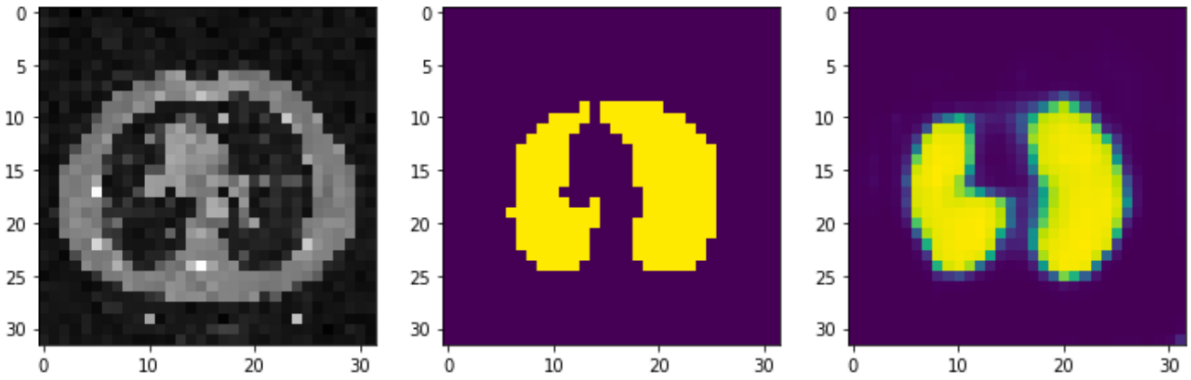
Praktikum04:
Image segmentation and classification with deep learning
23. April 2025

Exercise 1

1. Save the Jupyter notebook "Praktikum04_Unet-lung.ipynb" and the datasets "praktikum04_2d_masks.zip" and "praktikum04_2d_images.zip" from the FELIX platform to your computer. Unzip the zip folders.
2. Go through this tutorial step by step. An explanation of the tutorial can also be found online at:
    a. https://www.kaggle.com/toregil/a-lung-u-net-in-keras
    b. The goal of this tutorial is to train a neural network to segment lungs in computed tomography (CT) images. Segmentation assigns each pixel in the image to one of two classes: foreground (object) or background (not of interest). In the lookup table below, foreground pixels are shown in yellow and background pixels in blue.

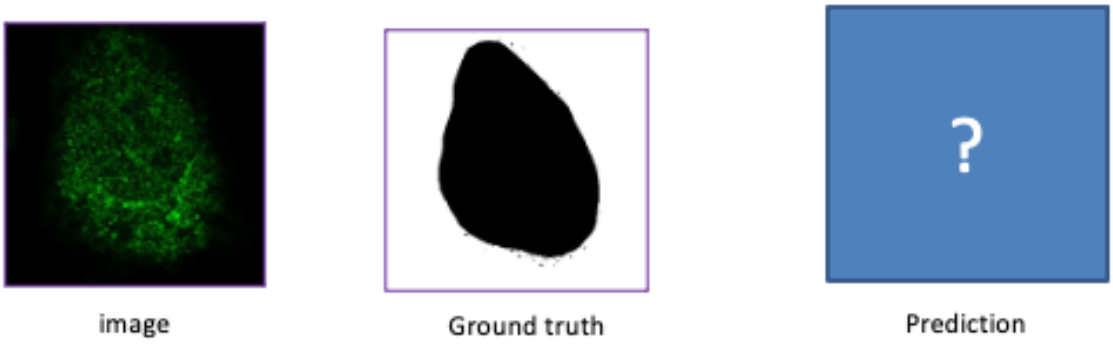


3. Now train your own instance of U-net, which will learn the segmentation using the masks from the FELIX "Cell-data" folder. Note: Not every image has a mask!

   The mask is assigned to the image using the prefix in the file name:

   The image "prot1_20_B5_1_green.jpg" is assigned the mask "prot1_20_B5_1_green_mask_AWA.jpg".

   Name this Jupyter notebook “Praktikum04_Unet-cell.ipynb” and show segmentation results on cells that the network has not seen before.



Exercise 2

1. Create a new Jupyter notebook named "Praktikum04_image_classification_ _wang.ipynb." Now train Alexnet with the 10 classes from the wang database (praktikum04 folder: "wangCustom10.zip"). Use a 90-10 train-test split. Document your code and the results.
2. Display the confusion matrix on the test data.
3. Display the training error over the epochs in a plot (see Unet notebook).
4. Write a function that creates a map with all images from the test dataset for a class that were correctly assigned.
5. Write a function that creates a map with all images from the test dataset for a class that were incorrectly assigned.

You can use the Jupyter notebook "Praktikum04_Classification_with_Alexnet.ipynb" as a template. In this notebook, the Alexnet was trained to distinguish images of type A cells from images of type B cells. The corresponding images can be found in the file "Praktikum2_images.zip."