What's important in a text? An extensive evaluation of linguistic annotations for summarization

Markus Zopf, Teresa Botschen, Tobias Falke, Benjamin Heinzerling, Ana Marasovic, Todor Mihaylov, Avinesh P.V.S, Eneldo Loza Mencia, Johannes Fürnkranz and Anette Frank
`https://www.aiphes.tu-darmstadt.de`

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ADAPTIVE INFORMATIONSAUFBEREITUNG AUS HETEROGENEN QUELLEN

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Suppose you are a journalist…

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The **U.S. Congress** will certify the results on January 6, 2017

Donald Trump won the election and will become the 45th president

There are rumors about **Russian interferences** in the elections

Automatic summarization = reduce text length while preserving most important information

1. make text shorter: $|\mathrm{Y}| < \sum_{i=1}^{n} |\mathrm{X}_i|$
2. don‘t add content: $\mathrm{Y} \subseteq \bigcup_{i=1}^{n} \mathrm{X}_i$
3. maximize a utility: $\mathrm{Y}^* = \underset{\mathrm{Y}}{\operatorname{argmax}} \; \boldsymbol{u}(Y)$

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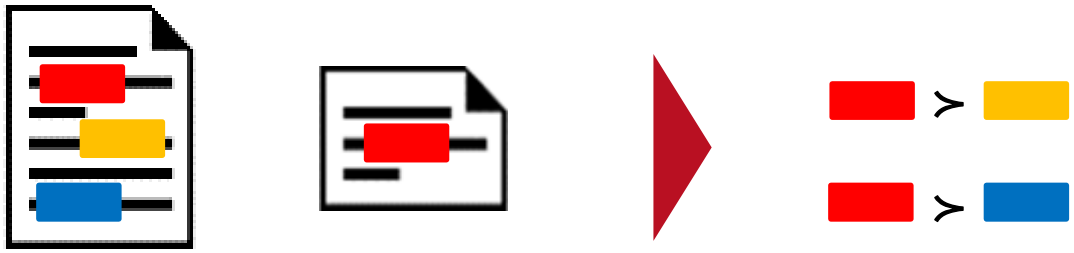
?

Estimating information importance is a key challenge in automatic summarization

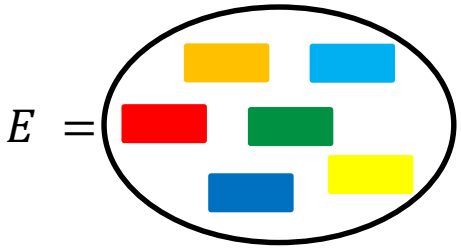
Promoted elements are preferred over not promoted elements



document X^i summary Y^i

- promoted elements $P^i = X^i \cap Y^i = \{$ $\}$
- not promoted elements $N^i = X^i \setminus P^i = \{$, $\}$

$$\mathrm{u}( ) = \frac{1}{|E|} \sum_{e \in E} \frac{n(\succ e)}{n(\succ e) + n(\succ e)}$$



$$E =$$

$$\mathrm{v}(x_j \in X^i) = \frac{1}{|s|} \sum_{e \in S} v(e)$$

Experimental Setup

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Annotations under Investiation

- Unigrams, bigrams, trigrams
- Chunks - parts of sentences with specific grammatical meaning
- Concepts detected with open information extraction
- Verb stems - {killing, killed} → kill
- FrameNet frame annotations
- Connotation frames - subjective roles and relationships
- Discourse Relation Senses, e.g. *causation*, *contrast*, or *concession*

Data used

- DUC 2004, TAC 2008, and TAC 2009 summarization dataset

Rankings for importance estimation evaluation

$x_i \in X$ $\quad Y$

$$\text{Precision} = \frac{x_i \cap Y}{|x_i|}$$

$$\text{Recall} = \frac{x_i \cap Y}{|Y|}$$

P	R
x_4	x_1
x_2	x_7
x_3	x_4
...	...

Dataset Generation

P	R
x_4	x_1
x_2	x_7
x_3	x_4
...	...

target

P	R
x_3	x_5
x_8	x_1
x_4	x_4
...	...

actual

Evaluation

We measure the distance to the target ranking with three different measures

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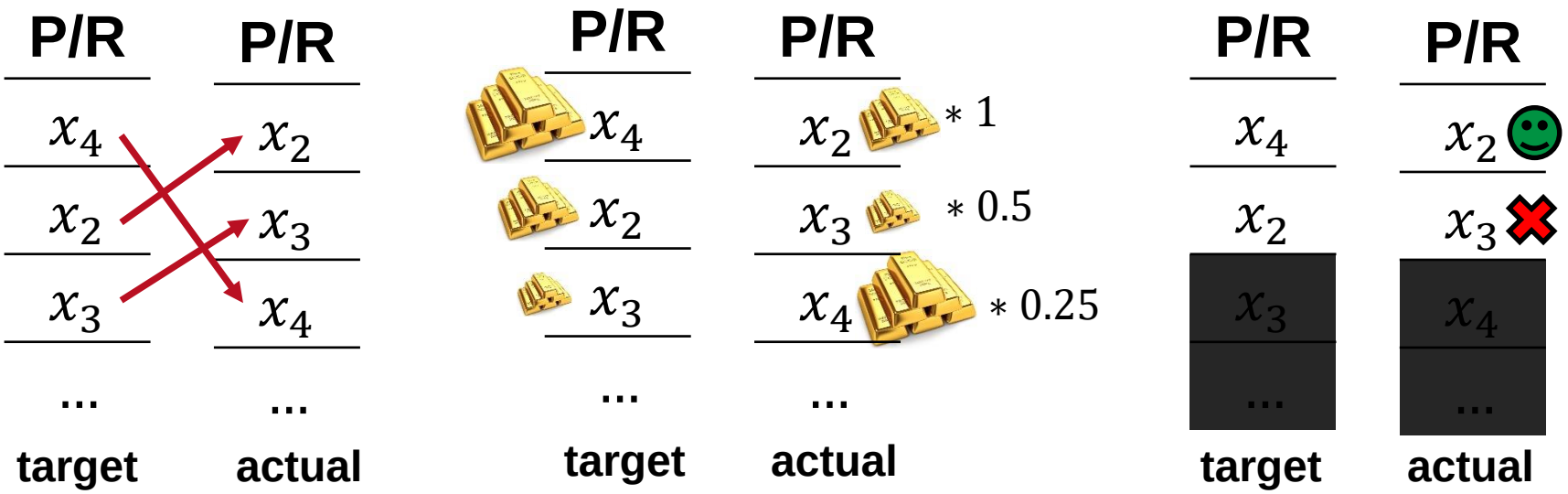

Kendall's Tau

NEW **nDCRS**

precision@k

Preference prediction for importance estimation evaluation

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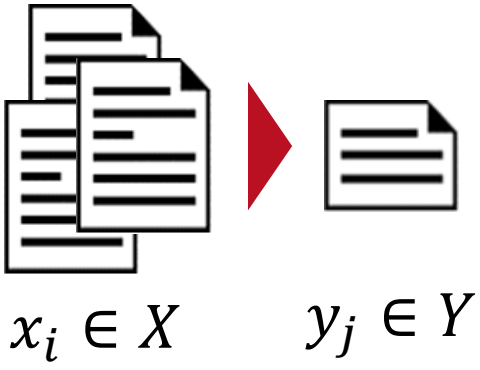

$x_i \in X$ $y_j \in Y$

$x_i \prec y_j$

Dataset Generation

s_i, s_j ?

$s_i \succ s_j$

$s_i \prec s_j$

Evaluation

Ranking on unseen test data shows that simple annotations perform best

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	Kendall's Tau		nDCRS		precision@k	
	P	R	P	R	P	R
bigram	**.306**	**.539**	**.253**	**.863**	**.253**	**.424**
cf-effect-object	-.051	.269	.083	.687	.083	.230
cf-state-subject	-.054	.284	.083	.697	.083	.234
chunk-concepts	**.175**	**.367**	**.206**	**.773**	**.206**	**.298**
concepts-string	.106	.193	.146	.639	.146	.179
concepts-sim	.093	.225	.135	.669	.135	.225
connotation-frames	-.011	.335	.089	.739	.089	.267
entity-importance	-.076	-.060	.107	.510	.107	.193
entity-links	**.135**	.264	**.169**	.709	**.169**	.261
entity-type-coarse	.031	.100	.138	.582	.138	.155
entity-type-corenlp	.075	.358	.132	.766	.132	**.316**
entity-type-figer	.122	.272	.165	.709	.165	.243
entity-type-fine	.117	.269	.163	.708	.163	.236
FN-frames	.027	**.383**	.107	**.772**	.107	.297
FN-frames-nounsOnly	.116	**.474**	.133	**.836**	.133	**.364**
FN-frames-verbsOnly	.010	.209	.096	.639	.096	.186
sentiment-annos	.068	.215	.148	.673	.148	.222
discours-rel	.011	.234	.133	.646	.133	.174
trigram	**.172**	.366	**.186**	.760	**.186**	.241
unigram	**.300**	**.654**	**.260**	**.913**	**.260**	**.515**
verb-stem	.042	.250	.114	.671	.114	.215

Simple annotations do not perform best at preference prediction on unseen test data

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	DUC 2003	DUC 2004	TAC 2008	TAC 2009	average
bigram	**0.573**	0.538	0.415	0.445	0.493
cf-effect-object	0.538	0.520	**0.663**	**0.743**	**0.616**
cf-state-subject	0.548	0.439	0.420	0.512	0.480
chunk-concepts	**0.641**	**0.613**	**0.556**	0.602	**0.603**
concepts-string	0.513	0.429	0.371	0.382	0.424
concepts-sim	0.520	0.468	0.438	0.473	0.475
connotation-frames	0.551	0.556	0.546	0.592	0.561
entity-importance	**0.597**	**0.634**	**0.655**	**0.658**	**0.636**
entity-links	0.510	0.450	0.370	0.364	0.424
entity-type-coarse	0.512	0.487	**0.664**	**0.695**	**0.590**
entity-type-corenlp	**0.582**	**0.608**	0.551	**0.616**	0.589
entity-type-figer	0.495	0.487	0.453	0.408	0.461
entity-type-fine	0.497	0.490	0.456	0.405	0.462
FN-frames	0.474	0.497	0.515	0.496	0.496
FN-frames-nounsOnly	0.521	0.537	0.531	0.539	0.532
FN-frames-verbsOnly	0.490	0.487	0.468	0.507	0.488
sentiment-annos	0.430	0.402	0.353	0.356	0.385
discours-rel	0.550	**0.608**	**0.628**	**0.604**	**0.598**
trigram	0.373	0.285	0.210	0.254	0.281
unigram	**0.617**	**0.601**	0.530	0.553	0.575
verb-stem	0.497	0.517	0.515	0.500	0.507

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Summary


Information importance estimation is a key problem in summarization


we investigated a wide range of annotations to replace bigrams


annotations close to surface work well for ranking input sentences


they do not work well for preference prediction

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