

```
1 C:\Users\Jay\anaconda3\python.exe "C:/Users/Jay/Storage/Studies
  /Term 3/Machine Learning/Assignment 4/from_strach.py"
2 2021-11-14 23:09:12.068972: I tensorflow/core/platform/
  cpu_feature_guard.cc:142] This TensorFlow binary is optimized
  with oneAPI Deep Neural Network Library (oneDNN)to use the
  following CPU instructions in performance-critical operations
  : AVX AVX2
3 To enable them in other operations, rebuild TensorFlow with the
  appropriate compiler flags.
4 Epoch 1/60
5 1563/1563 [=====] - 379s 243ms/step -
  loss: 1.5791 - accuracy: 0.4247 - val_loss: 1.4622 -
  val_accuracy: 0.4750
6 Epoch 2/60
7 1563/1563 [=====] - 377s 241ms/step -
  loss: 1.3034 - accuracy: 0.5334 - val_loss: 1.4419 -
  val_accuracy: 0.4837
8 Epoch 3/60
9 1563/1563 [=====] - 378s 242ms/step -
  loss: 1.1388 - accuracy: 0.5937 - val_loss: 1.2490 -
  val_accuracy: 0.5545
10 Epoch 4/60
11 1563/1563 [=====] - 380s 243ms/step -
  loss: 1.0042 - accuracy: 0.6443 - val_loss: 1.1789 -
  val_accuracy: 0.5794
12 Epoch 5/60
13 1563/1563 [=====] - 379s 243ms/step -
  loss: 0.8784 - accuracy: 0.6886 - val_loss: 1.3766 -
  val_accuracy: 0.5393
14 Epoch 6/60
15 1563/1563 [=====] - 379s 243ms/step -
  loss: 0.7397 - accuracy: 0.7393 - val_loss: 1.4115 -
  val_accuracy: 0.5483
16 Epoch 7/60
17 1563/1563 [=====] - 382s 244ms/step -
  loss: 0.6100 - accuracy: 0.7871 - val_loss: 1.2835 -
  val_accuracy: 0.6020
18 Epoch 8/60
19 1563/1563 [=====] - 379s 243ms/step -
  loss: 0.4879 - accuracy: 0.8301 - val_loss: 1.3209 -
  val_accuracy: 0.6054
20 Epoch 9/60
21 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.3904 - accuracy: 0.8618 - val_loss: 1.4572 -
  val_accuracy: 0.5933
22 Epoch 10/60
23 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.3002 - accuracy: 0.8935 - val_loss: 1.6409 -
  val_accuracy: 0.5884
24 Epoch 11/60
25 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.2340 - accuracy: 0.9177 - val_loss: 1.6814 -
```

```
25 val_accuracy: 0.5942
26 Epoch 12/60
27 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.1987 - accuracy: 0.9296 - val_loss: 1.7759 -
  val_accuracy: 0.5872
28 Epoch 13/60
29 1563/1563 [=====] - 377s 241ms/step -
  loss: 0.1454 - accuracy: 0.9492 - val_loss: 1.8687 -
  val_accuracy: 0.6030
30 Epoch 14/60
31 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.1316 - accuracy: 0.9542 - val_loss: 1.9897 -
  val_accuracy: 0.5899
32 Epoch 15/60
33 1563/1563 [=====] - 379s 242ms/step -
  loss: 0.1124 - accuracy: 0.9604 - val_loss: 1.9437 -
  val_accuracy: 0.6103
34 Epoch 16/60
35 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.0938 - accuracy: 0.9673 - val_loss: 2.0041 -
  val_accuracy: 0.6106
36 Epoch 17/60
37 1563/1563 [=====] - 377s 241ms/step -
  loss: 0.0891 - accuracy: 0.9689 - val_loss: 2.1695 -
  val_accuracy: 0.5941
38 Epoch 18/60
39 1563/1563 [=====] - 377s 241ms/step -
  loss: 0.0714 - accuracy: 0.9755 - val_loss: 2.2084 -
  val_accuracy: 0.6021
40 Epoch 19/60
41 1563/1563 [=====] - 377s 241ms/step -
  loss: 0.0604 - accuracy: 0.9783 - val_loss: 2.3167 -
  val_accuracy: 0.5995
42 Epoch 20/60
43 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.0564 - accuracy: 0.9811 - val_loss: 2.2301 -
  val_accuracy: 0.6084
44 Epoch 21/60
45 1563/1563 [=====] - 377s 241ms/step -
  loss: 0.0618 - accuracy: 0.9781 - val_loss: 2.4451 -
  val_accuracy: 0.5947
46 Epoch 22/60
47 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.0582 - accuracy: 0.9801 - val_loss: 2.4104 -
  val_accuracy: 0.5986
48 Epoch 23/60
49 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.0448 - accuracy: 0.9847 - val_loss: 2.3709 -
  val_accuracy: 0.6143
50 Epoch 24/60
51 1563/1563 [=====] - 378s 242ms/step -
  loss: 0.0425 - accuracy: 0.9856 - val_loss: 2.3946 -
```

```
51 val_accuracy: 0.6061
52 Epoch 25/60
53 1563/1563 [=====] - 378s 242ms/step
   - loss: 0.0326 - accuracy: 0.9886 - val_loss: 2.3430 -
   val_accuracy: 0.6201
54 Epoch 26/60
55 1563/1563 [=====] - 378s 242ms/step
   - loss: 0.0298 - accuracy: 0.9898 - val_loss: 2.6764 -
   val_accuracy: 0.5934
56 Epoch 27/60
57 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0341 - accuracy: 0.9884 - val_loss: 2.7170 -
   val_accuracy: 0.5911
58 Epoch 28/60
59 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0327 - accuracy: 0.9887 - val_loss: 2.5172 -
   val_accuracy: 0.6156
60 Epoch 29/60
61 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0303 - accuracy: 0.9898 - val_loss: 2.6222 -
   val_accuracy: 0.6018
62 Epoch 30/60
63 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0254 - accuracy: 0.9921 - val_loss: 2.5525 -
   val_accuracy: 0.6179
64 Epoch 31/60
65 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0232 - accuracy: 0.9925 - val_loss: 2.5929 -
   val_accuracy: 0.6163
66 Epoch 32/60
67 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0231 - accuracy: 0.9922 - val_loss: 2.6064 -
   val_accuracy: 0.6151
68 Epoch 33/60
69 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0180 - accuracy: 0.9942 - val_loss: 2.8551 -
   val_accuracy: 0.5956
70 Epoch 34/60
71 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0184 - accuracy: 0.9939 - val_loss: 2.7408 -
   val_accuracy: 0.6088
72 Epoch 35/60
73 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0183 - accuracy: 0.9940 - val_loss: 2.6349 -
   val_accuracy: 0.6213
74 Epoch 36/60
75 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0215 - accuracy: 0.9925 - val_loss: 2.7007 -
   val_accuracy: 0.6200
76 Epoch 37/60
77 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0192 - accuracy: 0.9932 - val_loss: 2.6616 -
```

```
77 val_accuracy: 0.6138
78 Epoch 38/60
79 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0175 - accuracy: 0.9939 - val_loss: 2.7502 -
   val_accuracy: 0.6129
80 Epoch 39/60
81 1563/1563 [=====] - 379s 243ms/step
   - loss: 0.0167 - accuracy: 0.9948 - val_loss: 2.7543 -
   val_accuracy: 0.6142
82 Epoch 40/60
83 1563/1563 [=====] - 378s 242ms/step
   - loss: 0.0144 - accuracy: 0.9953 - val_loss: 2.7694 -
   val_accuracy: 0.6160
84 Epoch 41/60
85 1563/1563 [=====] - 379s 242ms/step
   - loss: 0.0107 - accuracy: 0.9962 - val_loss: 2.7225 -
   val_accuracy: 0.6276
86 Epoch 42/60
87 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0131 - accuracy: 0.9955 - val_loss: 3.1451 -
   val_accuracy: 0.5913
88 Epoch 43/60
89 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0160 - accuracy: 0.9945 - val_loss: 2.8358 -
   val_accuracy: 0.6190
90 Epoch 44/60
91 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0126 - accuracy: 0.9957 - val_loss: 2.8443 -
   val_accuracy: 0.6278
92 Epoch 45/60
93 1563/1563 [=====] - 378s 242ms/step
   - loss: 0.0115 - accuracy: 0.9961 - val_loss: 2.9658 -
   val_accuracy: 0.6181
94 Epoch 46/60
95 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0148 - accuracy: 0.9953 - val_loss: 2.8647 -
   val_accuracy: 0.6240
96 Epoch 47/60
97 1563/1563 [=====] - 377s 241ms/step
   - loss: 0.0137 - accuracy: 0.9955 - val_loss: 2.8361 -
   val_accuracy: 0.6256
98 Epoch 48/60
99 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0163 - accuracy: 0.9942 - val_loss: 2.8858 -
   val_accuracy: 0.6251
100 Epoch 49/60
101 1563/1563 [=====] - 376s 241ms/step
   - loss: 0.0176 - accuracy: 0.9938 - val_loss: 2.8933 -
   val_accuracy: 0.6192
102 Epoch 50/60
103 1563/1563 [=====] - 377s 242ms/step
   - loss: 0.0170 - accuracy: 0.9942 - val_loss: 2.7961 -
```

```
103 val_accuracy: 0.6227
104 Epoch 51/60
105 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0178 - accuracy: 0.9938 - val_loss: 2.8994 -
    val_accuracy: 0.6122
106 Epoch 52/60
107 1563/1563 [=====] - 377s 241ms/step
    - loss: 0.0138 - accuracy: 0.9956 - val_loss: 2.8358 -
    val_accuracy: 0.6277
108 Epoch 53/60
109 1563/1563 [=====] - 377s 241ms/step
    - loss: 0.0111 - accuracy: 0.9961 - val_loss: 2.8258 -
    val_accuracy: 0.6250
110 Epoch 54/60
111 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0106 - accuracy: 0.9965 - val_loss: 2.9875 -
    val_accuracy: 0.6098
112 Epoch 55/60
113 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0108 - accuracy: 0.9968 - val_loss: 2.8789 -
    val_accuracy: 0.6258
114 Epoch 56/60
115 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0128 - accuracy: 0.9958 - val_loss: 2.8665 -
    val_accuracy: 0.6258
116 Epoch 57/60
117 1563/1563 [=====] - 377s 241ms/step
    - loss: 0.0106 - accuracy: 0.9966 - val_loss: 2.8759 -
    val_accuracy: 0.6222
118 Epoch 58/60
119 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0074 - accuracy: 0.9977 - val_loss: 2.9288 -
    val_accuracy: 0.6244
120 Epoch 59/60
121 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0068 - accuracy: 0.9977 - val_loss: 3.0037 -
    val_accuracy: 0.6243
122 Epoch 60/60
123 1563/1563 [=====] - 376s 241ms/step
    - loss: 0.0054 - accuracy: 0.9982 - val_loss: 3.0089 -
    val_accuracy: 0.6246
124
125 Process finished with exit code 0
126
```