

COMPARATIVE ANALYSIS OF ML MODELS IN THE CONTEXT OF SENTIMENT CLASSIFICATION IN BANKING

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Motivation

The rapid growth of digital communication has generated vast amounts of textual data, providing banks with valuable insights into customer opinions, reputation, and financial communication. As a result, sentiment analysis has become an important application of natural language processing (NLP), supporting data-driven decision-making and customer relationship management.

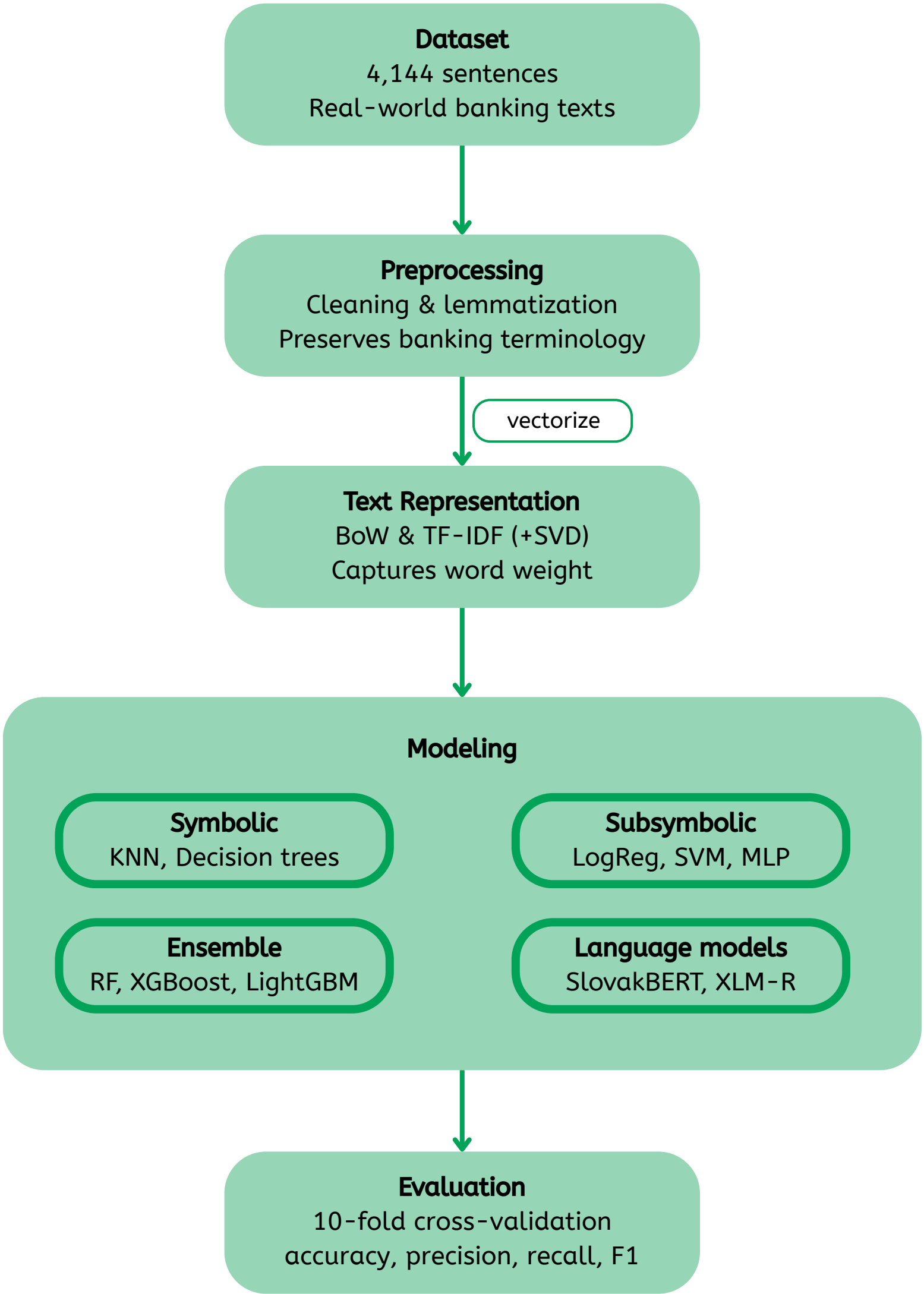
However, sentiment classification remains a challenge within low-resource languages such as Slovak due to the limited availability of annotated datasets and language-specific resources, especially combined with banking-specific jargon.

Thesis objectives

The aim of this study is to identify the most suitable machine learning approach for sentiment classification of Slovak banking texts through a comparative evaluation of symbolic, subsymbolic, ensemble, and language models.

- Review existing approaches to sentiment analysis in the banking domain.
- Prepare and annotate a dataset of Slovak banking texts.
- Apply symbolic, subsymbolic, ensemble, and language models in combination with different text representations.
- Compare model performance using standard classification metrics.
- Formulate recommendations for sentiment analysis in low-resource languages.

Methodology



Results

- **Best model:** Logistic Regression + TF-IDF
Accuracy 0.878 | Precision 0.841 | Recall 0.763 | F1 0.796
- **Other strong models:** SGD, SVM, and Ridge classifiers performed comparably across all metrics
- **Symbolic methods** (KNN, Decision Trees) consistently scored lowest among all tested approaches
- **Ensemble models** (Random Forest, LightGBM, XGBoost) reached moderate performance, but did not surpass the best linear models
- **Language models** were competitive but did not outperform traditional ML
- **Validation on new data:** applying the best model to 7,177 unseen sentences from 2023–2024 bank reports
Accuracy 0.88 | F1 0.86 (lower performance on minority sentiment classes due to class imbalance)

Conclusion

The comparative evaluation demonstrated that Logistic Regression with TF-IDF provides the most effective solution for sentiment classification of Slovak banking texts, achieving the best balance between predictive performance, stability, and interpretability. Contrary to expectations, more complex ensemble and language models did not consistently outperform traditional machine learning methods. These results indicate that, in low-resource domains, carefully selected text representations can have a greater impact on classification performance than model complexity alone. The proposed approach offers a practical and computationally efficient solution for sentiment analysis in the banking sector while providing a basis for future research on Slovak NLP.