UPM - DEEP LEARNING COURSE

The ffNN challenge 2024

Assignment 1

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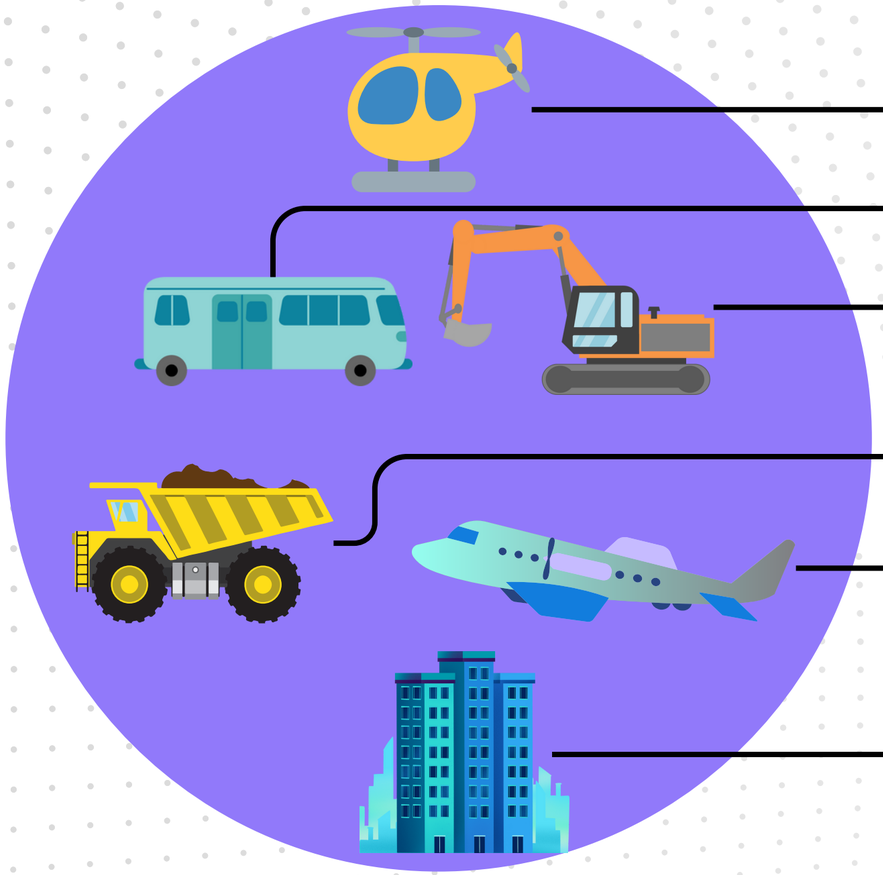
The Problem

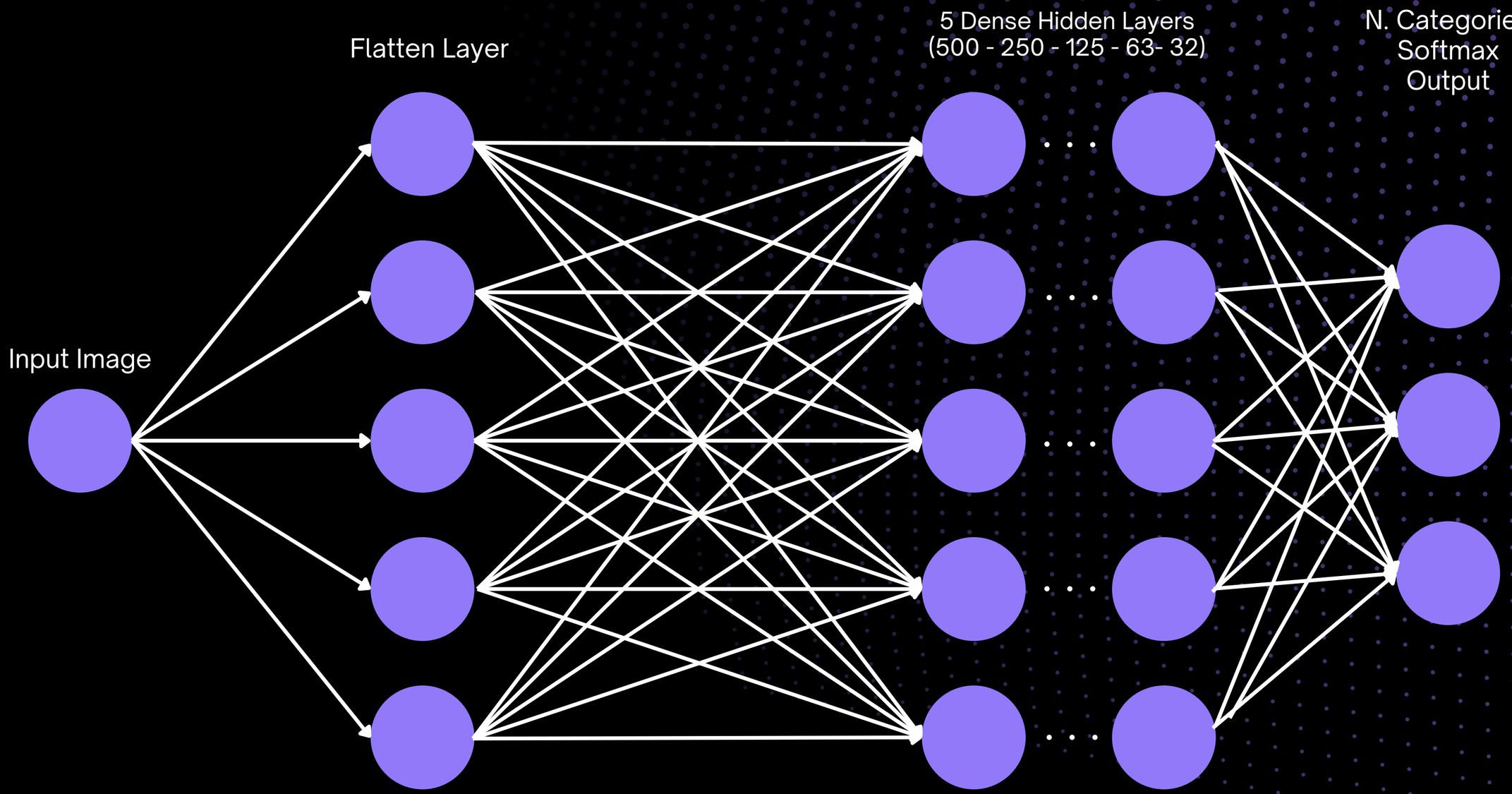
Images Dataset



Correct Label

- Building
- Bus
- Cargo Plane
- Dump Truck
- Excavator
- Helicopter

The architecture



Performance Optimizers

We started from a simple Neural Network and we changed the following hyperparameters and methodologies to increase the predicting performance

Deep Network

Adding 5 layers in the NN will catch complex relations in data

Leaky ReLU

Leaky ReLU gives better results than ReLU

Dropout

Dropout rate has been increased to 0.4

Normalization

Batch Normalization copes with vanishing gradient problem

Adam

Adam combines all pros from best optimizers

Before Optimization

The inizial Neureal Network implemented had the following hyperparameters:

- one initial layer with RELU activation function and drop-out rate of 20%
- one output layer with softmax transformation and 12 neurons (one for each category)
- The optimization has been implemented using Adam algorithm

RESULTS in terms of maximum ACCURACY

validation set: 41%

test test: 38%

Deep Neural Network

We optimized the hyperparameters making the Neural Network **Deep**. These are the main changes we applied:

- we **added 5 hidden layers**
- changed the activation function of the layers to **leaky ReLU** except the output one
- the **number of neurons for each hidden layer has been increased**: there are respectively 500, 250, 125, 63 and 32 neurons for each hidden layer. The input and the output layers have been kept the same size.

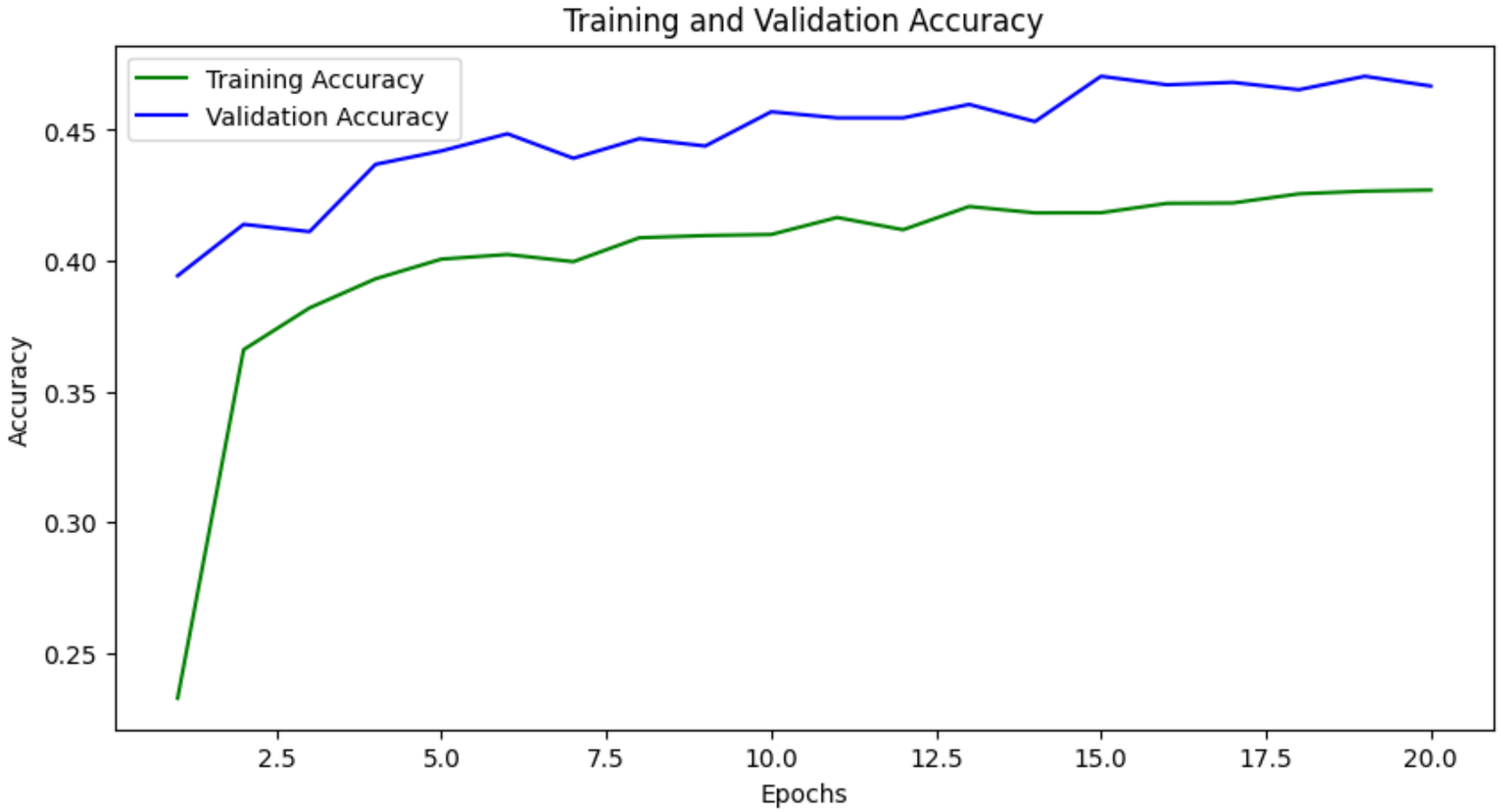
RESULTS in terms of maximum ACCURACY

validation set: 47%

test test: 47%

Accuracy vs Epochs

As visible from the plot here, both training and accuracy tend to increase, avoiding so overfitting case. Training set rears up in the first two epochs and then slows a bit, but increases a little quite all epochs.
On the other hand validation accuracy has more trends, but it's considerably better along all epochs.
The best result is reached with 15 epochs.



CONCLUSIONS

AND POSSIBLE FUTURE DEVELOPMENT

The optimization of hyperparameters can be taken to a deeper level: indeed, potential developments of the project to achieve better results would involve employing a grid search methodology, combining different numbers of hidden layers, activation functions, number of neurons per layer, additional dropout rates, or other normalizations, exploring all combinations of these parameters to determine the model that yields the best predictions. The results presented in this presentation have been primarily based on intuition, given the knowledge acquired in Unit 1 of the Deep Learning course. Therefore, by making the neural network deeper, given the significant complexity of the data, and adopting other suitable measures.

However, we can consider our results satisfying since we improved the perfomance of the easy Neural Network.