

# Case 2. Pneumonia X-ray image analysis

Neural Networks for Machine Learning Applications, Spring 2022

## Type

Team work, 25-40 hours

## Aim

The aim of this assignment is to learn to use convolutional neural networks to classify medical images.

## Task

Your task is to use convolutional neural networks to create *a binary classifier* for x-ray chest images.

Either download and extract the dataset (ChestXRay2017.zip) from:

<https://data.mendeley.com/datasets/rscbjbr9sj/2>

or alternatively use the same dataset in Kaggle (recommended for higher performance):

<https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia>

**Create minimum three (3) different CNN models and compare their results.** Calculate also the classification reports and confusion matrices for the outcomes. We aim to achieve minimum 90% (0.90) of sensitivity and 90% (0.90) of specificity in classification results. Select your best model and give reasons for your selection.

You may study others author's solutions (see the dataset in Kaggle), but make your own experiments and versions in your Notebooks. Remember to give credits to those authors from you have gained inspiration.

Use the given Notebook templates for documenting your solutions. Remember add more sections for each model into your Notebook. For more details how to document your results, see Case 1 instructions.

## Return

Save all your models into one (1) Notebook. Return your final Notebook to OMA.

## Evaluation

The following categories are used for evaluation:

- Organisation
  - o The code is sequential and the code cells (parts of scripts) are in right order
  - o The document follows a clear structure
- Clarity
  - o The document (and embedded code) is clear, polished, and easy to understand
  - o The code follows good coding practices and contains sufficient comments
  - o The document parts support the code
- Contents
  - o The background and data preprocessing are well explained
  - o The models are validated
  - o The results are reasonable
  - o The conclusions are clearly stated and in a line with the results

Max. 20 points. Late submission reduces the maximum achievable points.

## Tips and links

- Case study
  - o Jain et al. (2020). Pneumonia detection in chest X-ray images using convolutional neural networks and transfer learning, Measurement, Vol 165, December 2020.  
<https://doi.org/10.1016/j.measurement.2020.108046>
    - Login to MetCat Finna, Search International e-resources
- Tensorflow
  - o [Load images](#)
  - o [Convolutional neural network](#)
  - o [Image classification](#)
  - o [Data augmentation](#)
  - o [Transfer learning and fine-tuning](#)
- Keras
  - o [Deep learning with Python - Notebooks](#)
    - chapter08
    - First edition > 5.1, 5.2, and 5.3.
  - o [Convolutional layers](#)
  - o [Guide to sequential model](#)
- Other
  - o [Imageio usage examples](#)