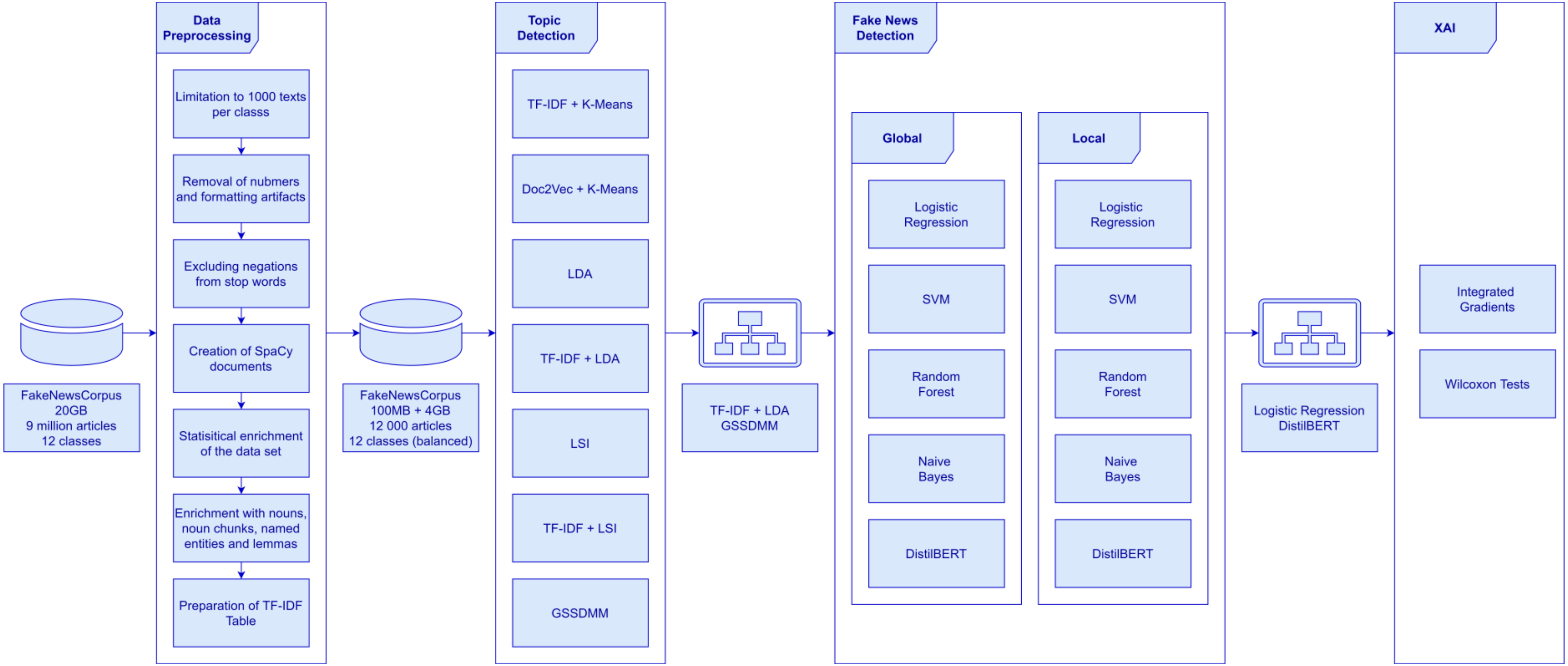
The Comparison of Local and Global Early Fake News Detection Methods

Maciej Pawlikowski, Hubert Ruczyński,
Bartosz Siński, Adrian Stańdo

Main goals

1. Comparison of different **topic detection** models.
2. Comparison of **fake news detection** methods.
3. Introduction of **local** fake news detection methods.
4. Evaluation of the **local** approach, and comparison to corresponding **global** solutions.
5. Exploration of models **differences** between the two strategies with the usage of **XAI**.

Methodology



Topic detection

Clustering Algorithm	Lemmas		Noun chunks	
	Silhouette Score (↑)	Calinski-Harabasz Score (↑)	Silhouette Score (↑)	Calinski-Harabasz Score (↑)
TF-IDF + K-Means	0.038	293.9	0.067	314.1
Doc2Vec + K-Means	0.134	449.6	0.386	3473.24
LDA	0.607	18668.8	0.883	110432.1
TF-IDF + LDA	0.873	91490.7	0.929	323993.32
LSI	-0.320	49.5	-0.512	132.0
TF-IDF + LSI	0.469	1655.9	-0.290	393.5
GSSDMM	0.714	529.4	0.867	15681.4

Fake News Detection

Model	No clustering	
	Accuracy (↑)	Accuracy w/o politics (↑)
Logistic Regression	0.581	0.628
SVM	0.518	0.577
Random Forest	0.491	0.540
Naive Bayes	0.444	0.501
DistilBERT	0.710	0.790

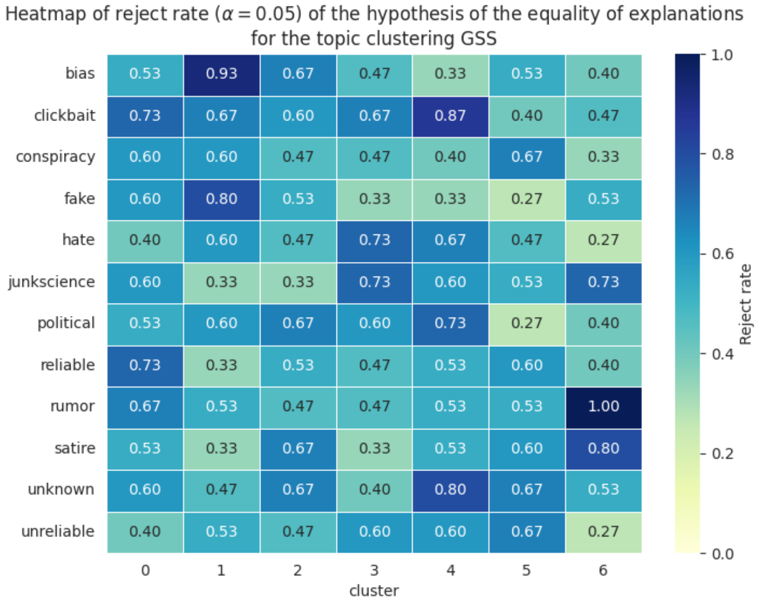
Global and local models

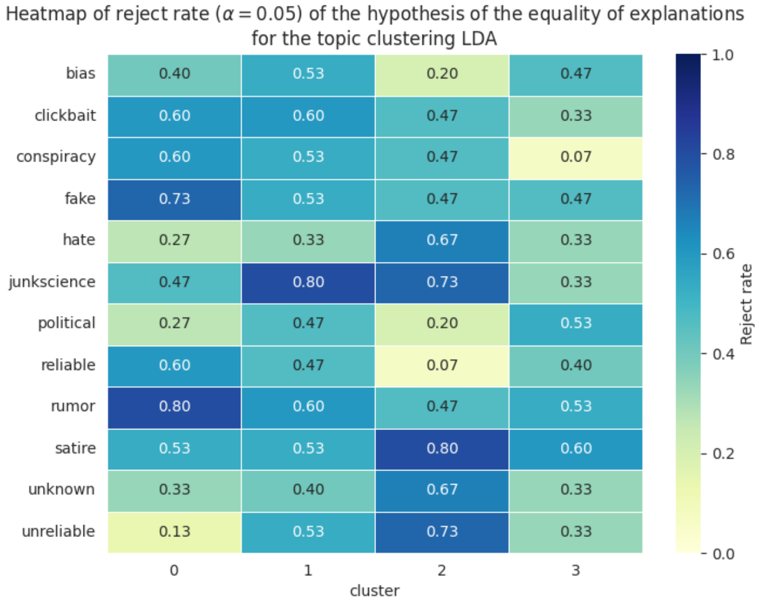
Model	No clustering (Global Model)	GSSDMM (Local Models)	LDA (Local Models)
Logistic Regression	LR	GSSDMM + LR	LDA + LR
SVM	SVM	GSSDMM + SVM	LDA + SVM
Random Forest	RF	GSSDMM + RF	LDA + RF
Naive Bayes	NB	GSSDMM + NB	LDA + NB
DistilBERT	D-BERT	GSSDMM+D-BERT	LDA + D-BERT

Global vs local - performance

Model	No clustering		GSSDMM	LDA
	Accuracy (↑)	Accuracy w/o politics (↑)	Weighted Accuracy (↑)	Weighted Accuracy (↑)
Logistic Regression	0.581	0.628	0.540	0.530
SVM	0.518	0.577	0.460	0.480
Random Forest	0.491	0.540	0.470	0.460
Naive Bayes	0.444	0.501	0.440	0.450
DistilBERT	0.710	0.790	0.600	0.620

Global vs local – XAI (IG)





Limitations

1. Computational resources – only private PCs.
2. Consideration of only 12,000 observations (out of 9,000,000 accessible!).
3. Consideration of 12 classess in such a small dataset.
4. Additional split into 4 and 7 clusters (results in ~250 and ~150 per class in clusters).
5. Employment of relatively simple models, only one transformer.

What could we improve?

1. Task simplification to 2 or 4 classes instead of 12.

2. Double the amount of observations to 24,000.

3. For local approaches with 4 and 7 clusters it results in ~3000/1500 and ~1500/750. osbervations per class, which is 12/6 times more than before.

4. Consider more transformer models, such as BERTopic.

Further works with more resources

1. Expansion to even greater numer of articles (100,000 observations).
2. Consideration of more/all classes.
3. Consideration of more topic detection methods (not only clustering models).
4. Testing even more advanced models as Fake News detectors (transformers, LLMs).
5. Deployment of the framework (best combination) as an online learning system.

- Consideration of online learning clustering methods, e.g. TextClust.

Thank you for your attention!