Case 2. Pneumonia X-ray image analysis

Neural Networks for Machine Learning Applications, Spring 2023

Type

Teamwork, 30—40 hours, 20 p

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.

Use the dataset in Kaggle (recommended for higher performance):
https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia

Or alternatively download, and extract the dataset (ChestXRay2017.zip) from:
https://data.mendeley.com/datasets/rscbjbr9sj/2

Develop a minimum of three (3) different CNN models and compare their results. Also calculate the classification reports and confusion matrices for the outcomes. We aim to achieve a minimum of 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 code tab in Kaggle) but make your own experiments and versions in your Notebooks. Remember to give credits to those authors from which you have gained inspiration.

Use the given Case 2 Template at Kaggle or Colab to document your solutions. Remember to add more sections for each model into your Notebook.

Return

Save all your models into one (1) Notebook. Share and save a hyperlink to your final Notebook in OMA.

Alternatively, if you have used Anaconda distribution, upload your Notebook to OMA as attachment.

Evaluation

The following categories are used for evaluation:

- Organization
  - The code is sequential, and the code cells (parts of scripts) are in right order
  - The document follows a clear structure
- Clarity
  - The document (and embedded code) is clear, polished, and easy to understand
  - The code follows good coding practices and contains sufficient comments
  - The document parts support the code
- Contents
  - The background and data preprocessing are well explained
  - The models are validated
  - The results are reasonable
  - 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
  - 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
  - Load images
  - Convolutional neural network
  - Image classification
  - Data augmentation
  - Transfer learning and fine-tuning
- Keras
  - Deep learning with Python - Notebooks
    - chapter08
    - First edition > 5.1, 5.2, and 5.3.
  - Convolutional layers
  - Guide to sequential model
- Other
  - Imageio usage examples