Automatic Extraction of Lithuanian Cybersecurity Terms Using Deep Learning Approaches

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Aim of the research:

- To determine the most effective deep learning method for automatic extraction of Lithuanian terms from specialised (cybersecurity) domain.

Objectives:

- Compilation of cybersecurity (CS) corpus
- Development of the gold standard (GS) corpus with manually labelled terminology
- Performing experiments to test various deep learning models

The Cybersecurity Corpus

The compiled corpus is composed of 6 main categories of texts covering the period 1999-2019:

- legal acts of the Republic of Lithuania and related documents,
- reports of the National Cybersecurity Centre,
- translated EU legislation,
- translated international conventions,
- academic papers,
- information publications for the general public.

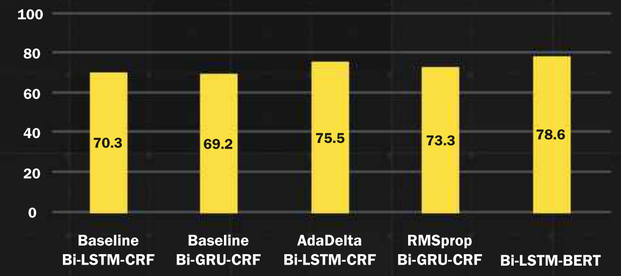
Gold standard (GS):

- The GS small-scale corpus (66,706 words) contains 1,258 manually annotated CS terms in BIESO annotation format.
- GS dataset was divided into 3 parts: 70% for training, 20% for validation and 10% for testing.
- GS dataset was supplemented by the entire Lithuanian Wikipedia database (27,907,392 words) in order to make embeddings more effective.

Experiments:

- Testing various baseline LSTM and GRU networks using Adam optimizer and FastText embeddings
- Testing each of the best baseline LSTM and GRU networks with various optimizers
- Comparing the best model with a model that has been trained using BERT contextual embeddings and testing if contextual embeddings can further improve our model

F1 Results of Top Performing Models



Conclusions:

- The results of our experiments suggest that for Lithuanian term extraction the semi-supervised deep learning approach is a way to go: although deep neural networks were trained on a very small amount of annotated data in these experiments, our top performing model managed to reach F1 78.6%.
- In order to achieve an even higher score, the quality and quantity of annotated data have to be increased.

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