IŻ SWÓJ JĘZYK MAJĄ!
An exploration of the computational methods for identifying language variation in Polish

Maria Irena Szawerna

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SUPERVISOR: ALEKSANDRS BERDICEVSKIS
EXAMINER: ASAD SAYEED
OPPONENT: NADINA-MARIANA SUDITU

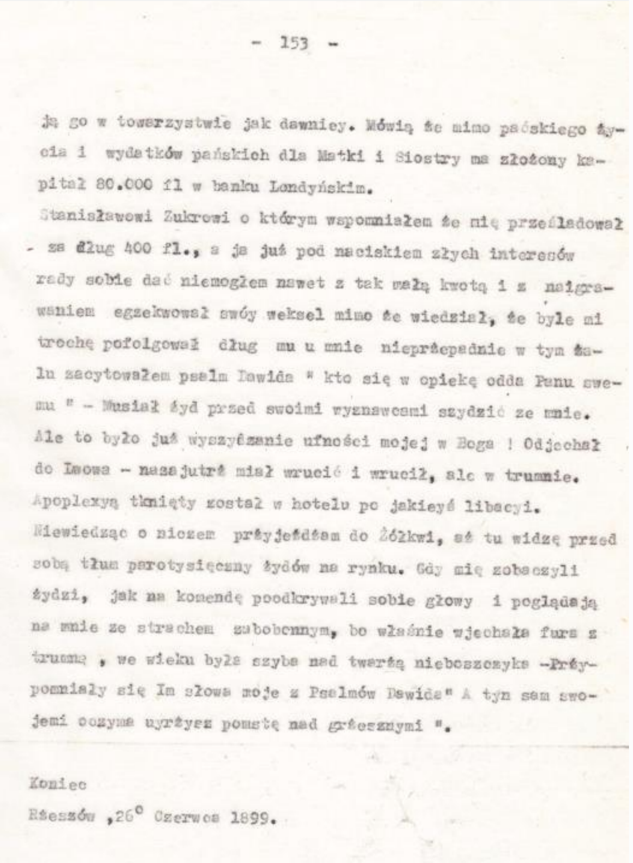
A niechaj narodowie wżdy postronni znają,
*Iż Polacy nie gęsi, **iż swój język mają!***

And may the other nations finally know
that Poles are not geese, **that they have their own language!**

Mikołaj Rej, 1562

Roadmap

- Data
  - Example
- Research Questions
- Background and Related Work
- Experiments
- Results
- Ethical Considerations
- Critiques and Limitations
- Future Work
- Conclusions



- 153 -

ją go w towarzystwie jak dawniey. Mówią że mimo pańskiego życia i wydatków pańskich dla Matki i Siostry ma złożony kapitał 80.000 fl w banku Londyńskim.

Stanisławowi Zukrowi o którym wspomniałem że mię prześladował - za dług 400 fl., a ja już pod naciskiem złych interesów rady sobie dać niemogłem nawet z tak małą kwotą i z naigrawaniem egzekwował swóy weksel mimo że wiedział, że byle mi trochę pofolgował dług mu u mnie nieprzepadnie w tym żalu zacytowałem psalm Dawida " kto się w opiekę odda Panu swemu " - Musiał żyd przed swoimi wyznawcami szydzić ze mnie.

Ale to było już wyszydzanie ufności mojej w Boga ! Odjechał do Lwowa - nazajutrz miał wrucić i wrucił, ale w trumnie.

Apoplexyą tknięty został w hotelu po jakieyś libacyi.

Niewiedząc o niczem przyjeżdżam do Żółkwi, aż tu widzę przed sobą tłum parotysięczny żydów na rynku. Gdy mię zobaczyli żydzi, jak na komendę poodkrywali sobie głowy i pogląda ją na mnie ze strachem zabobonnym, bo właśnie wjechała fura z trumną , we wieku była szyba nad twarzą nieboszczyka -Przypomniały się Im słowa moje z Psalmów Dawida" A tym sam swojemi oczyma uyrzysz pomstę nad grzesznymi ".

Koniec

Rzeszów ,26° Czerwca 1899.

Data

- 1899 memoir.
- Copied over from a manuscript.
- Visible variation in e.g. spelling, still intelligible for a native speaker.
- Manual UD-style annotation (with pre-annotation).
  - Total: 37 405 tokens.
  - UPOS-annotated: 10 286 tokens.
  - XPOS-annotated, lemmatized: 3271 tokens.

Data – example

Original:

Odjechał do Lwowa – nazajutrż miał wrucić i wrucił, ale w trumnie.
Apoplexyą tknięty został w hotelu po jakieyś libacyi.

Modernized spelling:

Odjechał do Lwowa – nazajutrz miał wrócić i wrócił, ale w trumnie.
Apopleksją tknięty został w hotelu po jakiejś libacji.

Heavily modernized language:

Pojechał do Lwowa – miał wrócić dzień później, i wrócił, ale w trumnie.
Dostał udaru w hotelu po jakiejś imprezie.

English:

He drove away to Lviv – and he was supposed to return the day after and that he did, but in a coffin.
He had suffered a stroke at a hotel after some party.

Research Questions

1. Is it possible to identify language variation in terms of orthography, morphology, and syntax in a Polish text using tools and resources such as lemmatizers, POS-taggers, and modern corpora?
2. In what ways does the text in question, a 19th-century memoir by Juliusz Czermiński, differ from modern standard Polish?

Background and Related Work

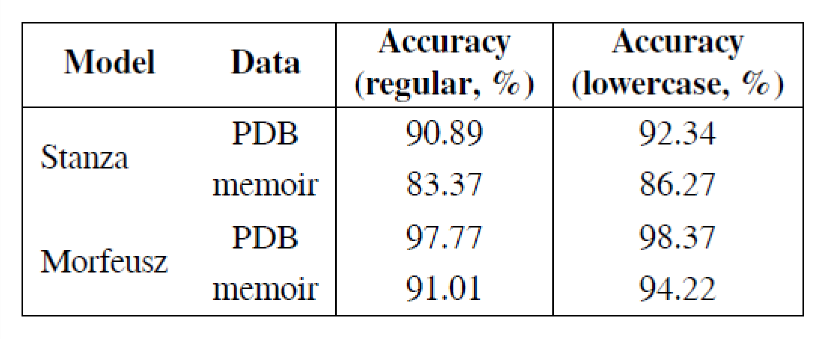
- Features and changes characteristic of 19th-century Polish and the *Kresy* dialects.
- Quantitative and corpus research in historical linguistics.
- Part-of-speech tagging of historical data.
- Methods for dealing with language variation in NLP.
- Detecting and modelling language variation and change.
- Appropriate models and tools (Polbert, Marmot, Morfeusz2+Concraft-pl, Cloud UD tagger, Stanza), resources (PDB-UD, National Corpus of Polish).

Experiments

- POS-tagging and lemmatization:
  - BERT, Marmot, Stanza, University of Sheffield UD Cloud tagger, Morfeusz2.
  - Error annotation for selected erroneous tags.
- N-gram (uni, bi, tri) statistics – approximation of syntactic variation.
- National Corpus of Polish vocabulary comparison.

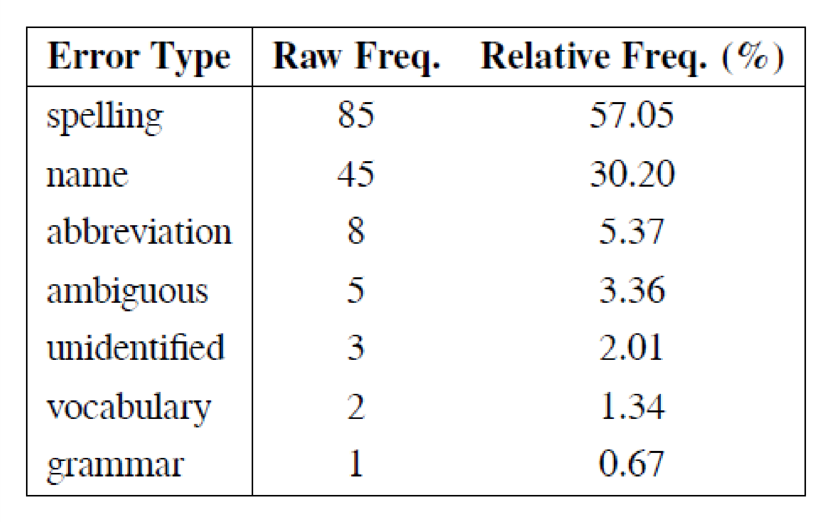
Tool	UPOS-tagging	XPOS-tagging	Lemmatization
BERT	Yes	Yes	-
Marmot	Yes	Yes	-
Stanza	Yes	Yes	Yes
Morfeusz	-	Yes	Yes
UD Cloud	Yes	-	-

Results: lemmatization



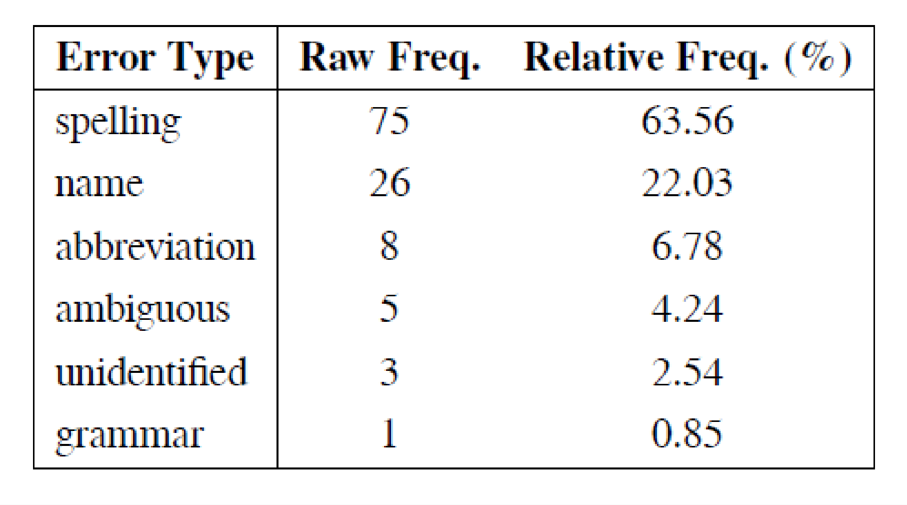
Model	Data	Accuracy (regular, %)	Accuracy (lowercase, %)
Stanza	PDB	90.89	92.34
	memoir	83.37	86.27
Morfeusz	PDB	97.77	98.37
	memoir	91.01	94.22

Original capitalization



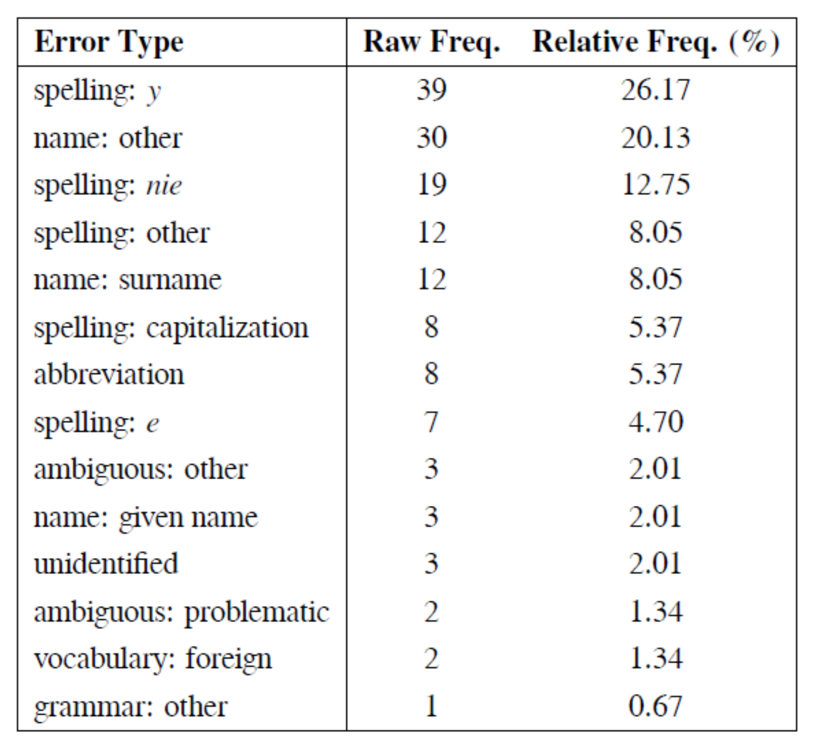
Error Type	Raw Freq.	Relative Freq. (%)
spelling	85	57.05
name	45	30.20
abbreviation	8	5.37
ambiguous	5	3.36
unidentified	3	2.01
vocabulary	2	1.34
grammar	1	0.67

Lowercased



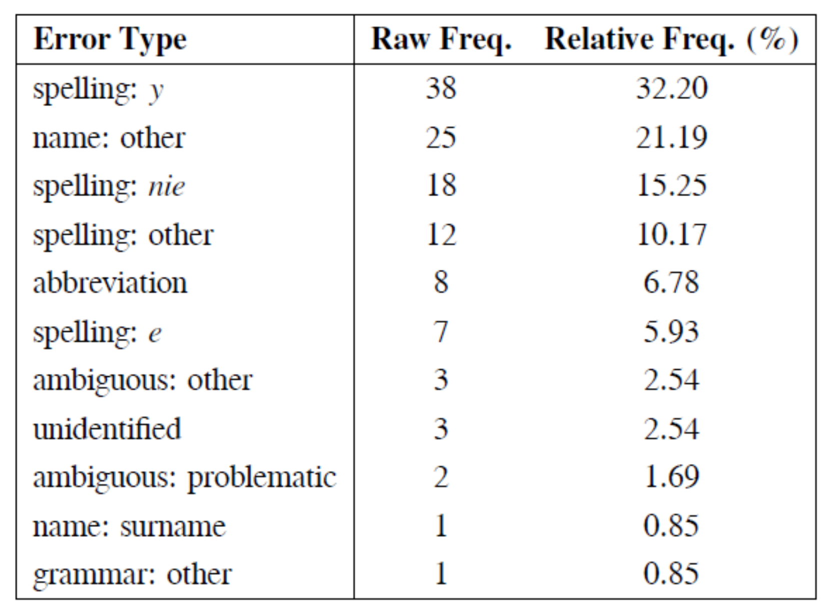
Error Type	Raw Freq.	Relative Freq. (%)
spelling	75	63.56
name	26	22.03
abbreviation	8	6.78
ambiguous	5	4.24
unidentified	3	2.54
grammar	1	0.85

Original capitalization



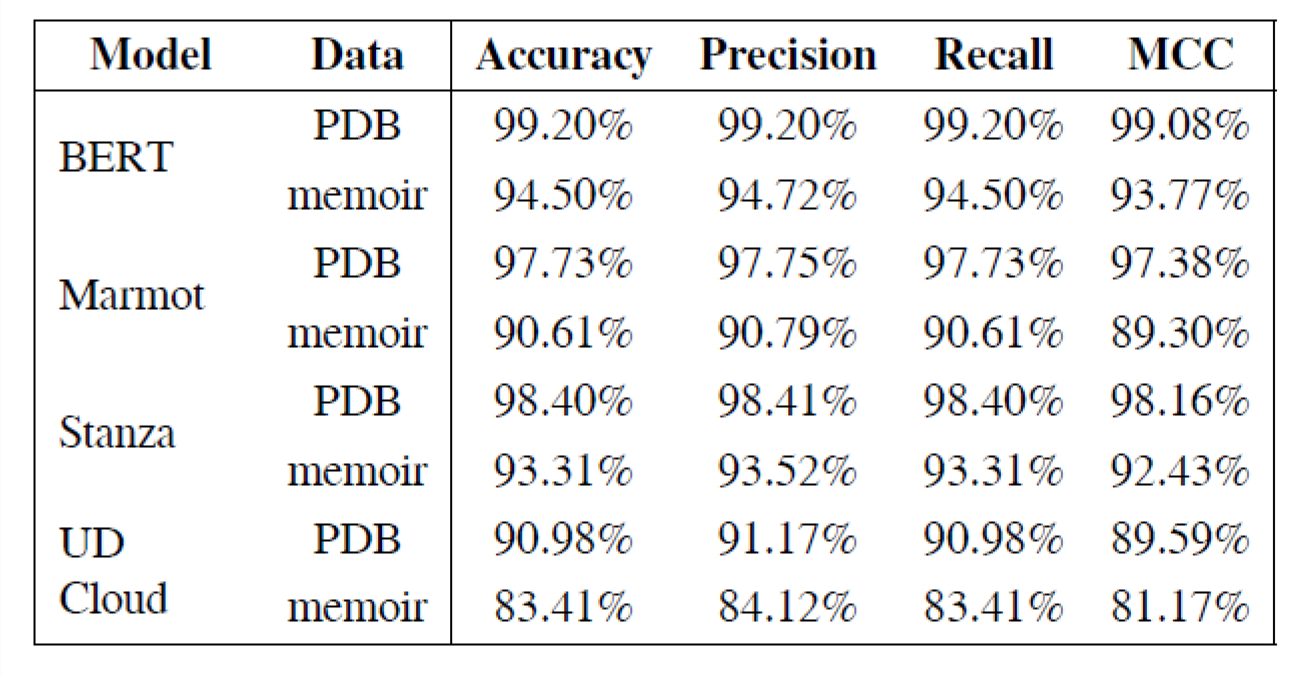
Error Type	Raw Freq.	Relative Freq. (%)
spelling: *y*	39	26.17
name: other	30	20.13
spelling: *nie*	19	12.75
spelling: other	12	8.05
name: surname	12	8.05
spelling: capitalization	8	5.37
abbreviation	8	5.37
spelling: *e*	7	4.70
ambiguous: other	3	2.01
name: given name	3	2.01
unidentified	3	2.01
ambiguous: problematic	2	1.34
vocabulary: foreign	2	1.34
grammar: other	1	0.67

Lowercased

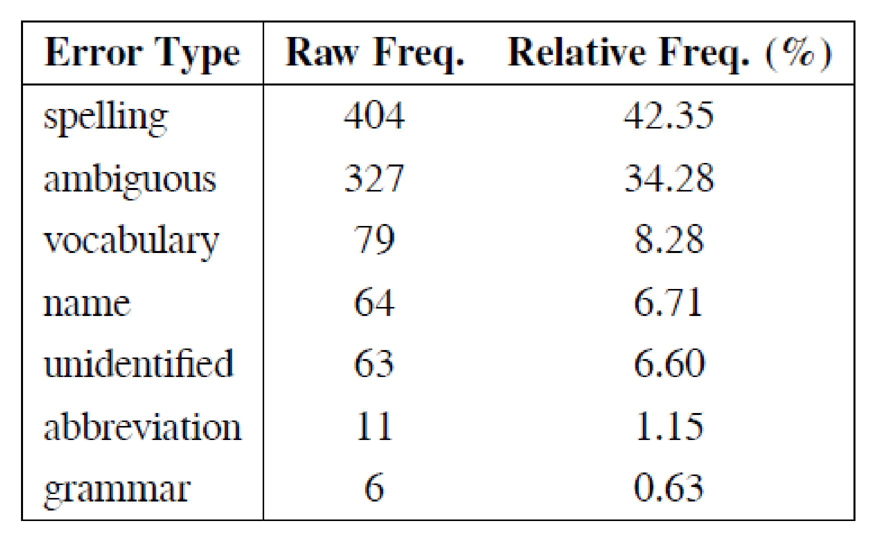


Error Type	Raw Freq.	Relative Freq. (%)
spelling: *y*	38	32.20
name: other	25	21.19
spelling: *nie*	18	15.25
spelling: other	12	10.17
abbreviation	8	6.78
spelling: *e*	7	5.93
ambiguous: other	3	2.54
unidentified	3	2.54
ambiguous: problematic	2	1.69
name: surname	1	0.85
grammar: other	1	0.85

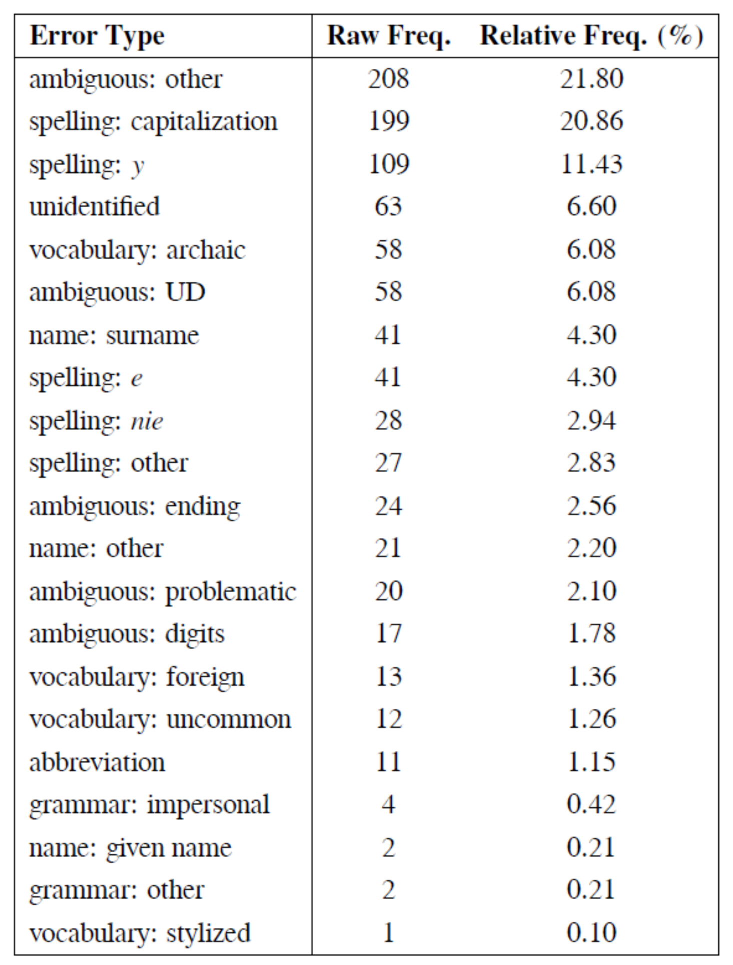
Results: UPOS tagging



Model	Data	Accuracy	Precision	Recall	MCC
BERT	PDB	99.20%	99.20%	99.20%	99.08%
	memoir	94.50%	94.72%	94.50%	93.77%
Marmot	PDB	97.73%	97.75%	97.73%	97.38%
	memoir	90.61%	90.79%	90.61%	89.30%
Stanza	PDB	98.40%	98.41%	98.40%	98.16%
	memoir	93.31%	93.52%	93.31%	92.43%
UD Cloud	PDB	90.98%	91.17%	90.98%	89.59%
	memoir	83.41%	84.12%	83.41%	81.17%

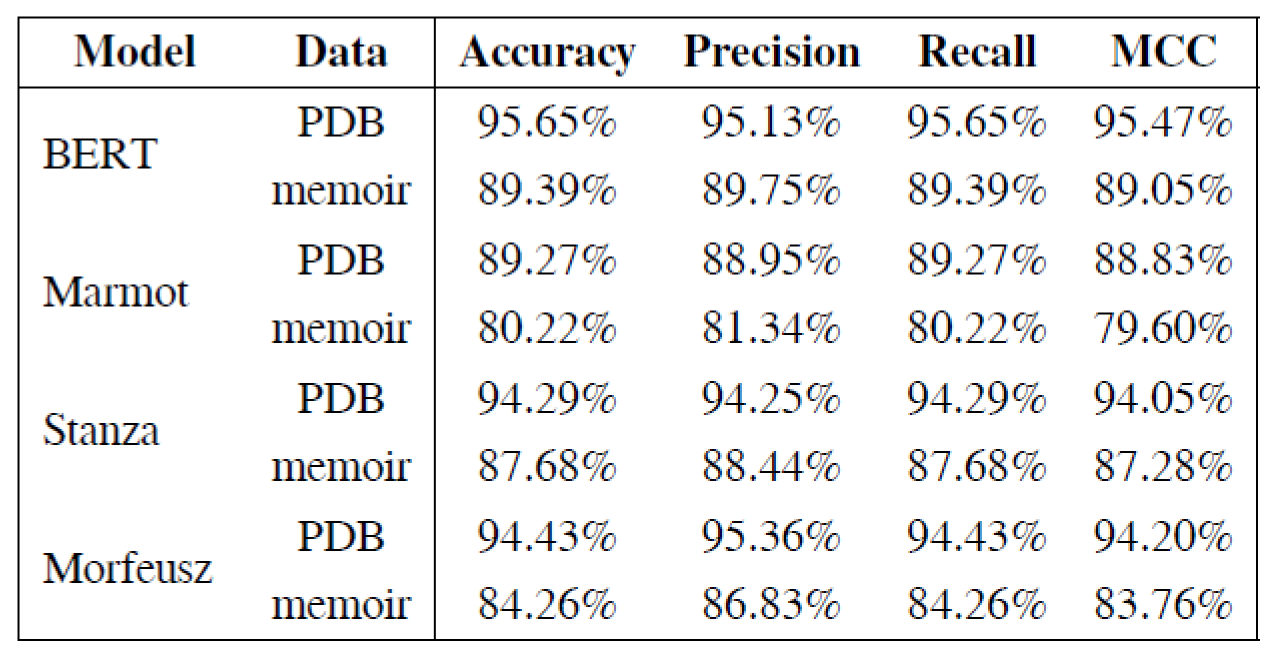


Error Type	Raw Freq.	Relative Freq. (%)
spelling	404	42.35
ambiguous	327	34.28
vocabulary	79	8.28
name	64	6.71
unidentified	63	6.60
abbreviation	11	1.15
grammar	6	0.63

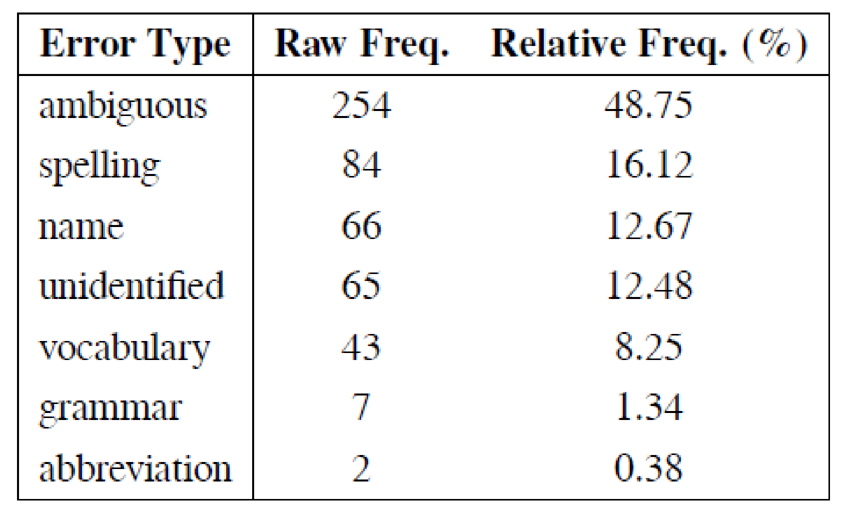


Error Type	Raw Freq.	Relative Freq. (%)
ambiguous: other	208	21.80
spelling: capitalization	199	20.86
spelling: *y*	109	11.43
unidentified	63	6.60
vocabulary: archaic	58	6.08
ambiguous: UD	58	6.08
name: surname	41	4.30
spelling: *e*	41	4.30
spelling: *nie*	28	2.94
spelling: other	27	2.83
ambiguous: ending	24	2.56
name: other	21	2.20
ambiguous: problematic	20	2.10
ambiguous: digits	17	1.78
vocabulary: foreign	13	1.36
vocabulary: uncommon	12	1.26
abbreviation	11	1.15
grammar: impersonal	4	0.42
name: given name	2	0.21
grammar: other	2	0.21
vocabulary: stylized	1	0.10

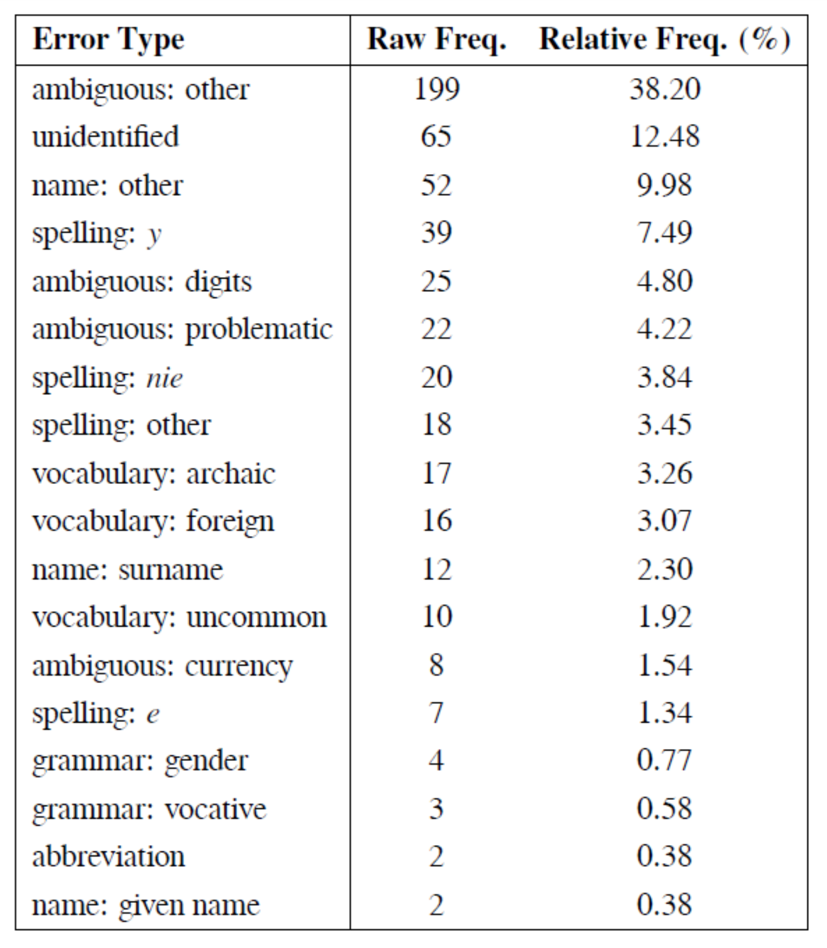
Results: XPOS tagging



Model	Data	Accuracy	Precision	Recall	MCC
BERT	PDB	95.65%	95.13%	95.65%	95.47%
	memoir	89.39%	89.75%	89.39%	89.05%
Marmot	PDB	89.27%	88.95%	89.27%	88.83%
	memoir	80.22%	81.34%	80.22%	79.60%
Stanza	PDB	94.29%	94.25%	94.29%	94.05%
	memoir	87.68%	88.44%	87.68%	87.28%
Morfeusz	PDB	94.43%	95.36%	94.43%	94.20%
	memoir	84.26%	86.83%	84.26%	83.76%

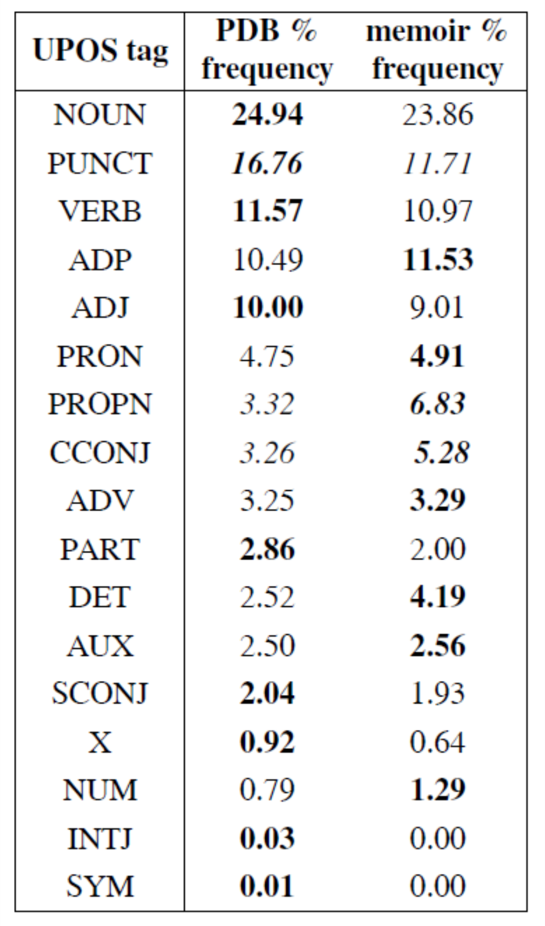


Error Type	Raw Freq.	Relative Freq. (%)
ambiguous	254	48.75
spelling	84	16.12
name	66	12.67
unidentified	65	12.48
vocabulary	43	8.25
grammar	7	1.34
abbreviation	2	0.38

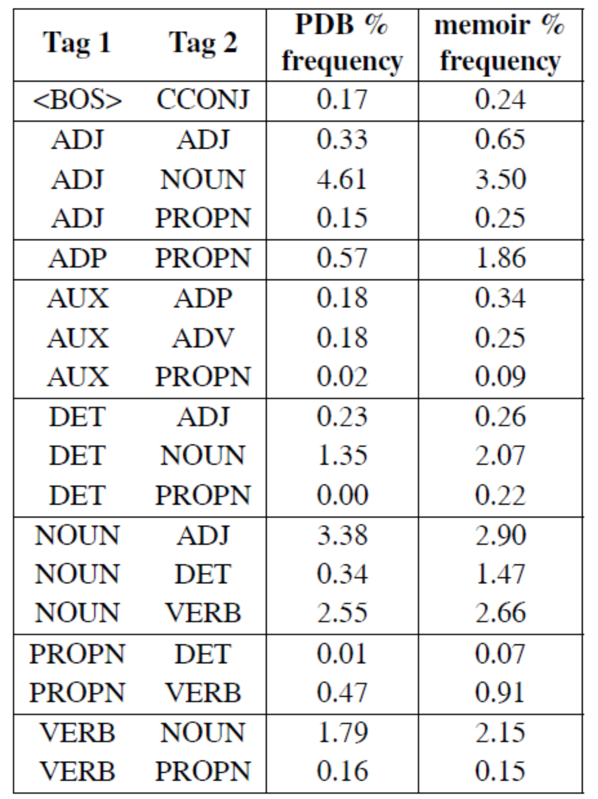


Error Type	Raw Freq.	Relative Freq. (%)
ambiguous: other	199	38.20
unidentified	65	12.48
name: other	52	9.98
spelling: *y*	39	7.49
ambiguous: digits	25	4.80
ambiguous: problematic	22	4.22
spelling: *nie*	20	3.84
spelling: other	18	3.45
vocabulary: archaic	17	3.26
vocabulary: foreign	16	3.07
name: surname	12	2.30
vocabulary: uncommon	10	1.92
ambiguous: currency	8	1.54
spelling: *e*	7	1.34
grammar: gender	4	0.77
grammar: vocative	3	0.58
abbreviation	2	0.38
name: given name	2	0.38

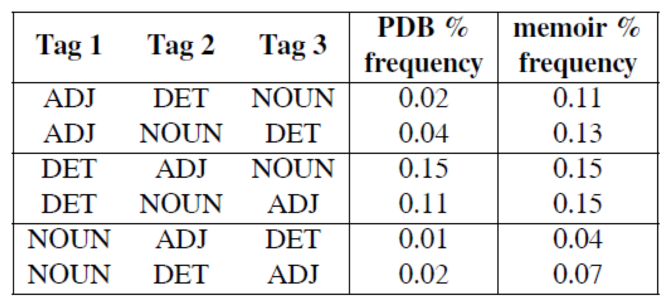
Results: n-gram statistics



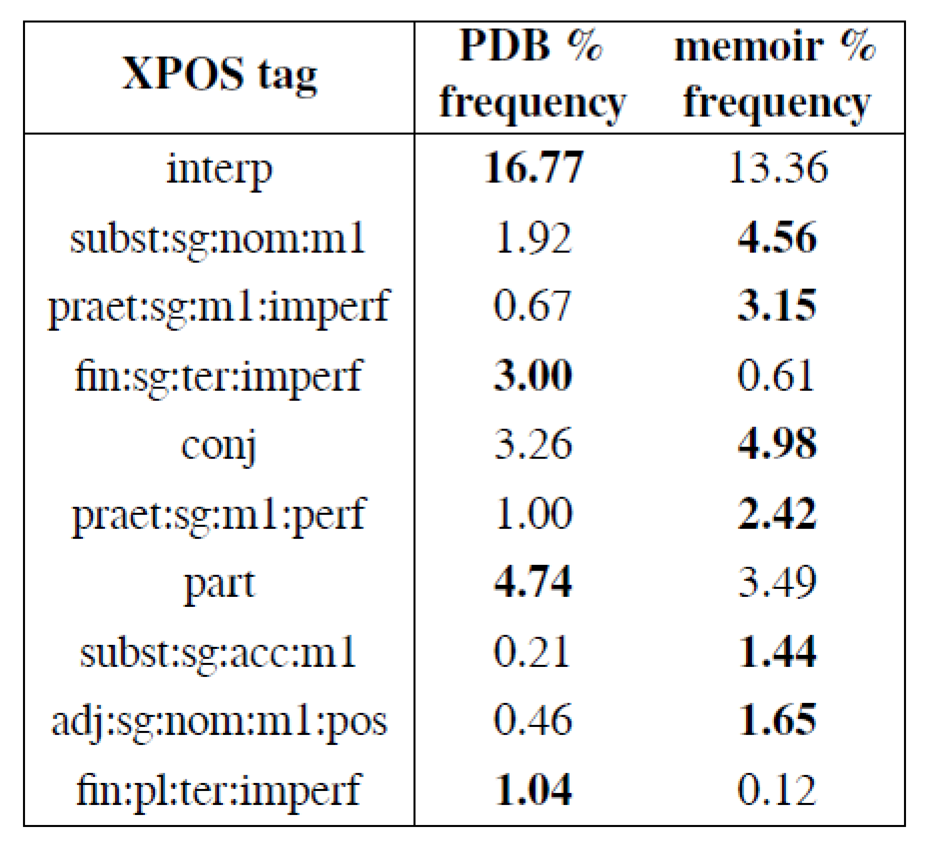
UPOS tag	PDB % frequency	memoir % frequency
NOUN	**24.94**	23.86
PUNCT	***16.76***	*11.71*
VERB	**11.57**	10.97
ADP	10.49	**11.53**
ADJ	**10.00**	9.01
PRON	4.75	**4.91**
PROPN	*3.32*	***6.83***
CCONJ	*3.26*	***5.28***
ADV	3.25	**3.29**
PART	**2.86**	2.00
DET	2.52	**4.19**
AUX	2.50	**2.56**
SCONJ	**2.04**	1.93
X	**0.92**	0.64
NUM	0.79	**1.29**
INTJ	**0.03**	0.00
SYM	**0.01**	0.00



Tag 1	Tag 2	PDB % frequency	memoir % frequency
<BOS>	CCONJ	0.17	0.24
ADJ	ADJ	0.33	0.65
ADJ	NOUN	4.61	3.50
ADJ	PROPN	0.15	0.25
ADP	PROPN	0.57	1.86
AUX	ADP	0.18	0.34
AUX	ADV	0.18	0.25
AUX	PROPN	0.02	0.09
DET	ADJ	0.23	0.26
DET	NOUN	1.35	2.07
DET	PROPN	0.00	0.22
NOUN	ADJ	3.38	2.90
NOUN	DET	0.34	1.47
NOUN	VERB	2.55	2.66
PROPN	DET	0.01	0.07
PROPN	VERB	0.47	0.91
VERB	NOUN	1.79	2.15
VERB	PROPN	0.16	0.15

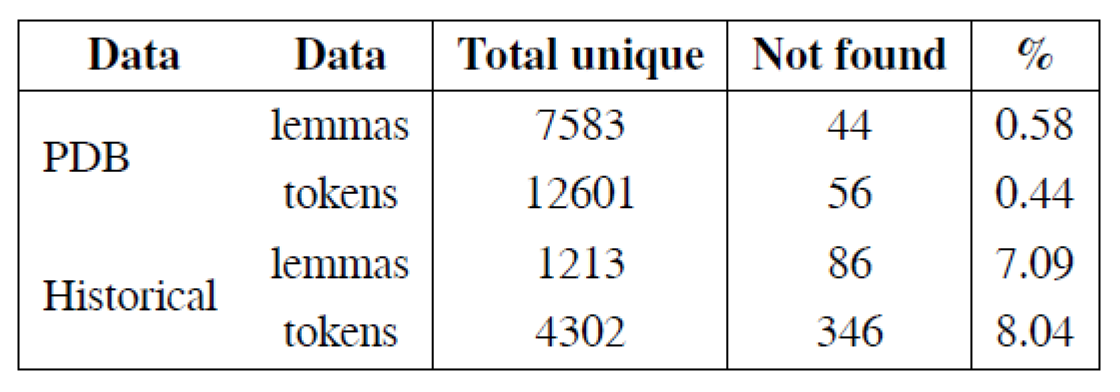


Tag 1	Tag 2	Tag 3	PDB % frequency	memoir % frequency
ADJ	DET	NOUN	0.02	0.11
ADJ	NOUN	DET	0.04	0.13
DET	ADJ	NOUN	0.15	0.15
DET	NOUN	ADJ	0.11	0.15
NOUN	ADJ	DET	0.01	0.04
NOUN	DET	ADJ	0.02	0.07



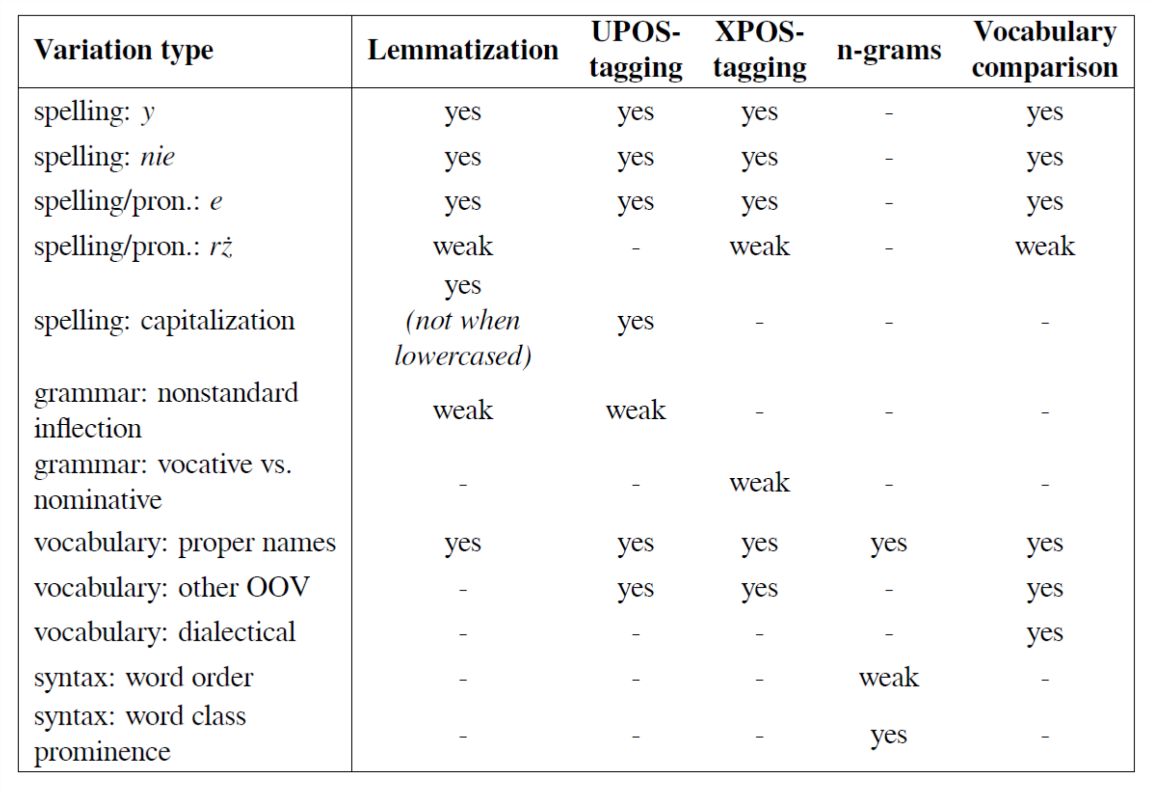
XPOS tag	PDB % frequency	memoir % frequency
interp	**16.77**	13.36
subst:sg:nom:m1	1.92	**4.56**
praet:sg:m1:imperf	0.67	**3.15**
fin:sg:ter:imperf	**3.00**	0.61
conj	3.26	**4.98**
praet:sg:m1:perf	1.00	**2.42**
part	**4.74**	3.49
subst:sg:acc:m1	0.21	**1.44**
adj:sg:nom:m1:pos	0.46	**1.65**
fin:pl:ter:imperf	**1.04**	0.12

National Corpus of Polish vocabulary comparison



Data	Data	Total unique	Not found	%
PDB	lemmas	7583	44	0.58
	tokens	12601	56	0.44
Historical	lemmas	1213	86	7.09
	tokens	4302	346	8.04

Results



Variation type	Lemmatization	UPOS-tagging	XPOS-tagging	n-grams	Vocabulary comparison
spelling: *y*	yes	yes	yes	-	yes
spelling: *nie*	yes	yes	yes	-	yes
spelling/pron.: *e*	yes	yes	yes	-	yes
spelling/pron.: *rż*	weak	-	weak	-	weak
spelling: capitalization	yes *(not when lowercased)*	yes	-	-	-
grammar: nonstandard inflection	weak	weak	-	-	-
grammar: vocative vs. nominative	-	-	weak	-	-
vocabulary: proper names	yes	yes	yes	yes	yes
vocabulary: other OOV	-	yes	yes	-	yes
vocabulary: dialectical	-	-	-	-	yes
syntax: word order	-	-	-	weak	-
syntax: word class prominence	-	-	-	yes	-

Ethical considerations

- Old data.
- Not expecially computationally heavy.
- Explores utilizing tools for underrepresented dialects or languages.
- Gender annotation on pronouns – gender bias?
  - `# sent_id = train-s2896`
  - `# text = - Ty nie wiesz?` (ENG: Do you not know?)
  - `# orig_file_sentence = 200-2-000093_morph_5.47-s#7092`
  - `...`
  - `2   Ty   ty   PRON    ppron12:sg:nom:m1:sec   ...`
  - `...`

Critiques and limitations

- Potential transctiption errors, only some data used.
- Not representative of *Kresy* Polish, just one author.
- No comparison to older data.
- Potentially imperfect annotation.
- Potentially not ideal training setup for taggers.
- Subjective error annotation.
- Lacking n-gram result analysis.

Future work

- Completing the annotation of the data.
  - Adding the syntactic structure annotation.
- Comparison to more data.
  - More data from the same time and region.
  - Older data.
  - Contemporary non-standard data.
- Tagger or lemmatizer confidence.
- Cross-tool agreement.

Conclusions: back to Research Questions

1. Is it possible to identify language variation in terms of orthography, morphology, and syntax in a Polish text using tools and resources such as lemmatizers, POS-taggers, and modern corpora?
    1. Yes, with orthography (and pronunciation) being the most prominent ones.

2. In what ways does the text in question, a 19th-century memoir by Juliusz Czermiński, differ from modern standard Polish?
    1. See the table in the Results section.

Thesis and repository

- Both available at: https://github.com/Turtilla/swe-ma-thesis

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Thank you for your attention!

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