Mining Rhetorical Devices by means of Natural Language Processing

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Chair of Web Technology and Information Systems Prof. Dr. Benno Stein Master Thesis Defense January 23rd, 2018

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What is Rhetoric?



Bob

What is Rhetoric?



What is Rhetoric?



What is a Rhetorical Device?

















Feeling down? Open a bottle, open happiness!

Feeling down? Open a bottle, open happiness!

Feeling down? Open a bottle, open happiness!









Envisioned Applications

Rhetoric-based NLG system



Envisioned Applications



Research Questions



Research Questions





Research Questions





1Detection of
Rhetorical Devices



input









txt

Pipeline – UIMA Ruta



• **UIMA Rule-based Text Annotation** - intuitive and flexible domain specific language for defining patterns of annotations (Klügl et al. [2016]).

Example: DECLARE Sentence; PERIOD #{-> MARK(Sentence)} PERIOD;

... This is a sample sentence. ...

•

Pipeline – Stanford CoreNLP





txt







<•••>

Omission schemes





Control the rhythm of thought









Key to persuasion (according to Aristotle)



Balance schemes

- Enumeration
- Pysma
- Isocolon -bicolon
 - -tricolon
 - -tetracolon



Omission schemes

- Asyndeton
- Hypozeugma
- Epizeugma



- Epanalepsis
- Mesarchia
- Epiphoza
- Mesodiplosis
- Anadiplosis
- Diacope
- Epizeuxis
- Polysyndeton



Custom schemes

- If-conditional 0
- If-conditional 1
- If-conditional 2
- If-conditional 3
- If-counterfactual
- Unless-cond.
- Whether-cond.
- Comparative Adjectives/Adverbs
- Superlative Adjectives/Adverbs

Balance schemes

• Enumeration

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 $\langle \bullet \bullet \bullet \rangle$

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Balance: Enumeration

Enumeration - a rhetorical device used to list a series of details, words or phrases. (literarydevices.net)


























Hypozeugma - placing last, in a construction containing several words or phrases of equal value, the word or words on which all of them depend. (Silva Rhetoricae)

A rooster, a prince and a lion walk into a bar...





















Epanalepsis - repeats the beginning word of a sentence at the end.

Our eyes saw it, but we could not believe our eyes.

Epanalepsis - repeats the beginning word of a sentence at the end.

Our eyes saw it, but we could not believe our eyes.















If-conditional 2 - expresses consequences that are totally unrealistic or will not likely happen in the future.

If I were president, I would cut taxes.

If-conditional 2 - expresses consequences that are totally unrealistic or will not likely happen in the future.



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Evaluation dataset



Evaluation dataset







Omission schemes











Repetition schemes



Omission schemes







Repetition schemes



Omission schemes





Evaluation Results F1-Score



Repetition schemes



Omission schemes









2 Analysis of Rhetorical Devices















Data Preparation

Experiments: datasets

The New York Times



US Presidential Debates 2016



Ben Wiseman [2016]

Data dimensionality



NYT Experiment: data subsampling



NYT Experiment: Findings

"Random" dataset

"Article-length based" dataset



Articles cover multiple dimensions

Hard to deduce particular styles

NYT Experiment: Findings

"Random" dataset

"Article-length based" dataset



Articles cover multiple dimensions

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NYT Experiment: Confounding



NYT Experiment: Confounding









Genre 1	Genre 2	Genre 3	Genre 4



Genre 1	Genre 2	Genre 3	Genre 4














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Findings

NYT Experiment: Frequency



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Genres: Editorial distribution



Style-based frequency of rhetorical devices



Authors				
	EPIPHOZA	REPETITION SCHEMES		
Author	Distribution (%)	Distribution (%)		
Hevesi Dennis	10.74	70.99		
Lewis Paul	12.99	81.93		
Martin Douglas	6.49	55.49		

Authors				
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Hevesi Dennis	10.74	70.99		
Lewis Paul	12.99	81.93		
Martin Douglas	6.49	55.49		
		Good Job, Lewis!		
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Authors						
	SIGN	NIFICANCE	EFFECT-SIZ	E		
Datasets	P-value	Independence	Cramer's V value	Effect		
Hevesi vs. Lewis Lewis vs. Martin Martin vs. Hevesi	$0.015 \ \sim 0 \ 0.017$	TRUE* TRUE TRUE*	$\begin{array}{c} 0.1 \\ 0.15 \\ 0.1 \end{array}$	SMALL SMALL SMALL		
* for $\alpha > 0.001$	* for $\alpha > 0.001$					

Comparatives					
Confounders	Dist	ribution (9	%)		
Genre:	Biography	Editorial	Review		
freedman-news	11.65	25.57	11.75		
norris-markets	22.59	30.06	20.99		
wada haalth	12.04	12 97	16 40		



Genres: tests' results			
SIGN	NIFICANCE	EFFECT-SIZ	Έ
P-value	Independence	Cramer's V value	Effect
~ 0	TRUE	0.16	SMALL
~ 0	TRUE	0.14	SMALL
0.68	FALSE	0.07	SMALL
	Gen SIGN P-value ~ 0 ~ 0 0.68	Genres: tests' res	Genres: tests' resultsSIGNIFICANCEEFFECT-SIZP-valueIndependenceCramer's V value~0TRUE0.16~0TRUE0.140.68FALSE0.07

Topics				
	C	OMPARATI	VES	
Confounders	D	istribution	(%)	
Topics:	Arts	Education	Science	
martin-biography saxon-biography	$\begin{array}{c} 11.95\\ 6.15 \end{array}$	$\begin{array}{c} 10.94 \\ 6.14 \end{array}$	$12.24 \\ 12.50$	
author genre				

Style-based frequency of rhetorical devices

Characteristic style patterns within each dimension



Topics: tests' results						
	SIGNIFICANCE EFFECT-SIZE					
Datasets	P-value	Independence	Cramer's V value	Effect		
Science vs. Education	0.70	FALSE	0.09	SMALL		
Education vs. Arts	0.26	FALSE	0.10	SMALL		
Arts vs. Science	0.19	FALSE	0.10	SMALL		

Style-based frequency of rhetorical devices

Characteristic style patterns within each dimension

Style is more author- and genre-dependent

Presidential Debates: Datasets



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	ASYNDETON	VOICE	BALANCE SCH.
Debate Type	Distribution (%)	Distribution (%)	Distribution (%)
Clinton \rightarrow Trump	15.24	8.07	17.69
Trump \rightarrow Clinton	10.83	5.29	19.92
Trump \rightarrow Clinton	10.83	5.29	19.92



	ASYNDETON	VOICE	BALANCE SCH.	
Debate Type	Distribution (%)	Distribution (%)	Distribution (%)	
$\begin{array}{c} \text{Clinton} \rightarrow \text{Trump} \\ \text{Trump} \rightarrow \text{Clinton} \end{array}$	$15.24 \\ 10.83$	$8.07 \\ 5.29$	17.69 19.92	
Asyndeton = clarity and rhythm				

Presidential Debates: Findings					
		ASYNDETON	VOICE	BALANCE SCH.	
Debate Typ	pe l	Distribution (%)	Distribution (%)	Distribution (%)	
Clinton \rightarrow Tr	ump	15.24	8.07	17.69	
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Acceptance Speech Analysis by Huffington Post					
Candidate	Sent.	Long Sent. (%)	Passive voice (%)	Grade Level (US)	
Hillary Clinton	413	7.26	3.39	5	
Donald Trump	341	16.42	8.8	. 8	

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Donald Trump	341	16.42	8.8	8				

Significance Test

Debate Type	$\textit{Clinton} \ \rightarrow \ \textit{Rest}$	$ $ Clinton \rightarrow Trump	$ $ Trump \rightarrow Clinton	$ $ Trump \rightarrow Rest
$Clinton \rightarrow Rest$		TRUE*	TRUE	TRUE
$Clinton \rightarrow Trump$	TRUE*		TRUE	TRUE
$Trump \rightarrow Clinton$	TRUE	TRUE		$FALSE^{\dagger}$
$Trump \rightarrow Rest$	TRUE	TRUE	FALSE^\dagger	

for $\alpha > 0.01$

[†] for $\alpha > 0.1$

Significance Test



Conclusions

System for rhetorical style identification in high-quality text documents

Rule-based algorithms for detection of RD

Vague style patterns across random and articlelength based subsampling: <u>Confounding</u>

Better style identification with Matching

Rhetorical style depends more on author and genre of writings rather than their topics

Debates: candidates employ different styles

Debates: domain experience trains an adaptive rhetorical style

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Novel framework for detecting rhetorical devices

Comprehensive dataset for evaluation of rhetoric detection systems

Elaborative style patterns and intriguing findings

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Efficiency

1st sentence \rightarrow 5.8 sec.

 2^{nd} sentence $\rightarrow 0.4$ sec.

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Efficiency 1^{st} sentence $\rightarrow 5.8$ sec.

 2^{nd} sentence $\rightarrow 0.4$ sec.

Initialization \rightarrow 1.7 sec.

Future Work

Larger dataset for analysis

Focus of semantical rhetoric

Analysis measures like placement and flows of rhetorical devices



References

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Existing research

- Gawryjołek et al. [2009] authorship identification system based on rhetorical style.
- Strommer [2011] authorial intent detection system based on the anaphora usage.
- Java [2015] machine-learning based authorship identification system using rhetorical devices (based on Gawryjołek et al. [2009])

Evaluation results

Device	Total No.	Precision	Recall	F1-score	Device	Total No.	Precision	Recall	F1-score
Anadiplosis	60	0.76	0.73	0.74	If Conditional Two	60	0.82	0.75	0.78
Asyndeton	60	0.25	0.95	0.4	If Conditional Zero	60	0.71	0.76	0.73
Comparative Adjective	67	0.51	0.61	0.56	If Counterfactual	60	0.84	0.87	0.85
Comparative Adverb	71	0.6	0.62	0.61	Isocolon	180	0.57	0.83	0.68
Diacope	60	0.75	0.73	0.74	Mesarchia	20	0.45	0.85	0.59
Enumeration	60	0.76	0.93	0.84	Mesodiplosis	40	0.28	0.68	0.4
Epanalepsis	60	0.63	0.83	0.72	Passive Voice	60	0.79	0.98	0.87
Epiphoza	60	0.61	0.93	0.74	Polysyndeton	60	0.77	0.7	0.73
Epizeugma	60	0.68	0.7	0.69	Pysma	60	1	1	1
Epizeuxis	60	0.79	0.77	0.78	Superlative Adjective	70	0.62	0.73	0.67
Hypozeugma	60	0.61	0.8	0.69	Superlative Adverb	70	0.63	0.5	0.56
If Conditional One	60	0.78	0.78	0.78	Unless Conditional	60	1	1	1
If Conditional Three	60	0.86	0.65	0.74	Whether Conditional	60	1	0.83	0.91

- Balance schemes

- Omission schemes

- Repetition schemes

- Custom schemes

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If-conditional Detection



If-counterfactual Detection



Presidential Debates: Findings



Comparatives						
Distribution (%)						
11.00						
7.02						