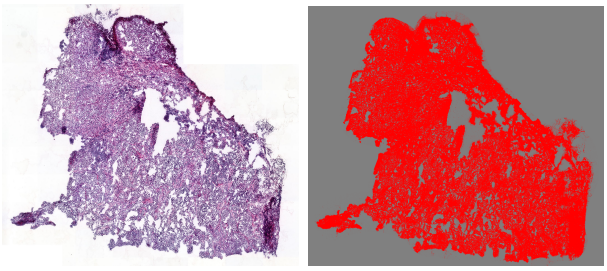
Department of Biomedical Engineering | Lund University | Presented 2020-09-10

Thesis Automated Histopathological Evaluation of Tumor Images using Convolutional Neural Networks
Author Jonatan Nyström
Supervisor Jonatan Eriksson (LTH)
Examiner Christian Antfolk (LTH)

Robot Pathologists

A Popular Science Summary by **Jonatan Nyström**

Annotation of Medical Images is time consuming work that currently requires the highly specialized skills of a pathologist. Using a statistical model called a Convolutional Neural Network, *CNN*, there is a potential for automating this process. Hopefully resulting in a faster, but still accurate annotation.



Analysis of medical images in general and histopathological images in particular, is used in medical research as well as to make diagnoses of patients. A histopathological image is an image of a dyed, thin slice, of a medical biopsy. For example a suspected skin tumor.

To annotate the image means to determine what kind of biological components that are present and where they are situated. Typically, this is represented by coloring the different segments according to the components. Using the annotation one can then draw conclusions about the state of the patient or look for patterns between the presence of certain tissue-types and the outcome of the patient.

A Convolutional Neural Networks is a statistical model that typically looks at a small image and tries to classify it into a pre-determined set of classes. However, before the model can do it's job it needs to learn how. This is done by fitting the model parameters, or *weights*, to some dataset where the true answer is included.

In this thesis, three different types of CNNs performance to annotate an histopathological image was tested. For each model, three different sizes of input images or *tiles* were also tested. The automated annotation was done by splitting the large histopathological whole-slides into smaller tiles. The tiles were then classified and the original whole-slide was colored accordingly.

The thesis found that a model called *InceptionV3* using a tile size of 224×224 pixels, performed the best, but with a small margin. It accurately annotated roughly 90% of the tiles. The impact of the tile size on the performance did not seem to be significant. In the future one can imagine using statistical models to not only annotate medical images, but also give suggestions on diagnoses and actions to take.