

## **Abstract**

Modern biological research generates large amounts of data, which require automation for efficient analysis. Lately, machine learning solutions are being developed for many of the problems in this field. This thesis focuses on applications of machine learning for image analysis, such as detecting cells in microscopy images and classifying them based on their phenotype. After a brief introduction to machine learning concepts, eight published methods are presented, which employ machine learning for either detecting and classifying, or counting objects in biological images. Five open-source software tools for biological image analysis, which employ some of the methods mentioned above, are introduced. A new project is also described, which aims to create a convolutional neural network for counting bacterial colonies in images of agar plates. The results of this project are discussed.

**Keywords:** machine learning, neural network, pattern recognition, cell biology, segmentation