Assignment 3 [100 Points]
Due March 8, 2023 11:59 PM

Problem 1 - Code a Convolutional Neural Network (CNN) Keras Model [70 points] Create a python file named as A3_P1_[your AccessID].py and train a Convolutional Neural Network in Keras Model for digit classification task.

Part 1 [5 points] Load the MNIST dataset by using TensorFlow datasets.

Part 2 [35 points] Use functional API in TensorFlow to create a Keras model named *CNN*. The structure is listed below:

Name	Type	Filters/Units	Kernel/Pooling size	Padding	Strides	Activation
conv1	Convolutional	32	(3,3)	same	(1,1)	relu
maxpool2	MaxPooling	-	(2,2)	valid	(1,1)	-
conv3	Convolutional	64	(3,3)	same	(1,1)	relu
maxpool4	MaxPooling	-	(2,2)	valid	(1,1)	-
conv5	Convolutional	128	(3,3)	same	(1,1)	relu
maxpool6	MaxPooling	-	(2,2)	valid	(1,1)	-
flatten	Flatten	-	-	-	-	-
dense1	Dense	1024	-	-	-	relu
dense2	Dense	256	-	-	-	relu
classification	Dense	10	-	-	-	Softmax

Part 3 [10 points] Use Adam optimizer with a 0.0001 learning rate, categorical cross entropy loss, and categorical accuracy to compile the model.

Part 4 [10 points] Train your model for 10 epochs with a batch size of 128. Make a screenshot of your training procedure to A3_P1_[your AccessID].jpg

Part 5 [10 points] Use your testing dataset to evaluate your trained model then save your model as A3_P1_[your AccessID].model. Your accuracy must be higher than 98%. Report your accuracy as a comment in your .py file. Submit all your files to Canvas.

Problem 2 - Fine tune your model with dataset USPS [30 points] Fine tuning is a technique used in deep learning to avoid training a model from sketch with a small dataset. More information for Fine-tuning can be found at http://wiki.fast.ai/index.php/Fine tuning. Download USPS dataset from Canvas and A3_P2.py from Canvas and rename .py file as A3_P2_[your AccessID].py. Code the missing part in the python file.

     Part 1 [10 points] Restore the model you saved in Problem 1.

     Part 2 [10 points] Test the restored model with both MNIST and USPS testing samples, batch-size 128. Report mini-batch testing accuracy as a comment in your .py file.

     Part 3 [5 points] Train you CNN with USPS training samples for 5 epochs batch size 128.

     Part 4 [5 points] Test your fine-tuned CNN on USPS testing data and report testing accuracy with comment in your .py file. Your accuracy must be higher than 98%.

Submit all your files to Canvas.