Assignment 2 –
Case Study for Implementation

[40 Marks]

Release date is 28 Feb 2024

Deadline is 24th March 2024

You are working as a research engineer or a data scientist in a company. Your team lead asked you to have a look of the data provided by a customer. They want a desktop/web-application to view the results with a machine/deep learning model running in the backend.

An initial understanding by the management is that the company want to differentiate and recognize the various surfaces of the road and to be displayed with the respective name of the category.

Your task is to understand the data, read the literature, and propose a model for it that can recognize the images. However, one thing that the company said is that they don't want a model as it is from the web, they want you to bring some novelty in the model so that they can say that it is their own model. In other words, not to face Intellectual property related issues.

You can use any algorithm for it. However, in your report you need to justify why you designed/proposed this model for this problem.

The data provided is already in training, validation, and testing set. Train, test and report the results with appropriate performance metrics.

Also, in conclusion, do highlight any issues or scenarios where the model might fail so that the company knows in advance.

You must upload **a pdf** and **your code**.

Report the following in a pdf:

1. At first page, write your names (as this is a group of 5 students project write all member names), roll numbers, and group number, and then in 50-150 words, report who did what in the assignment e.g., who came up with the idea of how to implement it, who implemented it (as a whole or part of it), who debugged it, who gave suggestions (and what suggestion/s), who wrote the report, who created the frontend, who did which simulations, etc.
2. Explain how your group selected and implemented the novelty (if any) in a network using an existing library (keras, TensorFlow, PyTorch, or other) or from scratch or by combining multiple codes or ideas or by reading from a paper. This information should be added to the proposed model section of the report.

3. Report the successful implementation of the network and complete model with a figure from tensor board. This should be part of the Proposed Model section.
4. Train the model with the dataset provided for this assignment and report the training and testing performance against various hyper parameters (e.g. learning rate = 0.1, batch sizes {8, 16, 50, or others depending on your system/laptop capacity}, epochs {100, 200, 700, 1000 or other depending on the model performance}) using stochastic gradient decent or another algorithm, or optimizers. Report all results in a table, even if they are not good. Also show their training and testing performance in the form of a graph. All this should be properly explained in the Experiments/results & analysis section of the report.

5. Finally, prepare a desktop/web application for your algorithm. You can use any platform that is easy for you. It does not need to be sophisticated. However, it should show at least a sample file selection option, once selected, the trained model to be used to categorize it in respective category and showing a message from which class it belongs or by writing on the image or showing a list with image number and respective class name. [**10 Marks**]

6. Some main sections of the report other than front page and explanation i.e.
   a. Abstract, **[2 Marks]**
   b. Introduction, **[3 Marks]**
   c. Short to the point literature review e.g. 2-4 papers, **[3 Marks]**
   d. Proposed model **[7 Marks],**
   e. Dataset explanation section that describes the data, any issues in the data, stats of the data, preprocessing that might be needed for the data while preparing it for training, **[3 Marks]**
   f. Experiments/results & analysis, **[7 Marks]**
   g. conclusion (with future directions). **[3 Marks]**
   h. References **[2 Mark]**

NOTE:

Make a group of 5 members and perform the following actions:

- Send me the names of your group members so that I can share the link of the dataset.
- You can use existing libraries and update them or implement the network from scratch. All depends on you.
- Once you implement it, use the dataset provided and show the results.
- Upload two files. One for the code and one for the report with code, results, and your analysis. Share the code (Jupiter notebook).
- If you have any questions, please feel free to ask me or the TA in the Lab session, on discussion board, or after the class.