Lab 4.1 TensorFlow

Instructions

1. Answer the below question in the boxes if needed.
2. Code on your computer and zip all your code before submission.
3. Please submit the assignment after you finish.

**Assignment Purpose**

The purpose of this assignment is to implement a handwritten digit recognition model based on the MNIST dataset using the TensorFlow framework. By building and training a Convolutional Neural Network (CNN), you will learn how to extract features from raw image data and use those features for classification.

**Assignment Requirements**

**1. Data Loading and Preprocessing**

* Load the MNIST dataset using tf.keras.datasets.mnist.load\_data().
* Normalize the pixel values to the range of 0-1.
* Convert the data format to be suitable for input into the TensorFlow model (e.g., add a color channel dimension).
* **Note: we have done this part for you.**

**2. Model Building**

* Create a sequential model using tf.keras.Sequential().
* Add at least one convolutional layer (Conv2D), each followed by a max pooling layer (MaxPooling2D).
* Add a flattening layer (Flatten) to convert the multi-dimensional input into a format acceptable by fully connected layers.
* Add at least one fully connected layer (Dense) with a ReLU activation function.
* Add an output layer with a Softmax activation function for multiclass classification.

**3. Model Compilation**

* Compile the model using an optimizer (e.g., Adam), a loss function (e.g., SparseCategoricalCrossentropy), and evaluation metrics (e.g., accuracy).

**4. Model Training**

* Train the model using the fit() method, specifying the training set, validation set, number of epochs, and batch size.

**5. Model Evaluation**

* Evaluate the model's performance on the test set using the evaluate() method.
* **Note: we have done this part as a demo for you, you could try different evaluation methods if you want.**

**6. Prediction and Visualization**

* Randomly select a few samples from the test set, make predictions using the model, and display the original images and prediction results.
* **Note: we have done this part as a demo for you, you could try different samples from the test set if you want.**

**Hint**: We already provide you a template notebook for this, you could download the lab folder and find the template notebook inside. You could find all the code you need from the lecture slide on the given example teaching how to implement the CNN model. If you follow the example step by step, you will be able to find all the correct answers from the lecture note easily and complete this task.

**Note:** You need to submit one/two Ipython notebooks which clearly explains the thought process behind your ML model (either in comments or markdown text), code and relevant plots. Also, all the visualizations and plots must be done in Python (should be present in the Ipython notebook).