NLP-IE 2024

Extraction of Narratives from Online News

The olive branches

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Agenda

- Introduction
  - Problem description
  - Dataset description
- What is propaganda?
  - Ukraine war
  - Climate change
- Preprocessing
- Establishing a baseline
  - Traditional ML methods
  - Bert Baseline
  - Roberta Baseline
- Deep Learning Improvements
  - Weighted loss
  - Multi-level training
- Multilingual model
  - Distilled BERT architecture
  - Performance overview
- Result analysis
  - Quantitative
  - Qualitative
- Questions?

Problem description

- **Extraction of Narratives from Online News** (‘*propaganda* detection’) - **Narrative Classification** (task 3, subtask 2)

- “Given a news article and a **two-level taxonomy** of narrative labels (where each narrative is subdivided into subnarratives) from a particular domain, assign to the article all the appropriate subnarrative labels - this is a **multi-label multi-class document classification task**”

- SemEval 2025: Multilingual Characterization and Extraction of Narratives from Online News

- Motivation: addressing misinformation, supporting media literacy and counter-*propaganda* efforts using advanced **NLP** techniques.

Dataset Description

- **Ukraine-Russia War** (URW)
- **Climate Change** (CC)

- Bulgarian, English, Hindi, Portuguese, Russian

- Hundreds of articles (100-200 per language), ~50/50 split between URW&CC

Dataset Description - Taxonomies

- URW: 12 narratives (e.g., Praise of Russia, Overpraise the West).
- CC: 11 narratives (e.g., Downplaying CC, Amplifying Climate Fears).

- 38 subnarratives for URW, and 36 for CC.

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Praise of Russia
- Praise of Russian military might
- Praise of Russian President Vladimir Putin
- Russia is a guarantor of peace and prosperity
- Russia has international support from a number of countries and people
- Russian invasion has strong national support
Overpraising the West
- NATO will destroy Russia
- The West belongs in the right side of history
- The West has the strongest international support
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Amplifying Climate Fears
- Earth will be uninhabitable soon
- Amplifying existing fears of global warming
- Doomsday scenarios for humans
- Whatever we do it is already too late
Green policies are geopolitical instruments
- Climate-related international relations are abusive/exploitative
- Green activities are a form of neo-colonialism
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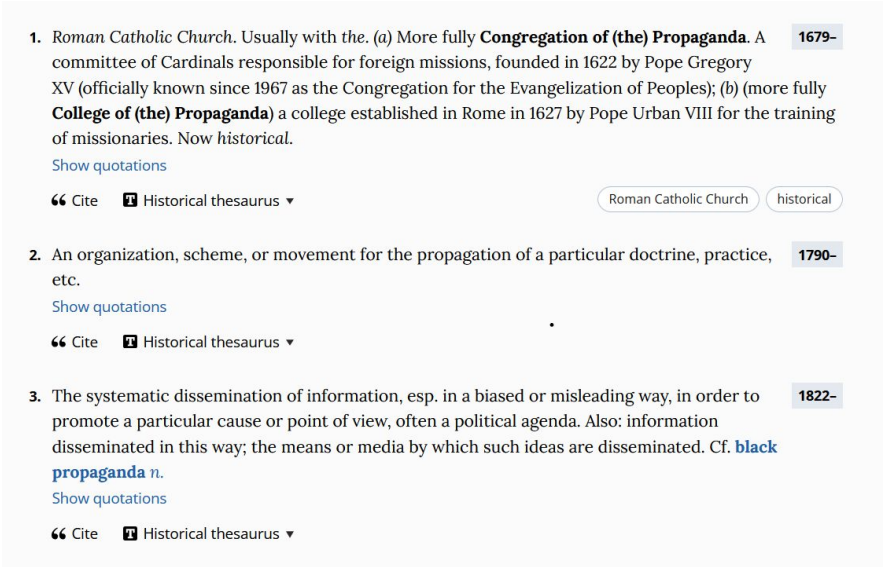
What is propaganda?

“The systematic dissemination of information, esp. in a biased or misleading way, in order to promote a particular cause or point of view, often a political agenda.”
(Oxford En. Dict.)



1. *Roman Catholic Church*. Usually with *the*. (*a*) More fully **Congregation of (the) Propaganda**. A committee of Cardinals responsible for foreign missions, founded in 1622 by Pope Gregory XV (officially known since 1967 as the Congregation for the Evangelization of Peoples); (*b*) (more fully **College of (the) Propaganda**) a college established in Rome in 1627 by Pope Urban VIII for the training of missionaries. Now *historical*. **1679–**

Show quotations

Cite | Historical thesaurus ▾ | Roman Catholic Church | historical

2. An organization, scheme, or movement for the propagation of a particular doctrine, practice, etc. **1790–**

Show quotations

Cite | Historical thesaurus ▾

3. The systematic dissemination of information, esp. in a biased or misleading way, in order to promote a particular cause or point of view, often a political agenda. Also: information disseminated in this way; the means or media by which such ideas are disseminated. Cf. **black propaganda** *n.* **1822–**

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Cite | Historical thesaurus ▾

What is propaganda?

- In the context of the Ukraine war, propaganda refers to narratives or rhetoric used by various parties (such as Ukraine, Russia, or external actors) to sway public opinion, justify actions, and promote specific political goals.
- It often employs:
  - **Polarization:** Creating or amplifying divisions between groups (e.g., demonizing the West, glorifying Russia, or discrediting Ukraine).
  - **Manipulation:** Presenting exaggerated or misleading claims to evoke fear, trust, or hatred (e.g., speculating on nuclear threats or discrediting international diplomacy).
  - **Repetition of Narratives**: Reiterating certain themes (e.g., "The West is weak," "Russia is a victim") to create familiarity and acceptance.

What is propaganda?

- In the context of climate change, propaganda can be defined as information intended to influence opinions or actions regarding environmental policies, technologies, or lifestyle changes.
- It often employs:
  - **Distrust in Institutions:** Criticizing governments, financial organizations, or climate scientists for perceived hidden agendas or exploitation.
  - **Conspiracy Narratives:** Suggesting that climate policies are part of global elite schemes to enslave populations or harm national sovereignty.
  - **Fear-inducing narratives:** Portraying climate actions as tools of control (e.g., "15-minute cities as prisons") or as economically disastrous.
  - **Discrediting climate initiatives:** Framing climate actions or policies as harmful, fraudulent, or oppressive. Climate policies described as "The Great Climate Con."

Preprocessing

- English (EN):
  - POS Tagging Errors (e.g., "Jane" → NOUN instead of PROPN).
  - Residual stopwords (e.g., "that," "do").

- Portuguese (PT):
  - POS Tagging & NER Errors (e.g., "ucrânia" → VERB instead of PROPN).
  - Lemmatization Issues (e.g., "fizesse" → "fazer").

Enhanced tokenization with spaCy: **some improvements** achieved, remaining errors guide future optimizations.

Traditional ML Baseline

- Narratives and Subnaratives level
- Simple Bag Of Words (BoW) embedding
- Models
  - Random Forest (RF)
  - Multinomial Naive Bayes
- Feature selection & Hyperparameter optimization
- Macro F1, recall, precision
- Train test split ratio 8:2
- Very easy to construct much simpler baselines

Traditional ML Baseline

Language	Model	f1 nar.	f1 sub.	recal nar.	recal sub.	prec nar.	prec sub.
PT	NB	0.325244	0.122312	0.574495	0.212674	0.237612	0.092789
PT	RF	0.143697	0.020312	0.116208	0.015377	0.210498	0.041666
EN	NB	0.281192	0.080692	0.468887	0.122447	0.255638	0.091133
EN	RF	0.056926	0.016782	0.047581	0.013684	0.121212	0.026864
HI	NB	0.284848	0.055754	0.275325	0.058903	0.338636	0.067361
HI	RF	0.080692	0.006770	0.122447	0.004092	0.0911334	0.020833
BG	NB	0.274399	0.097154	0.447452	0.171875	0.218578	0.077110
BG	RF	0.052381	0	0.036868	0	0.113636	0

Traditional ML Baseline

- Good results with simple BoW model
- Portuguese seems to be the easiest to model
- Easier to predict narratives than subnaratives (multilevel training approach)
- Hard to predict training points with no training data
    - CC: Climate change is beneficial
    - CC: Amplifying Climate Fears

RoBERTa Baseline

- RoBERTa (Robustly Optimized BERT Pretraining Approach) is a transformer-based language model designed for Natural Language Processing (NLP) tasks.

- Why RoBERTa?
  - Pretrained for natural language understanding.
  - Handles multi-label tasks effectively.
  - Efficiently tokenizes long text inputs.

- Training Process:
  - Articles split (80:20) into training and validation sets.
  - Model trained for 5 epochs using AdamW optimizer.

RoBERTa Baseline

Metric	Precision	Recal	F1	Support
Micro avg	0.45	0.11	0.17	168
Macro avg	0.00	0.01	0.01	168
Weighted avg	0.05	0.11	0.11	168
Samples avg	0.45	0.23	0.30	168

- Despite RoBERTa's strengths, this implementation shows limitations due to:
  - Class imbalance and insufficient data.
  - Challenges in learning from few instances per class.

Bert Baseline

- Bert-base-multilingual-cased model
  - Multilingual transformer-based pretrained model
- Narratives and Subnarratives level
  - **Combined label space** for both narratives and subnarratives
  - Multi-label classification approach using **binary vectors**
- Models
  - Single BERT model handling both tasks
- Train test split ratio 8:2

Max Context Length	512
Pred. threshold	0.3
Epochs	3
Batch size	32

Bert Baseline

Narrative	Precision	recal	F1	Support
Other	0.47	1.00	0.64	38
URW: Speculating war outcomes: Other	0.05	1.00	0.10	4
CC: Criticism of institutions and authorities: Criticism of international entities	0.05	1.00	0.10	4
URW: Discrediting Ukraine: Ukraine is a puppet of the West	0.03	1.00	0.05	2
CC: Criticism of climate movement	0.00	0.00	0.00	8

1. Class imbalance issues
2. Problematic Prediction Patterns

Bert Baseline

Language	f1 micro.	f1 macro.	recal micro.	recal macro.	prec micro.	prec macro.
EN	0.16	0.02	0.31	0.09	0.11	0.01

1. Gap between micro and macro metrics demonstrates severe class imbalance impact
2. Recall consistently higher than precision in both averagings, confirming model's over-prediction tendency

Comparison of Baseline Models

Model	Macro F1	Macro Precision	Macro Recall
RandomForest	0.016	0.026	0.013
MultinomialNB	0.08	0.09	0.122
BERT	0.02	0.01	0.09
RoBERTa	0.01	0.00	0.01

- **MultinomialNB** outperforms state-of-the-art models like BERT and RoBERTa on the small, sparsely labeled dataset.
- **Reason:** MultinomialNB uses simple word counts as features, which are effective for this dataset.

Deep Learning Improvements

- Hierarchical training
- Custom Loss function with label dependent weighting
    - Variant of Binary Cross Entropy with dynamic weighting
    - Calculates positive/negative sample ratios
    - Handles class imbalance dynamically
- Threshold optimization
    - Find the optimal decision boundary

Deep Learning Improvements

	f1 micro.	f1 macro.	recal macro.	prec macro.
Narrative	0.1529	0.1447	0.8182	0.0828
Subnarrative	0.0587	0.0554	0.4769	0.0302

- Better performance
- Still some problematic predictions patterns

Multilingual Modeling

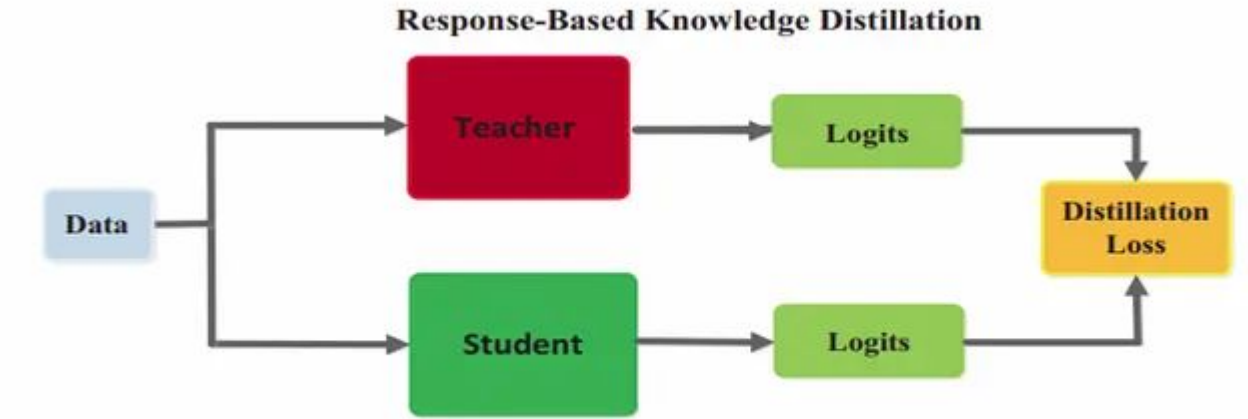
- Models pre-trained on multiple languages
- improve performance for low resource languages

Issues:

- language interference
- The curse of multilinguality
- Grammatical structure bias

Distilled multilingual BERT

- student model trained by teacher model
- 6 layers, 768 dimension and 12 heads, totalizing 134M (25% reduction)
- is twice as fast as mBERT-base
- trained on the concatenation of Wikipedia in 104 different languages



https://amit-s.medium.com/everything-you-need-to-know-about-knowledge-distillation-aka-teacher-student-model-d6ee10fe7276

Distilled multilingual BERT

Narratives:

Language	f1 single	f1 all	recal single	recall all	prec single	prec all
PT	**0.11661**	0.10120	**0.07000**	0.05811	0.54545	0.54545
EN	0.06032	**0.09305**	0.03272	**0.05636**	0.50000	**0.59090**
HI	0.06863	**0.08663**	0.03939	**0.05151**	0.36363	**0.45454**
BG	0.09896	**0.10361**	0.05793	**0.06060**	0.59090	0.59090

Distilled multilingual BERT

Subnaratives:

Language	f1 single	f1 all	recal single	recall all	prec single	prec all
PT	0.02855	**0.03310**	0.015833	**0.01812**	0.2291666	**0.30208**
EN	0.02825	**0.03556**	0.015416	**0.01937**	0.3020833	**0.35416**
HI	0.03138	**0.04019**	0.017361	**0.02222**	0.2395833	**0.29166**
BG	**0.03845**	0.03586	**0.021037**	0.01960	0.3645833	**0.35416**

Qualitative analysis

- More often than not, the model incorrectly **predicts *False*** when the **actual label is *True***
- Model may struggle because of **subjective** interpretations (depending on **political ideology**), may cause misclassification
- ***Other*** label and other generalized narratives seem to be **more frequently misclassified** (sometimes overclassified, sometimes underclassified)
- Statements that mention/critique **specific policies or persons** (e.g., *Ad hominem attacks on key activists*) may involve subtle language and multi-layered arguments, which might be difficult for the model to properly “interpret”

Performance could improve with **additional training on context-specific data** (e.g.: articles that address subjectivity and nuance).

Future improvements

- Refine the models
- Incorporate new data
    - Gather additional, labeled data from the new batch to address class imbalance and improve model generalization.
    - Include Russian data

- Quantitative and quantitative analysis of final model
    - Compare the performance of the final model against baselines and earlier iterations.

Sources

- When Is Multilinguality a Curse? Language Modeling for 250 High- and Low-Resource Languages
- On Negative Interference in Multilingual Models: Findings and A Meta-Learning Treatment
- Distiled multilingual BERT