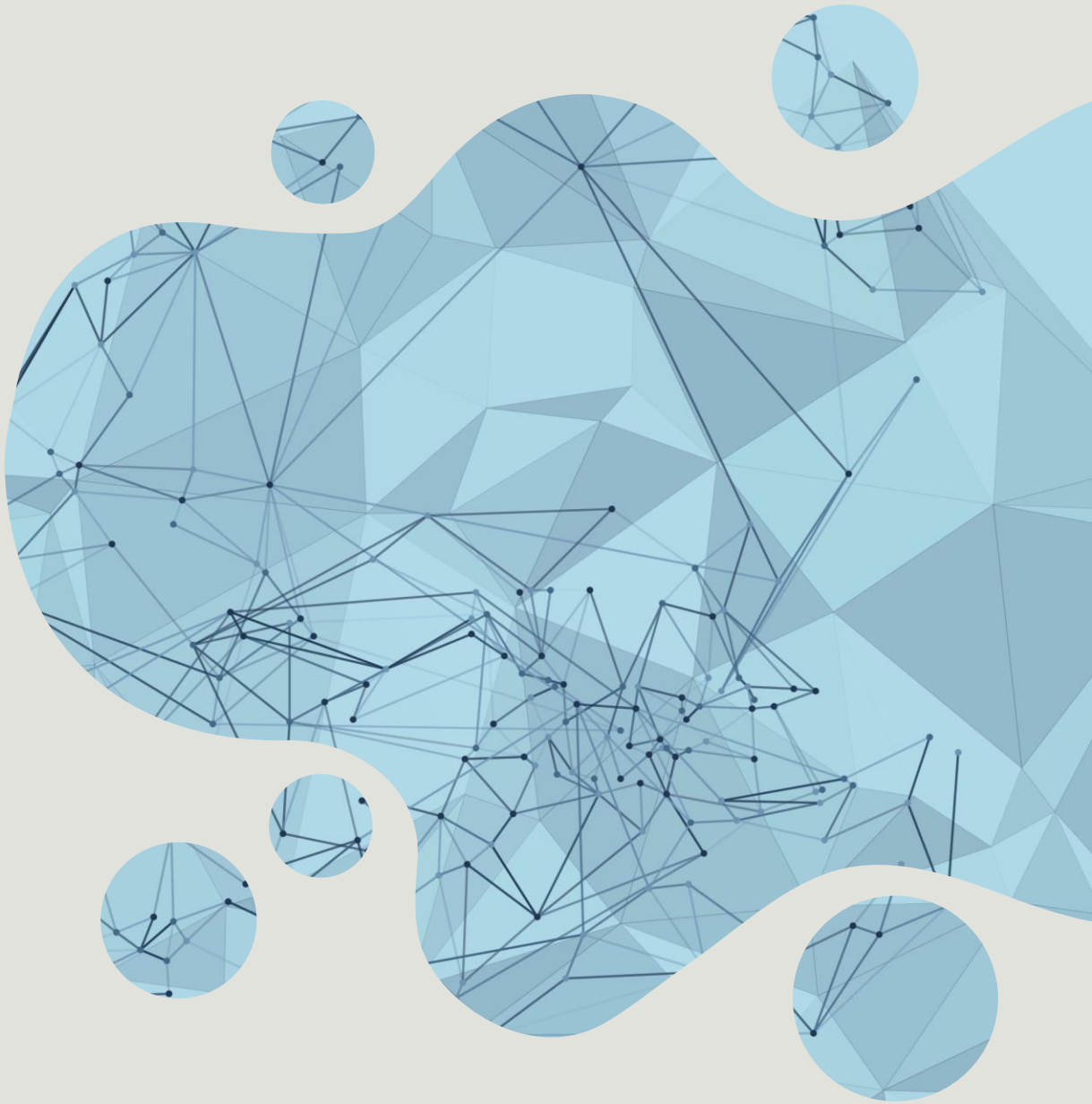
Anomaly detection on Scientific Publications

David-Gabriel ION

Thesis advisor:

Prof. dr. ing. Ciprian DOBRE



Context

The problem

Determine if an author wrote a given scientific publication

Intuition

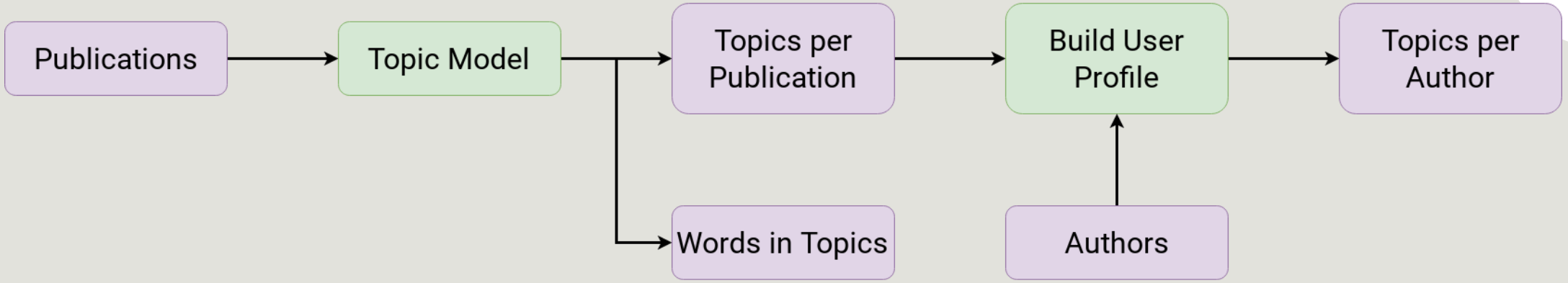
An author only writes publications in their area of expertise

General solution

Determine what are the areas of expertise for the given authors, given their past published papers

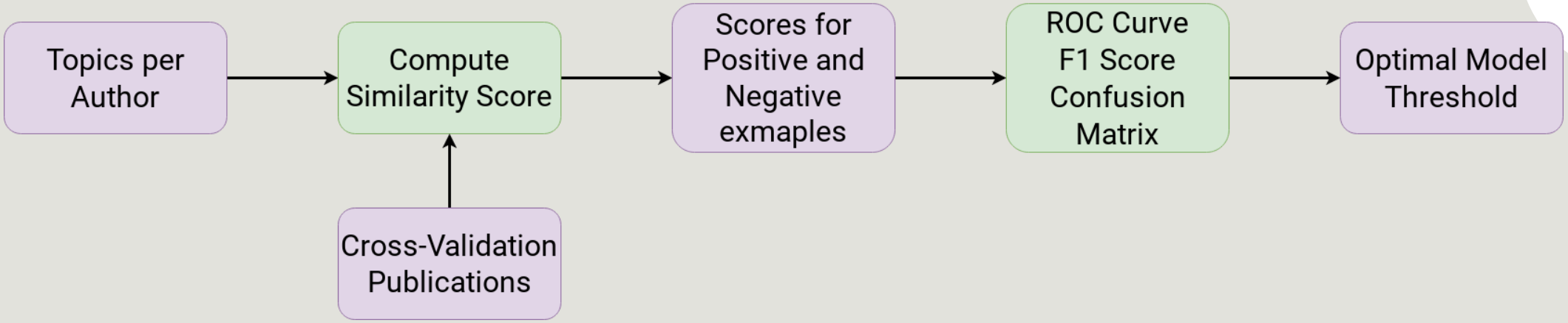
Check if a new publication is about a field unrelated to a given author

Training



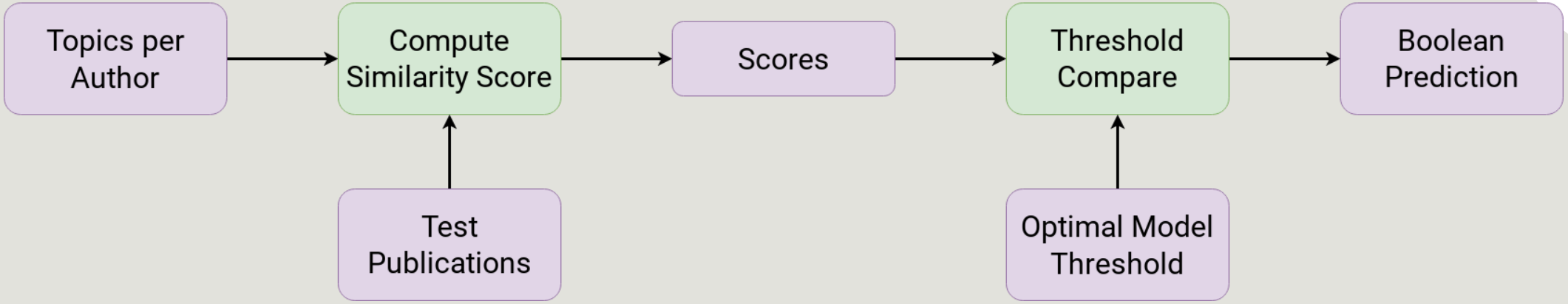
- Topic Model is Latent Dirichlet Allocation (will be replaced by BERT)
- User profile is the mean and standard deviation of the authored publications

Tuning

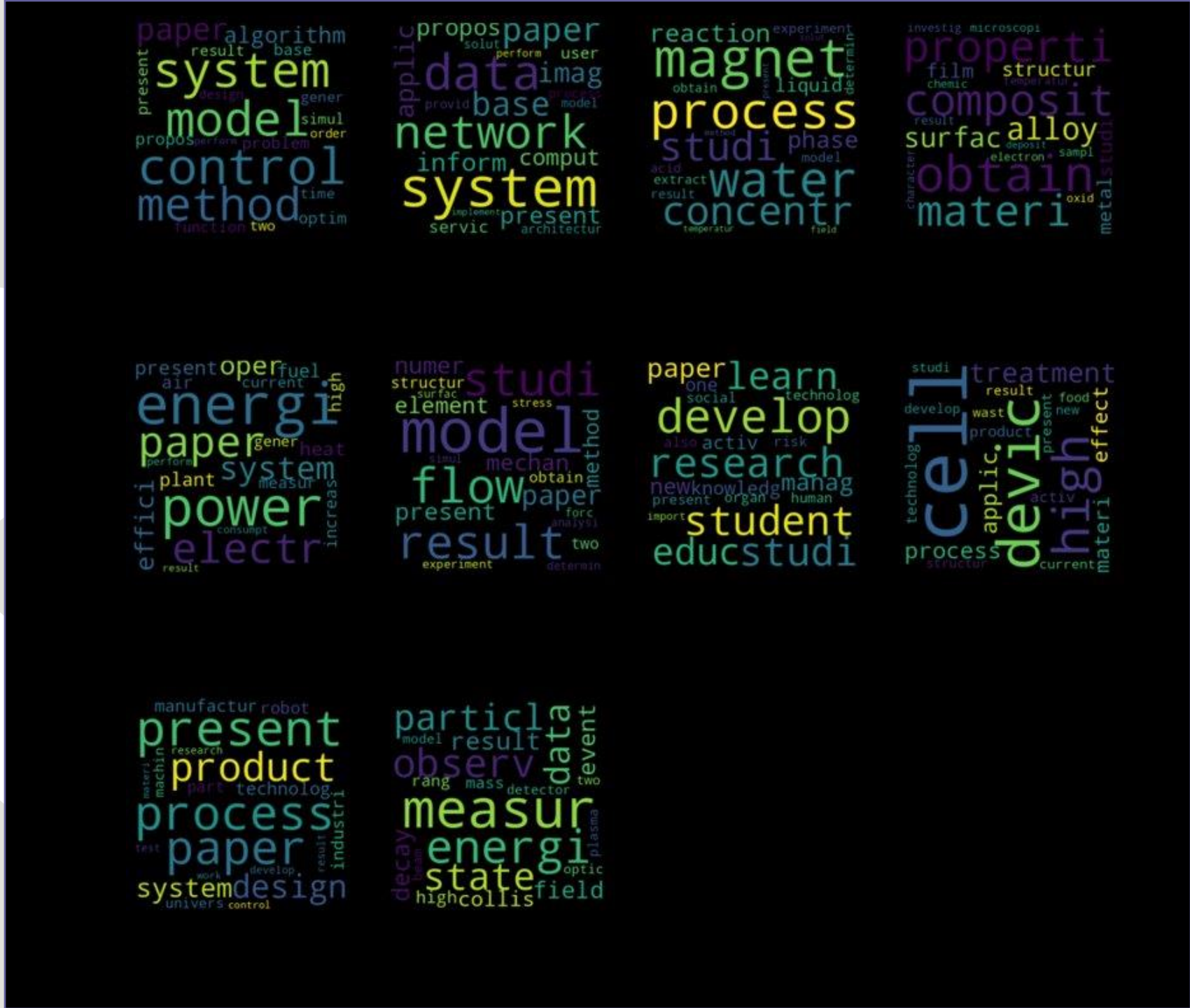


- Similarity Score is the Normal Probability Density Function

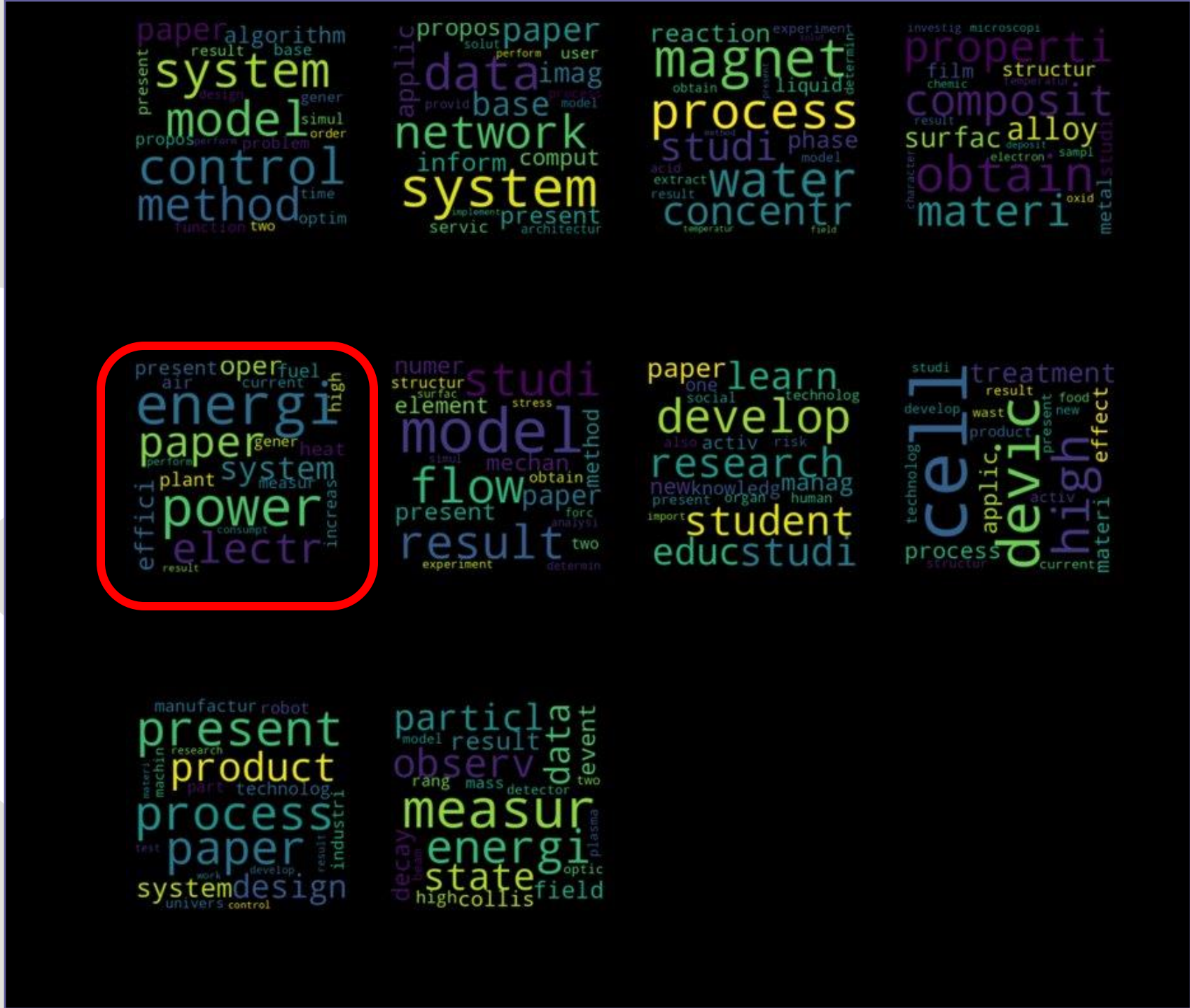
Testing


Topics per Author
Compute Similarity Score
Scores
Threshold Compare
Boolean Prediction
Test Publications
Optimal Model Threshold

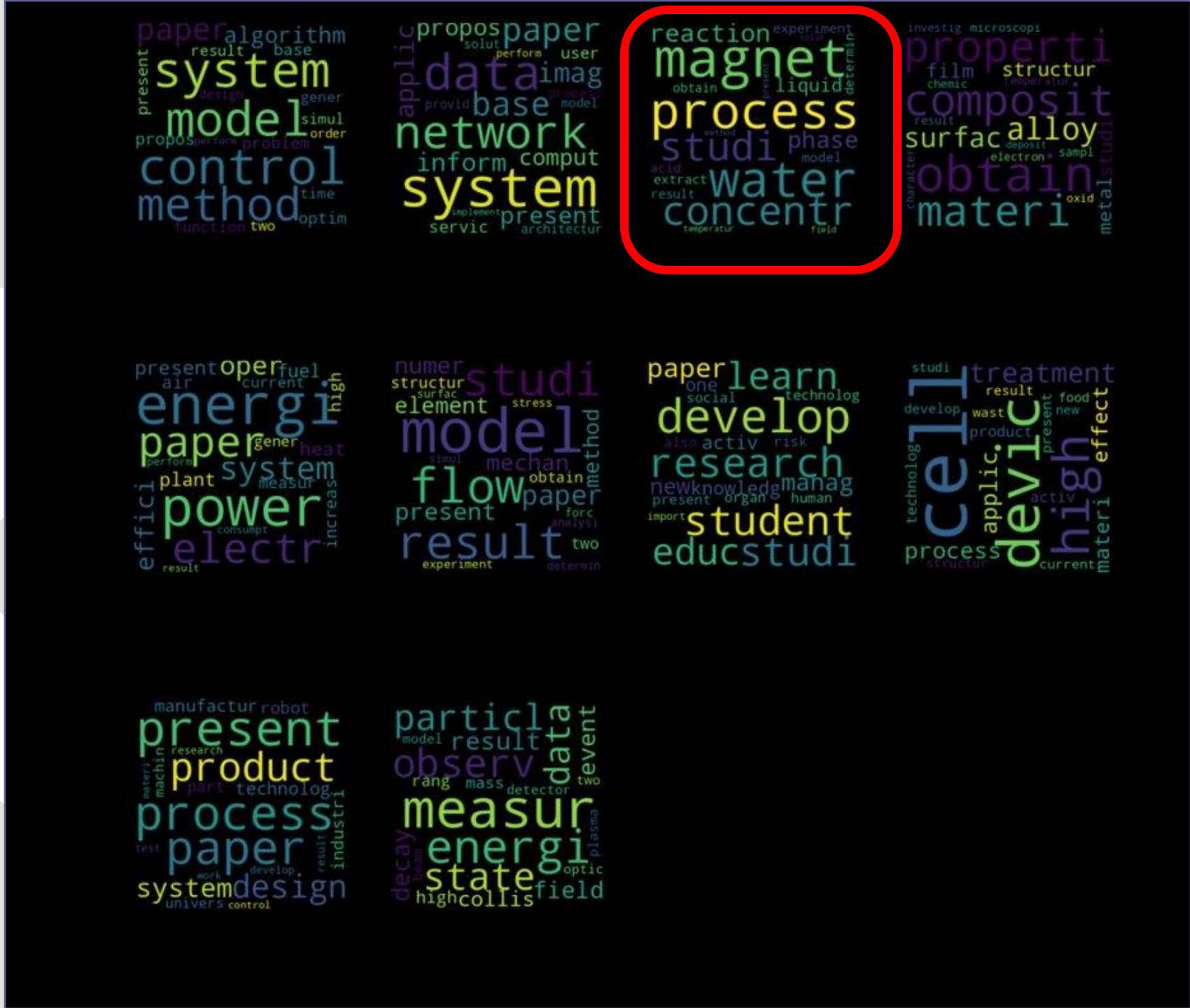
Discovered topics



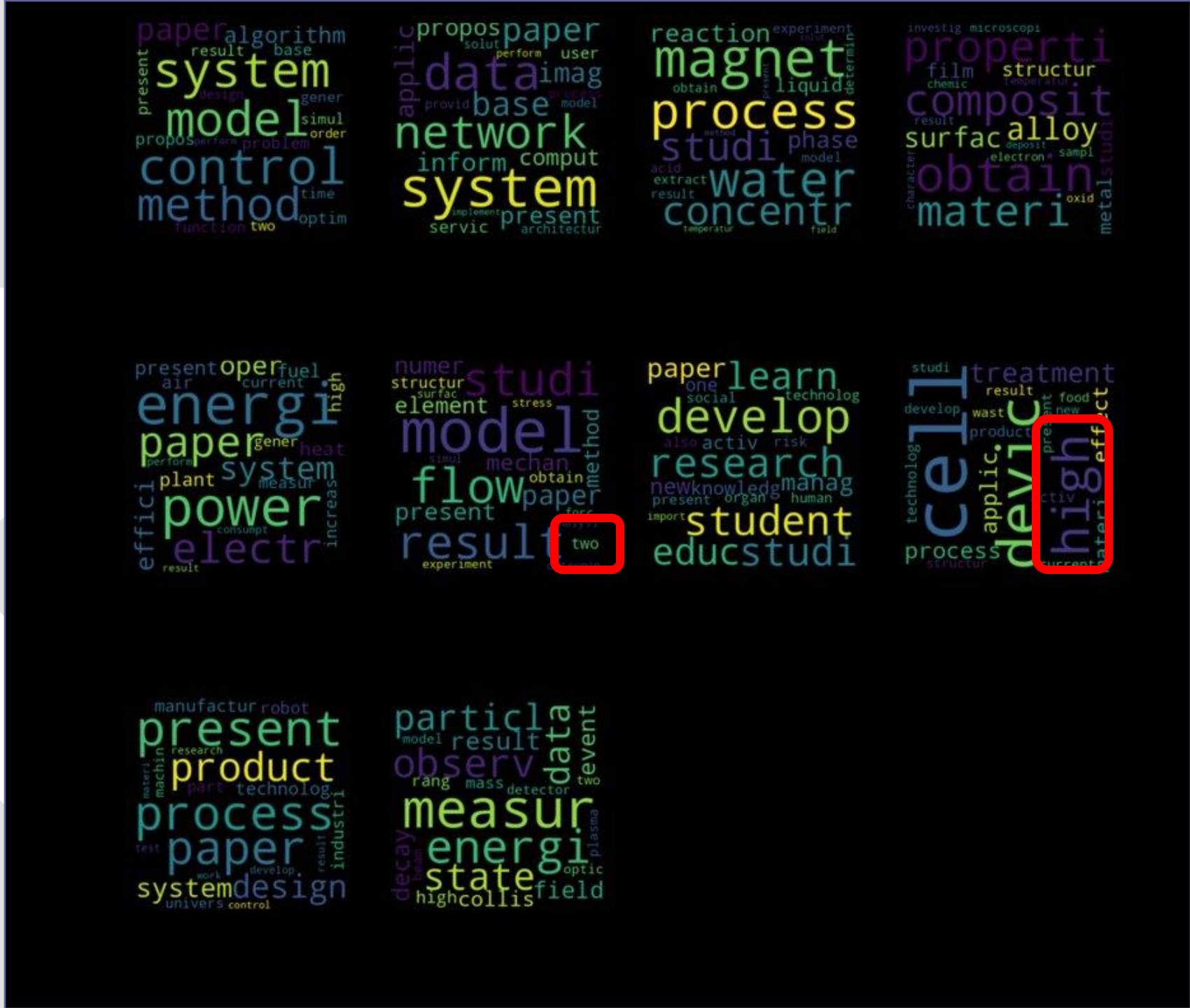
Discovered topics



Discovered topics



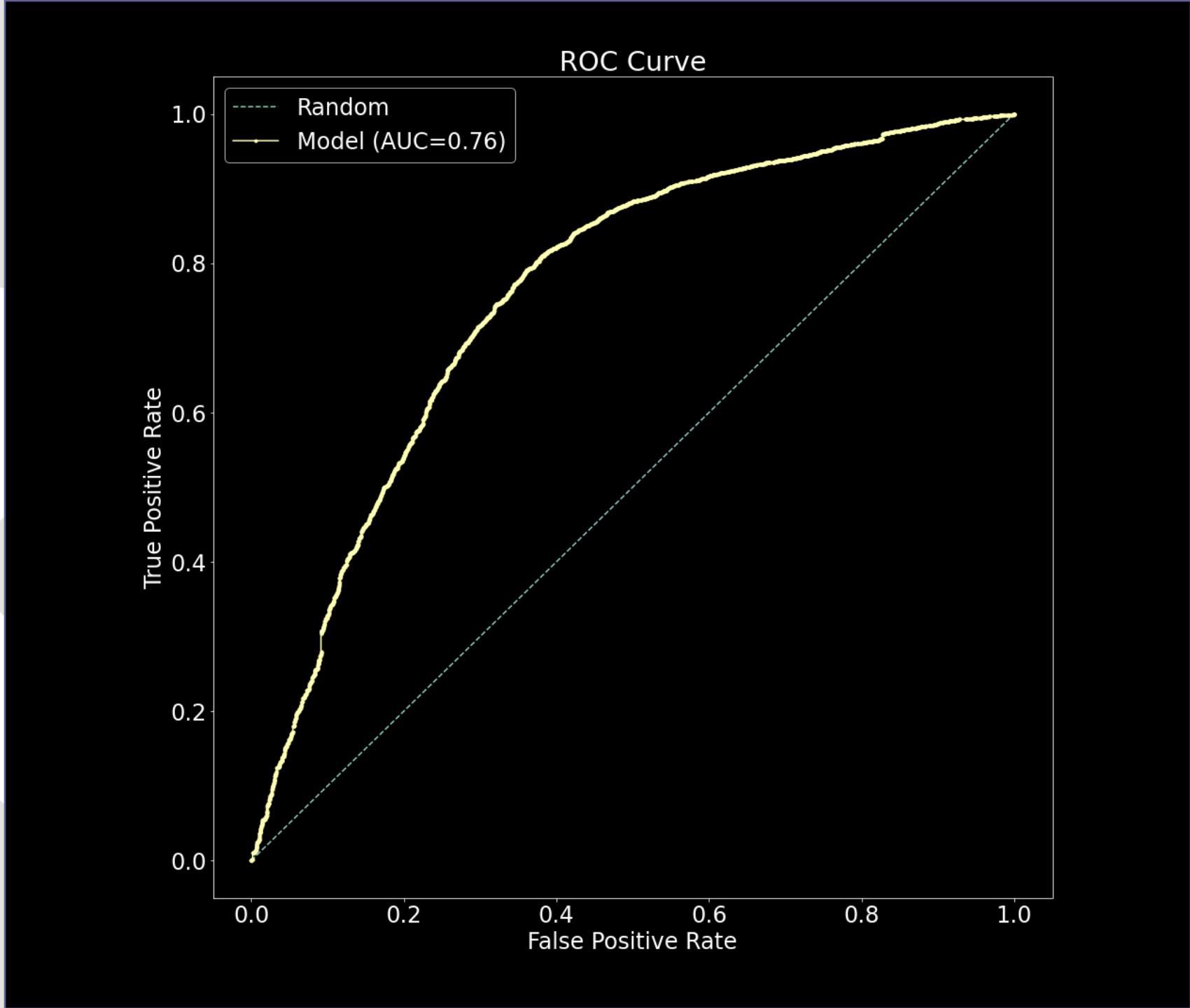
Discovered topics



ROC Curve

Using the real negative examples

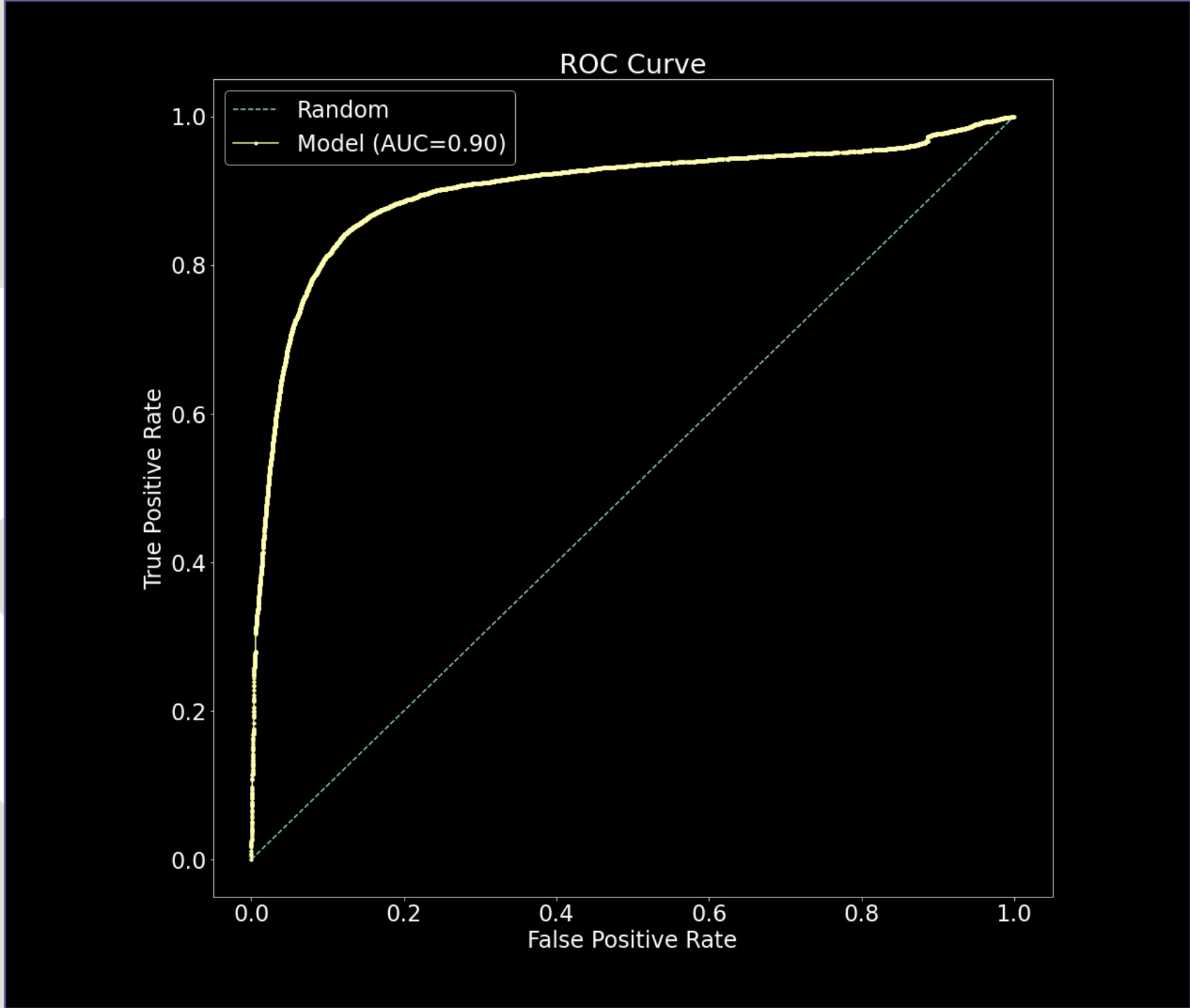
- Imbalanced dataset (7:1 ratio)
- Harder to tune
- Could have used FBeta score, but that introduces another parameter



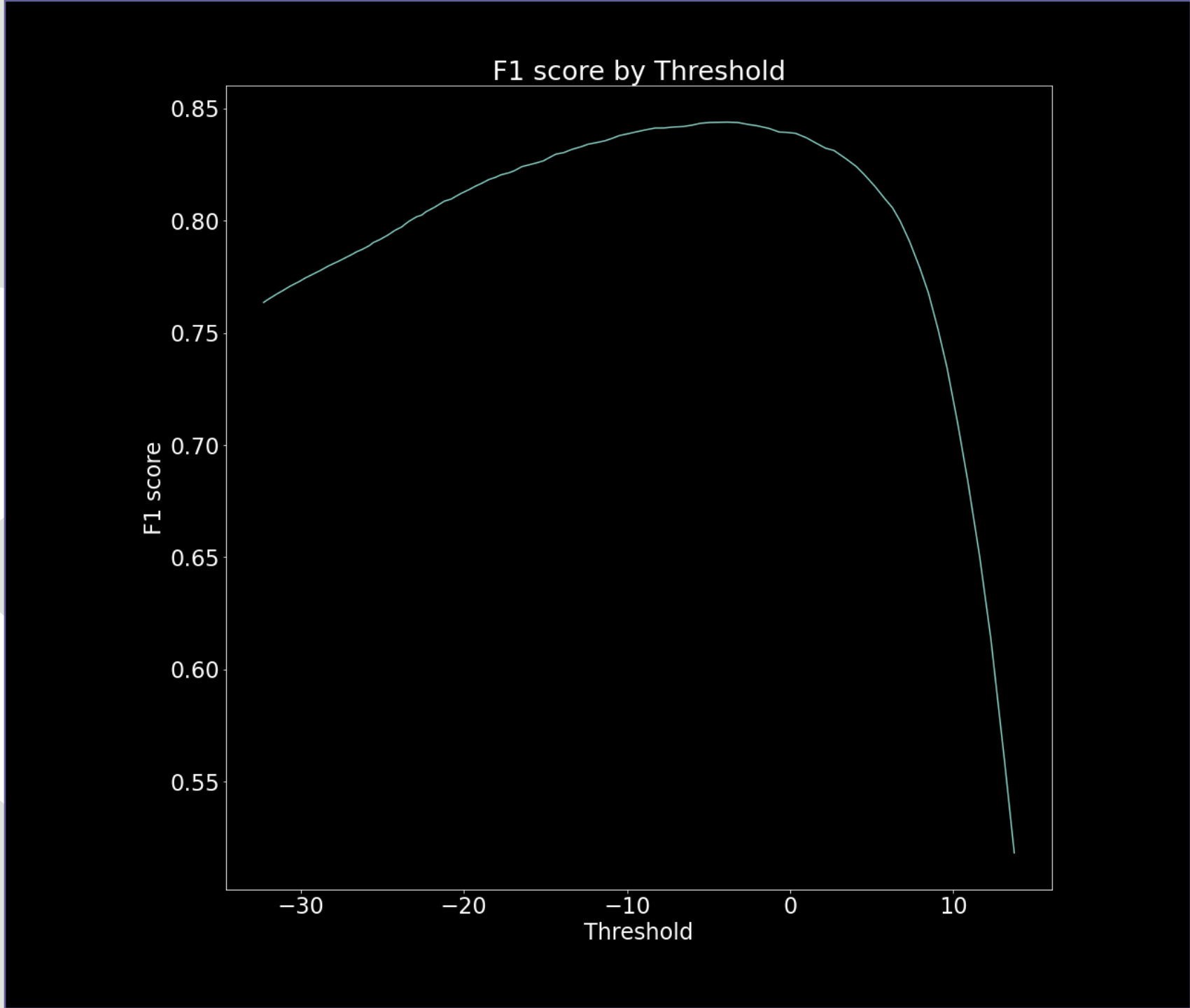
ROC Curve

Using random publication-author pairs

- Easier to tune using F1 score



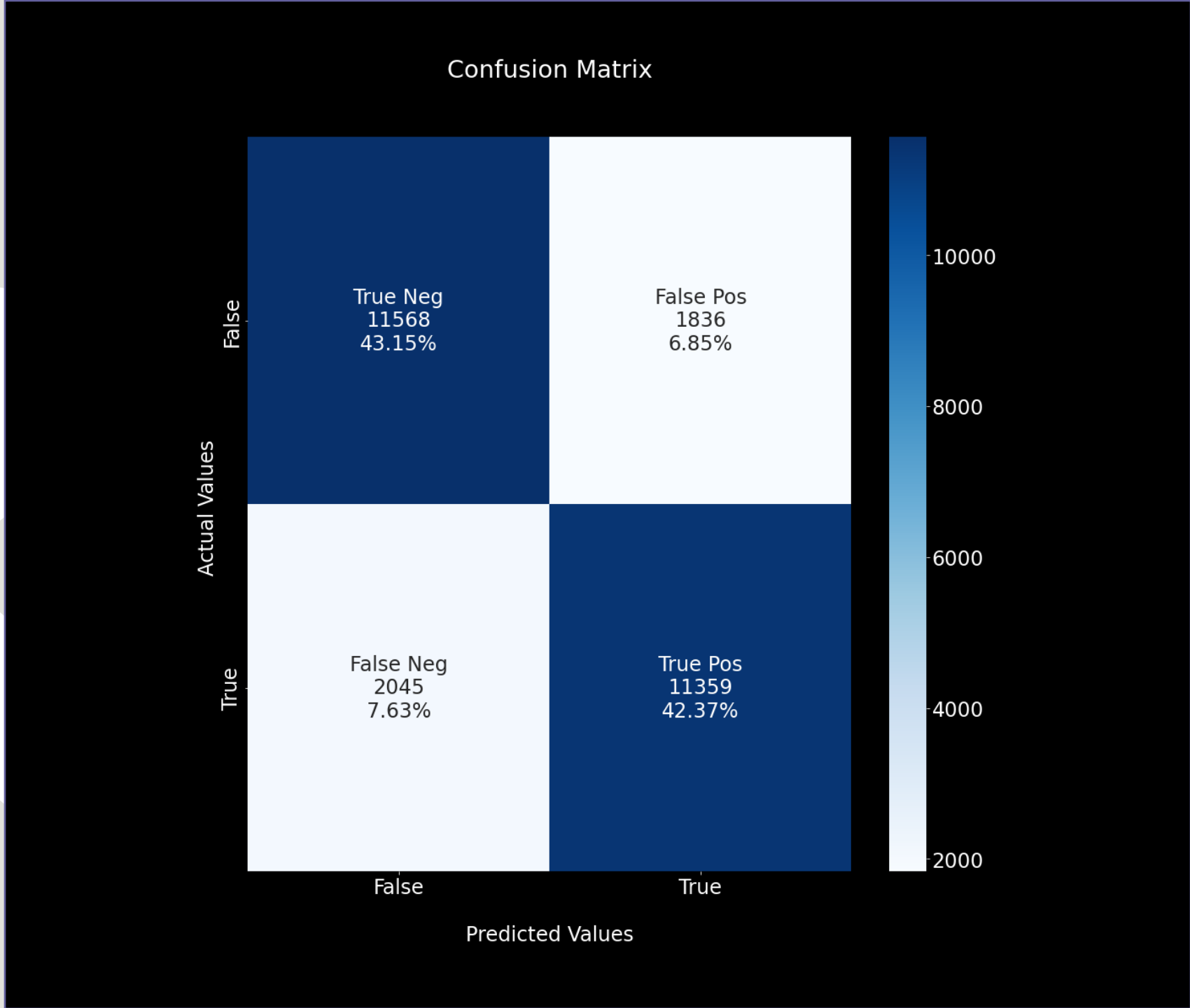
F1 Score


F1 score by Threshold
0.85
0.80
0.75
0.70
0.65
0.60
0.55
F1 score
−30
−20
−10
0
10
Threshold

Confusion Matrix

On the synthetic dataset

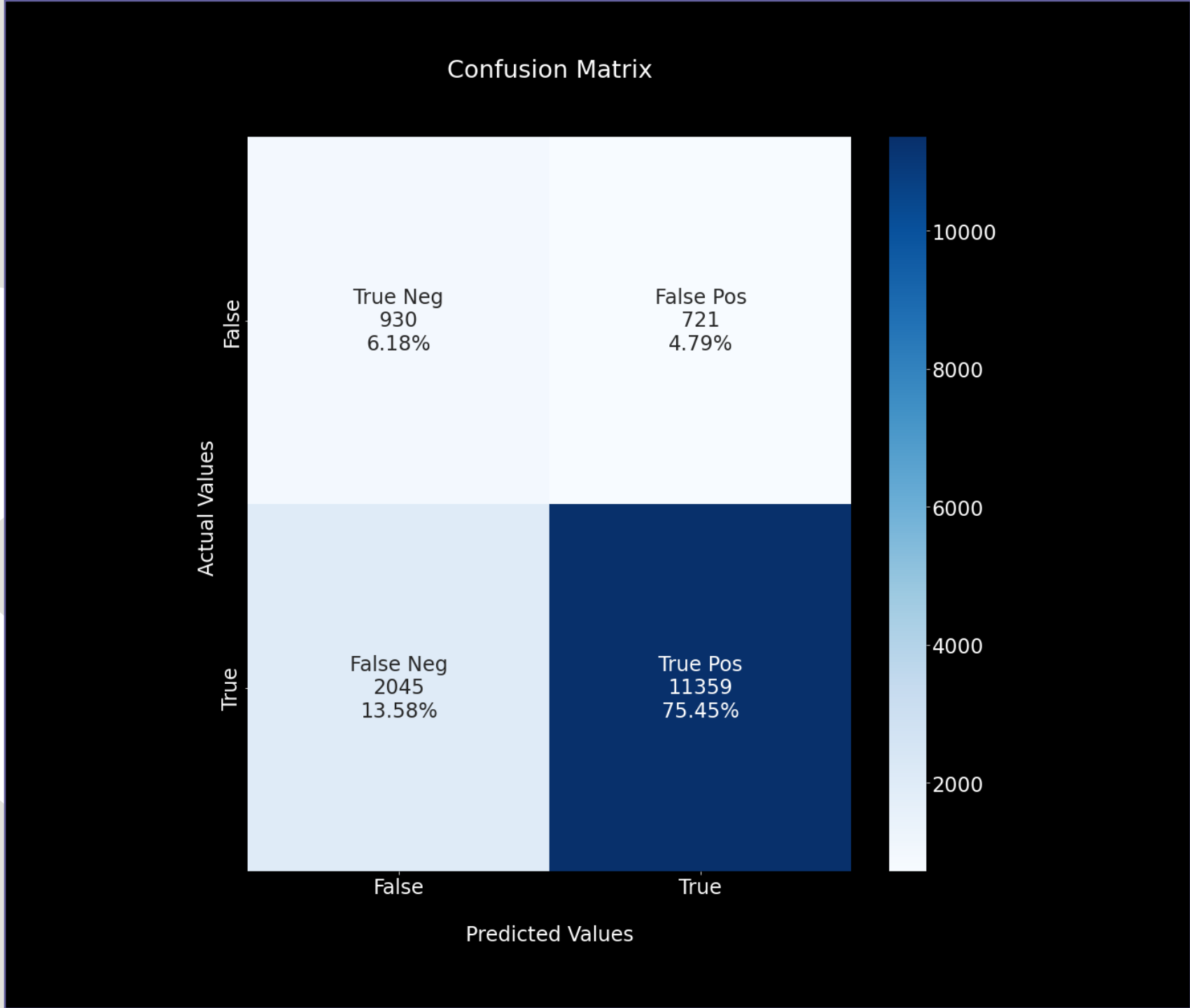
- 86% accuracy



Confusion Matrix

On the cross-validation dataset

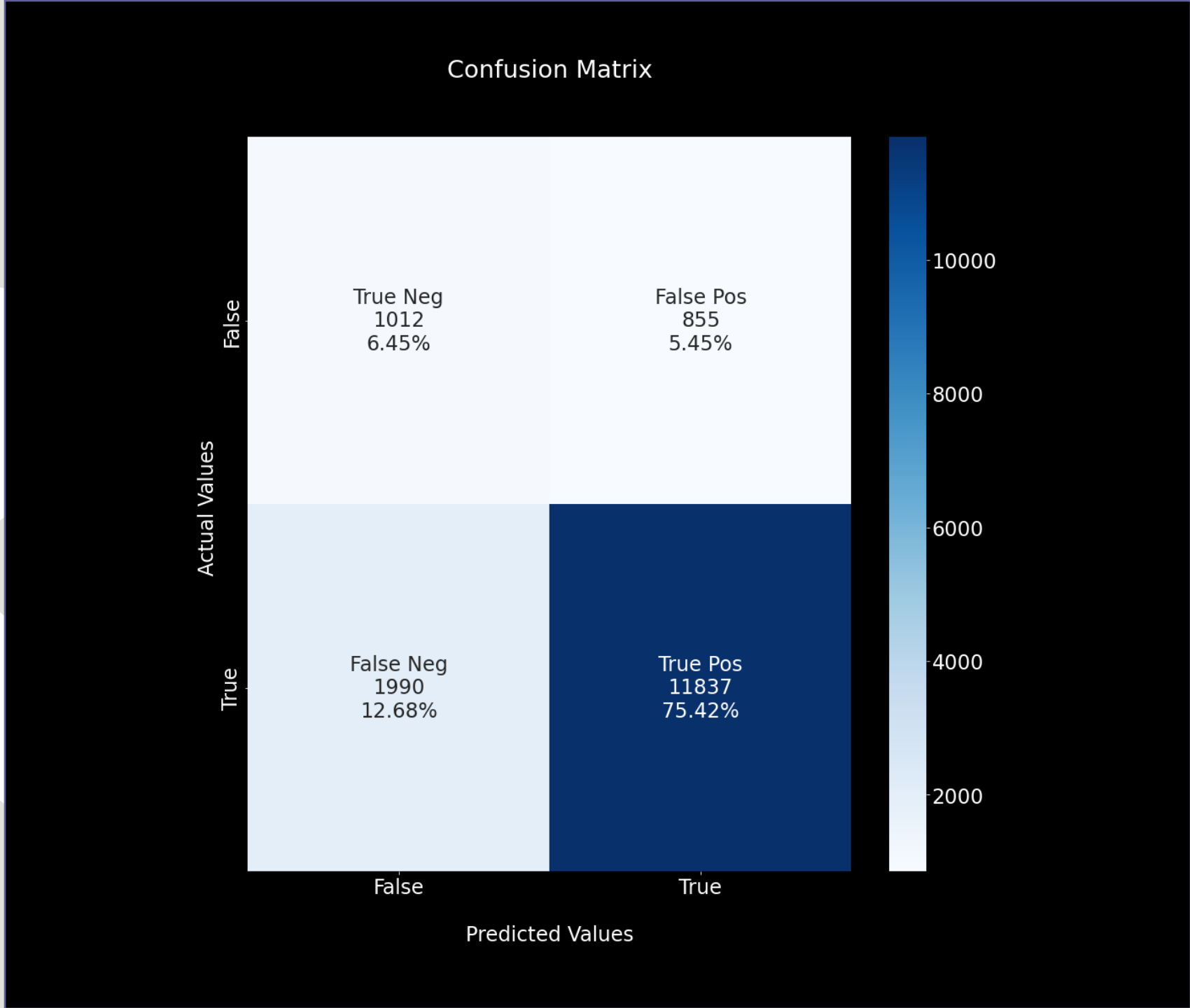
- 81% accuracy
- 0.84 F1 score



Confusion Matrix

On the test dataset

- 81% accuracy
- 0.89 F1 score



Conclusions

Limitations

- Word Ambiguity
- Small Dataset
- No end-to-end training

Improvement plans

- Replace LDA with BERT
- Implement end-to-end supervised training

Thank you!