Deep Learning Fundamentals Course - Final Project - 2024

Objective: Classification of Chest X-ray images

Dataset for training: Kaggle Chest X-ray Pneumonia Dataset

This dataset contains 5,863 X-ray images divided into two main categories:

1. Healthy
2. With pneumonia (further divided into *bacterial* and *viral* pneumonia, which can be inferred from the image name).

The dataset is divided into training, validation, and test datasets. Keep the test set as is. You may combine the training and validation sets and redistribute them differently.

Project Tasks:

1. Solve the following problems using deep neural networks:
    a. Classification of healthy/sick.
    b. Classification of healthy/bacterial pneumonia/viral pneumonia (a network with three outputs, not hierarchical).
2. After selecting a successful network from the previous tasks, demonstrate how to classify a new image using the embedding vector created from the classification network and **KNN**. Visualize the different classes using t-SNE (you may use a ready-made t-SNE library).
3. In this task, you only have data for "healthy" images. Try to identify "sick" individuals using Anomaly Detection methods.
4. **Explainability**: Implement and analyze one of the explainability techniques you have learned during the course for the model trained in task 1.1. Discuss how this technique helps understand the model's decisions.

Remember, this project is designed to reflect the knowledge you've gained during the course. For different tasks, use and consider the factors discussed during the course, such as learning rate, optimizers, transfer learning, network architectures, loss functions, etc. Do not use tools that were not covered in the course.

Submission:

- Submit in pairs.
- Due date: March 31, 2024 23:59

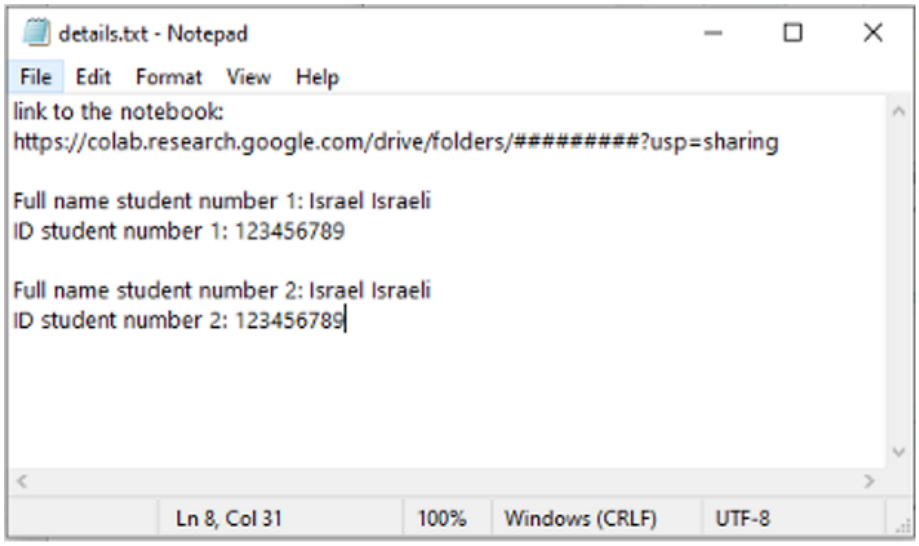
Technical Instructions:

- The neural network should be built using only the Keras library. For the rest of the project, you can use helper libraries like NumPy, Pandas, Seaborn, scikit-learn, Matplotlib, etc.
- Save the trained weights of the "winning architecture" and set up a test environment for each task. The test notebook should allow loading the trained weights/model and give the user the option to upload new input for classification (according to the different tasks).
- Provide clear instructions on how to run the notebooks you've attached.

Submission Instructions:

1. Detailed Report: Include graphs, **source code links (to Google Colab)**, relevant images, and a README file with explanations for running the notebook. Structure your report like a conference paper with an introduction, related work, method, experiments, and discussion sections. Document all experiments, and if an experiment failed, explain why and what steps were taken to improve.
2. Report Format: Use this Overleaf format for report creation. The report must be in your own words with all quotes properly attributed.
3. Report Submission: Submit the report as a PDF in the following naming format: report_ID1_ID2.pdf. Include the project title, your name, and student IDs. The **report is limited to a maximum of 12 pages (but you don't have to use them all!)**
4. Notebook Presentation: The Colab notebook should be well-organized with separate code and text cells clearly explaining each action performed. **Ensure all training results are included in the notebook outputs when submittin**g. **Write a clean code**! **A sloppy notebook will result in a lower grade.**
5. Do not change anything in the notebook after the final submission date. A notebook that has been run/changed after the submission date will be **automatically disqualified**.
6. Sharing and Submitting Notebooks: Share the notebook via Google Drive with a shareable link. In the submit.txt file, provide your details, the names and IDs of both partners and the links to your notebooks.

7. Files to Submit:
    a. Submit.txt :



    b. report_ID1_ID2.pdf
    c. train.ipynb
    d. test.ipynb
    e. trained weights
8. Academic Integrity: Do not copy code from others. Any use of external code must be properly attributed. Failure to do so will be considered a violation of the academic integrity policy and will be dealt with accordingly.

Good Luck!!