Assignment No. 2

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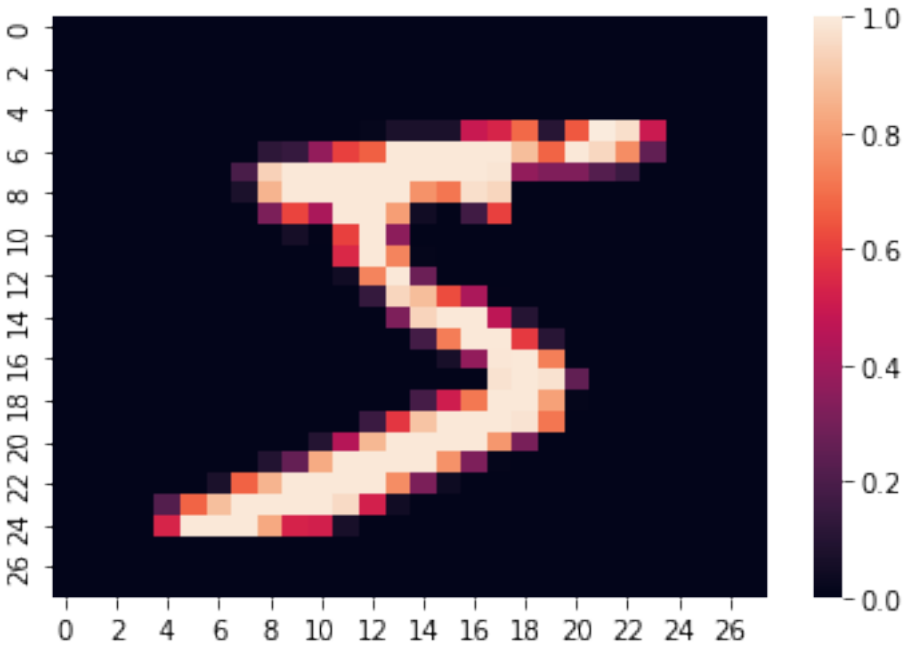
Subject: LP-IV(DL)

[18]:
```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Dropout, Flatten
import matplotlib.pyplot as plt
import seaborn as sns
```

0.0.1 MNIST dataset

[10]:
```
mnist = tf.keras.datasets.mnist
(x_train, y_train) , (x_test, y_test) = mnist.load_data() # Data loading
x_train, x_test = x_train/255.0 , x_test/255.0 #Normalizing the data
```

[27]:
```
sns.heatmap(x_train[0])
plt.show()
```



Prepearing the model

[11]:
```
model = Sequential([
    Flatten(input_shape=(28,28)),
    Dense(128, activation="relu"),
    Dropout(0.2),
    Dense(10)
])
```

[12]:
```
predictions = model(x_train[:1]).numpy()
predictions
```

[12]:
```
array([[-0.40410277, -0.46030605, -0.6388068 ,  0.24000591,  0.32878405,
         0.5329246 , -0.21563345,  0.71689916, -0.16056764,  0.03700624]],
      dtype=float32)
```

[13]:
```
tf.nn.softmax(predictions).numpy()
```

[13]:
```
array([[0.06105226, 0.05771557, 0.04828043, 0.11626115, 0.12705462,
        0.15582873, 0.0737145 , 0.18730384, 0.07788749, 0.09490147]],
      dtype=float32)
```

[14]:
```
loss_fn = tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True)
```

[15]:
```
model.compile(optimizer="adam", loss = loss_fn, metrics=["accuracy"])
```

[16]:
```
model.fit(x_train, y_train, epochs=5)
```

```
Epoch 1/5
1875/1875 [==============================] - 10s 5ms/step - loss: 0.2981 -
accuracy: 0.9138
Epoch 2/5
1875/1875 [==============================] - 9s 5ms/step - loss: 0.1442 -
accuracy: 0.9575
Epoch 3/5
1875/1875 [==============================] - 12s 6ms/step - loss: 0.1081 -
accuracy: 0.9669
Epoch 4/5
1875/1875 [==============================] - 11s 6ms/step - loss: 0.0880 -
accuracy: 0.9730
Epoch 5/5
1875/1875 [==============================] - 10s 5ms/step - loss: 0.0741 -
accuracy: 0.9770
```

[16]:
```
<keras.callbacks.History at 0x2bd9145b610>
```

[17]:
```
model.evaluate(x_test, y_test, verbose=2)
```

```
313/313 - 1s - loss: 0.0867 - accuracy: 0.9749 - 787ms/epoch - 3ms/step
```

[17]:
```
[0.08666389435529709, 0.9749000072479248]
```

Validation of Model

[21]:
```
val = model.fit(x_train, y_train, epochs=5, validation_data=(x_test, y_test),␣
↪batch_size=200)
```

```
Epoch 1/5
300/300 [==============================] - 1s 4ms/step - loss: 0.0533 -
accuracy: 0.9837 - val_loss: 0.0669 - val_accuracy: 0.9808
Epoch 2/5
300/300 [==============================] - 2s 5ms/step - loss: 0.0467 -
accuracy: 0.9856 - val_loss: 0.0664 - val_accuracy: 0.9805
Epoch 3/5
300/300 [==============================] - 2s 6ms/step - loss: 0.0447 -
accuracy: 0.9862 - val_loss: 0.0672 - val_accuracy: 0.9809
Epoch 4/5
300/300 [==============================] - 2s 5ms/step - loss: 0.0436 -
accuracy: 0.9867 - val_loss: 0.0638 - val_accuracy: 0.9812
Epoch 5/5
300/300 [==============================] - 2s 5ms/step - loss: 0.0398 -
accuracy: 0.9878 - val_loss: 0.0656 - val_accuracy: 0.9811
```

[24]:
```
plt.title("Model Accuracy")
plt.ylabel("Accuracy")
plt.xlabel("epoch")
```

```
plt.plot(val.history["accuracy"])
plt.plot(val.history["val_accuracy"])
plt.legend(["train","val"])
plt.show()
```