

## Laboratory Work No. 3

### Research on Convolutional Neural Networks (CNNs)

#### **Main task [8 points]**

In this lab work, conduct research on how Convolutional Neural Networks (CNNs) with different architectures are used for microscopy image analysis. To complete the lab, find two CNN models with as different architectures as possible on the internet (GitHub, researchers' personal pages) that are used for microscopy image segmentation or object search. Most of the networks will assign a pixel to a certain class, e.g., cell or background (semantic segmentation), or not only recognize the pixel class, but also distinguish individual objects from each other, e.g., cell1, cell2, ... (instance segmentation). There may be networks that only calculate the bounding box of an object or return the contours/boundaries of an object.

Try the examples you find with these images:

[https://www.dropbox.com/s/qscq5qa5v5nbwx/LD4\\_images.zip?dl=0](https://www.dropbox.com/s/qscq5qa5v5nbwx/LD4_images.zip?dl=0)

Also, look for additional images that these networks should work with (i.e., do not force them to work with image types that they are not designed to work with), but make mistakes, i.e., finding weak points in the network – an important part of more detailed testing to determine the network's ability to operate under new conditions (whether the network generalizes well), predict where operational errors are possible, and what to improve to avoid them.

#### **Questions [2 points] [optional task]**

1. What difficulties did you encounter while performing the task and how did you solve/resolve them?
2. Which CNN architectures are best suited for analyzing microscopy images and why?
3. Come up with your own question related to this LW, answer it for yourself.

#### **Contents of the Report**

Submit your report (written work) in PDF format: with solutions, all graphical results, program code (the part you added yourself) and the final results obtained during its execution, a brief overview of the SDNT examples you found and used.

#### **Report Submission and Evaluation**

This LW task should be completed and sent by email to [dalius.matzevicius@vilniustech.lt](mailto:dalius.matzevicius@vilniustech.lt) by 23:59 on 2025-10-30. Late submission of the report will result in a 25% reduction in the task.