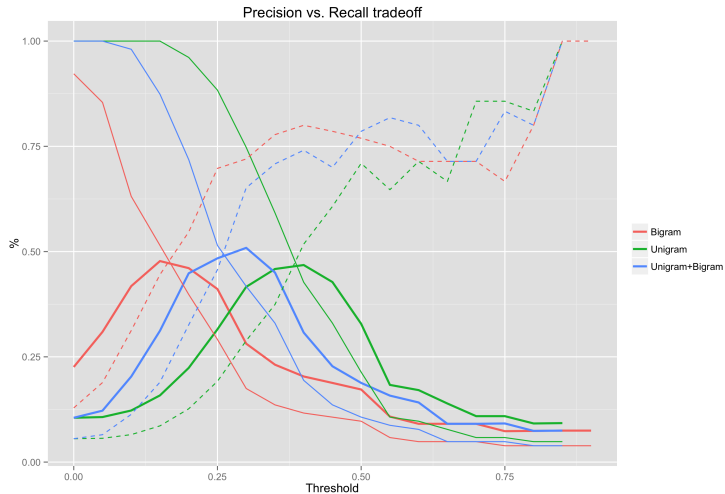
- ▶ Remove non-alphanumeric characters and split into set of words
- ▶ Cardinality of intersection between sets
- ▶ Normalize by maximum overlap
- ▶ Classify with threshold

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%

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.*

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

Best methods:

	Precision	Recall	F-Score
Ungrammaticality	72.8	49.1	58.6
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Adapted annotation scheme, better for automatic processing

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Redundancy	58.0	28.2	37.0

Adapted annotation scheme, better for automatic processing

Tool will be made available to annotate with our methods

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?

Ungrammaticality

- ▶ detection methods for other subtypes

Ungrammaticality

- ▶ detection methods for other subtypes

Redundancy

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

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Redundancy

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- ▶ include source document information
- ▶ semantic approaches

Corpus

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

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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
UT_{gw}	15.0	98.7	26.0	99.9	69.1	81.7
UT_{gw+heur}	30.5	97.3	46.5	99.8	87.8	93.4
UT_{gw+heur+ner}	35.5	97.3	52.0	99.8	90.3	94.8
UT_{gw+heur+ner+wiki}	70.3	96.0	81.2	99.8	97.8	98.8
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