

## ABSTRACT

The topic: Image Captioning System Using Bayesian Recurrent Neural Networks.

The master's thesis: 92 p., 20 fig., 24 tabl., 2 appendices, 48 sources.

Object of study: systems and methods for automatic image captioning.

The purpose of this thesis: development of an automatic image annotation system that is able to capture the objects and their relationships in the image and express them in a meaningful caption in the natural language.

The method of observation: methods and models for computer vision and natural language processing.

In this thesis an approach to image captioning problem that combines deep neural networks for image recognition with recurrent neural networks for language generation was explored. A comparison of possible model components and characteristics was conducted and an optimal model design was chosen. In addition, several metrics assessing the quality of captions generated by the model were analyzed and compared. The model was trained on the Flickr-8k dataset.

Training the model using the traditional algorithm of backpropagation was compared to treating the model as a Bayesian neural network and training it using Bayes by Backprop algorithm. The obtained results show the advantages of the latter approach. They also reasonably compare to the state of the art taking into account the practical restrictions in their attainment.

The resulting trained model was incorporated into a program that provides annotations for given images. This is the practical result of the thesis which can be treated as a proof-of-concept but can also have some immediate applications.

IMAGE CAPTIONING, CONVOLUTIONAL NEURAL NETWORKS,  
LONG SHORT-TERM MEMORY, ENCODER-DECODER PARADIGM,  
BAYESIAN NEURAL NETWORKS, BAYES BY BACKPROP, METRICS.