Machine Learning
Project-2

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Network Description

Prog1-5

- Dense (20 units) – activation function = relu
- Batch Normalization
- Dense (20 units) – activation function = relu
- Dropout (0.3)
- Dense – activation function = linear
- Dense – activation function = softmax

Prog1-10

- Dense (20 units) – activation function = relu
- Batch Normalization
- Dense (20 units) – activation function = elu
- Dropout (0.3)
- Dense (10 units) – activation function = elu
- Dropout (0.3)
- Dense (5) – activation function = elu
- Dense (5) – activation function = elu
- Dense – activation function = linear
- Dense – activation function =softmax

Prog2-5

Layers (5% training):

- Dense (64 units) – activation function = relu
- Batch Normalization
- Dropout (0.3)
- Dense (32 units) – activation function = relu
- Batch Normalization
- Dropout (0.3)
- Dense (16 units) – activation function = relu
- Batch Normalization
- Dropout – activation function = softmax

Prog2-10

Layers (10% training):

- Dense (64 units) – activation function = relu
- Batch Normalization
- Dropout (0.3)
- Dense (32 units) – activation function = relu
- Batch Normalization
- Dropout (0.3)
- Dense (16 units) – activation function = relu
- Batch Normalization
- Dropout
- Dense – activation function = softmax

- Optimizer: ADAM

- Loss: Sparse Categorical Cross Entropy

Results:

Accuracy for 5% data:

Prog1-5: 0.9192

```
Epoch 494/500
1/1 [==============================] - 0s 11ms/step - loss: 8.2545e-04 - accuracy: 1.0000
Epoch 495/500
1/1 [==============================] - 0s 10ms/step - loss: 2.2054e-04 - accuracy: 1.0000
Epoch 496/500
1/1 [==============================] - 0s 11ms/step - loss: 1.1593e-04 - accuracy: 1.0000
Epoch 497/500
1/1 [==============================] - 0s 11ms/step - loss: 2.5736e-04 - accuracy: 1.0000
Epoch 498/500
1/1 [==============================] - 0s 10ms/step - loss: 2.5565e-04 - accuracy: 1.0000
Epoch 499/500
1/1 [==============================] - 0s 10ms/step - loss: 3.7407e-05 - accuracy: 1.0000
Epoch 500/500
1/1 [==============================] - 0s 10ms/step - loss: 7.0322e-04 - accuracy: 1.0000
Reading testing data
569 test examples.
Evaluate
18/18 [==============================] - 0s 3ms/step - loss: 0.9794 - accuracy: 0.9192
```

Prog2-5: 0.9016

```
1/1 [==============================] - 0s 19ms/step - loss: 0.0089 - accuracy: 1.0000
Epoch 492/500
1/1 [==============================] - 0s 16ms/step - loss: 0.0032 - accuracy: 1.0000
Epoch 493/500
1/1 [==============================] - 0s 13ms/step - loss: 0.0066 - accuracy: 1.0000
Epoch 494/500
1/1 [==============================] - 0s 14ms/step - loss: 0.0098 - accuracy: 1.0000
Epoch 495/500
1/1 [==============================] - 0s 12ms/step - loss: 0.0083 - accuracy: 1.0000
Epoch 496/500
1/1 [==============================] - 0s 14ms/step - loss: 0.0013 - accuracy: 1.0000
Epoch 497/500
1/1 [==============================] - 0s 13ms/step - loss: 0.0058 - accuracy: 1.0000
Epoch 498/500
1/1 [==============================] - 0s 13ms/step - loss: 0.0054 - accuracy: 1.0000
Epoch 499/500
1/1 [==============================] - 0s 11ms/step - loss: 0.0082 - accuracy: 1.0000
Epoch 500/500
1/1 [==============================] - 0s 13ms/step - loss: 0.0749 - accuracy: 0.9655
Reading testing data
569 test examples.
Evaluate
18/18 [==============================] - 1s 6ms/step - loss: 0.8054 - accuracy: 0.9016
[0.8054153323173523, 0.9015817046165466]
```

```
[ ]
```
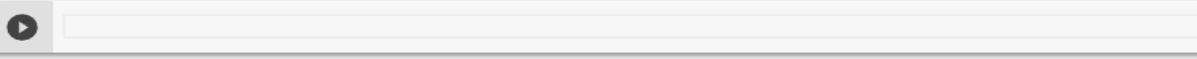
Accuracy for 10% data:

Prog1-10: 0.9315

```
       Epoch 491/500
✓ [58] 2/2 [==============================] - 0s 10ms/step - loss: 0.0223 - accuracy: 0.9825
23s    Epoch 492/500
       2/2 [==============================] - 0s 13ms/step - loss: 0.0414 - accuracy: 0.9649
       Epoch 493/500
       2/2 [==============================] - 0s 9ms/step - loss: 0.0744 - accuracy: 0.9825
       Epoch 494/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.0721 - accuracy: 0.9649
       Epoch 495/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.0025 - accuracy: 1.0000
       Epoch 496/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.0628 - accuracy: 0.9825
       Epoch 497/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.0099 - accuracy: 1.0000
       Epoch 498/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.1131 - accuracy: 0.9649
       Epoch 499/500
       2/2 [==============================] - 0s 10ms/step - loss: 0.0575 - accuracy: 0.9649
       Epoch 500/500
       2/2 [==============================] - 0s 9ms/step - loss: 0.0456 - accuracy: 0.9649
       Reading testing data
       569 test examples.
       Evaluate
       18/18 [==============================] - 0s 3ms/step - loss: 0.4424 - accuracy: 0.9315
       [0.44240957498550415, 0.9314587116241455]
```

Prog2-10: 0.9297

```
       Epoch 488/500
✓ ▶   2/2 [==============================] - 0s 10ms/step - loss: 0.0174 - accuracy: 1.0000
17s   Epoch 489/500
      2/2 [==============================] - 0s 13ms/step - loss: 0.0877 - accuracy: 0.9474
      Epoch 490/500
      2/2 [==============================] - 0s 13ms/step - loss: 0.0068 - accuracy: 1.0000
      Epoch 491/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.0386 - accuracy: 0.9825
      Epoch 492/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.0633 - accuracy: 0.9825
      Epoch 493/500
      2/2 [==============================] - 0s 10ms/step - loss: 0.0648 - accuracy: 0.9825
      Epoch 494/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.0348 - accuracy: 0.9825
      Epoch 495/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.0776 - accuracy: 0.9474
      Epoch 496/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.0565 - accuracy: 0.9649
      Epoch 497/500
      2/2 [==============================] - 0s 12ms/step - loss: 0.0357 - accuracy: 0.9825
      Epoch 498/500
      2/2 [==============================] - 0s 11ms/step - loss: 0.1382 - accuracy: 0.9474
      Epoch 499/500
      2/2 [==============================] - 0s 10ms/step - loss: 0.0604 - accuracy: 0.9649
      Epoch 500/500
      2/2 [==============================] - 0s 10ms/step - loss: 0.0499 - accuracy: 0.9474
      Reading testing data
      569 test examples.
      Evaluate
      18/18 [==============================] - 0s 4ms/step - loss: 0.6215 - accuracy: 0.9297
      [0.621509850025177, 0.9297012090682983]
```