Lesson 2 Exercise
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Class ENEL 525

1. **My entire code running without errors (terminal output):**

PS C:\Users\Harry\Desktop\ENEL525\enel-525\project\lesson2exercise> python lesson2ex2.py
2023-12-02 12:17:46.847954: I tensorflow/core/util/port.cc:113] oneDNN custom operations are on. You may see slightly different numerical results due to floating-point round-off errors from different computation orders. To turn them off, set the environment variable `TF_ENABLE_ONEDNN_OPTS=0`.
WARNING:tensorflow:From C:\Users\Harry\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\losses.py:2976: The name tf.losses.sparse_softmax_cross_entropy is deprecated. Please use tf.compat.v1.losses.sparse_softmax_cross_entropy instead.

2023-12-02 12:19:07.349336: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized to use available CPU instructions in performance-critical operations.
To enable the following instructions: SSE SSE2 SSE3 SSE4.1 SSE4.2 AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler flags.
Number of datapoints in x_train: 3200
Number of datapoints in x_test: 800
Dataset shape: (4000, 2)
WARNING:tensorflow:From C:\Users\Harry\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\backend.py:873: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.

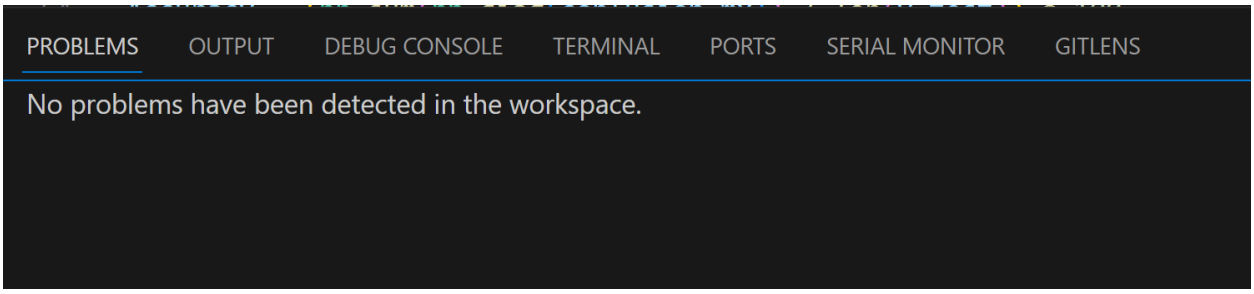
WARNING:tensorflow:From C:\Users\Harry\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\optimizers__init__.py:309: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

Epoch 1/100
WARNING:tensorflow:From C:\Users\Harry\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.

WARNING:tensorflow:From C:\Users\Harry\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name

```
tf.executing_eagerly_outside_functions is deprecated. Please use
tf.compat.v1.executing_eagerly_outside_functions instead.

107/107 [==============================] - 1s 5ms/step - loss: 1.3690 - accuracy: 0.3422 -
val_loss: 1.3314 - val_accuracy: 0.3719
Epoch 2/100
107/107 [==============================] - 0s 2ms/step - loss: 1.2902 - accuracy: 0.4461 -
val_loss: 1.2782 - val_accuracy: 0.5125
Epoch 3/100

More epochs completing…

Epoch 98/100
107/107 [==============================] - 1s 7ms/step - loss: 0.1923 - accuracy: 0.9285 -
val_loss: 0.1753 - val_accuracy: 0.9250
Epoch 99/100
107/107 [==============================] - 0s 3ms/step - loss: 0.1852 - accuracy: 0.9281 -
val_loss: 0.1703 - val_accuracy: 0.9328
Epoch 100/100
107/107 [==============================] - 0s 3ms/step - loss: 0.1682 - accuracy: 0.9355 -
val_loss: 0.1658 - val_accuracy: 0.9312
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 50)                150

 dense_1 (Dense)             (None, 50)                2550

 dense_2 (Dense)             (None, 4)                 204

=================================================================
Total params: 2904 (11.34 KB)
Trainable params: 2904 (11.34 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
25/25 [==============================] - 0s 4ms/step
[[185.  15.   0.   0.]
 [  9. 190.  12.   0.]
 [  0.   9. 191.   5.]
 [  0.   0.   1. 183.]]
Accuracy: 93.625 %
PS C:\Users\Harry\Desktop\ENEL525\enel-525\project\lesson2exercise>
```

Problems tab in VSCode:



2. **Screenshot of model summary printout**

```
Model: "sequential"
_________________________________________________________________
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=================================================================
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=================================================================
Total params: 2904 (11.34 KB)
Trainable params: 2904 (11.34 KB)
Non-trainable params: 0 (0.00 Byte)
```

3. **Screenshot of the confusion matrix and accuracy printout**

```
_________________________________________________________________
25/25 [==============================] - 0s 1ms/step
[[185.  15.   0.   0.]
 [ 10. 190.  11.   0.]
 [  0.  11. 189.   5.]
 [  0.   0.   2. 182.]]
Accuracy: 93.25 %
```

4. Screenshot of the model accuracy and loss plots