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/home/ubuntu/.virtualenvs/Exam2/bin/python /home/ubuntu/Project/Code/Train.py
vgg16
Epoch 1/50
125/125 [==============================] - 21s 71ms/step - loss: 0.9638 - accuracy: 0.6709 - val_loss: 0.5929 - val_accuracy: 0.7626
Epoch 2/50
125/125 [==============================] - 7s 60ms/step - loss: 0.5945 - accuracy: 0.7648 - val_loss: 0.5933 - val_accuracy: 0.7666
Epoch 3/50
125/125 [==============================] - 7s 60ms/step - loss: 0.5371 - accuracy: 0.7879 - val_loss: 0.4920 - val_accuracy: 0.8209
Epoch 4/50
125/125 [==============================] - 8s 60ms/step - loss: 0.4718 - accuracy: 0.8075 - val_loss: 0.5063 - val_accuracy: 0.7958
Epoch 5/50
125/125 [==============================] - 8s 60ms/step - loss: 0.4453 - accuracy: 0.8209 - val_loss: 0.4802 - val_accuracy: 0.7938
Epoch 6/50
125/125 [==============================] - 8s 60ms/step - loss: 0.4130 - accuracy: 0.8319 - val_loss: 0.5298 - val_accuracy: 0.7887
Epoch 7/50
125/125 [==============================] - 7s 60ms/step - loss: 0.3872 - accuracy: 0.8405 - val_loss: 0.6254 - val_accuracy: 0.7616
Epoch 8/50
125/125 [==============================] - 7s 60ms/step - loss: 0.4109 - accuracy: 0.8274 - val_loss: 0.5562 - val_accuracy: 0.8199
Epoch 9/50
125/125 [==============================] - 8s 60ms/step - loss: 0.3689 - accuracy: 0.8460 - val_loss: 0.5231 - val_accuracy: 0.8099
Epoch 10/50
125/125 [==============================] - 7s 60ms/
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22 step - loss: 0.3511 - accuracy: 0.8528 - val_loss: 0.
   5190 - val_accuracy: 0.8119
23 Epoch 11/50
24 125/125 [==============================] - 8s 60ms/
   step - loss: 0.3536 - accuracy: 0.8548 - val_loss: 0.
   5793 - val_accuracy: 0.7928
25 Epoch 12/50
26 125/125 [==============================] - 7s 60ms/
   step - loss: 0.3214 - accuracy: 0.8702 - val_loss: 0.
   4716 - val_accuracy: 0.8380
27 Epoch 13/50
28 125/125 [==============================] - 8s 60ms/
   step - loss: 0.3250 - accuracy: 0.8707 - val_loss: 0.
   6105 - val_accuracy: 0.8199
29 Epoch 14/50
30 125/125 [==============================] - 8s 60ms/
   step - loss: 0.3134 - accuracy: 0.8725 - val_loss: 0.
   5801 - val_accuracy: 0.8179
31 Epoch 15/50
32 125/125 [==============================] - 8s 60ms/
   step - loss: 0.2979 - accuracy: 0.8757 - val_loss: 0.
   5852 - val_accuracy: 0.8350
33 Epoch 16/50
34 125/125 [==============================] - 8s 60ms/
   step - loss: 0.2859 - accuracy: 0.8797 - val_loss: 0.
   5728 - val_accuracy: 0.8270
35 Epoch 17/50
36 125/125 [==============================] - 8s 60ms/
   step - loss: 0.3424 - accuracy: 0.8614 - val_loss: 0.
   6596 - val_accuracy: 0.8310
37 Epoch 18/50
38 125/125 [==============================] - 8s 60ms/
   step - loss: 0.3127 - accuracy: 0.8697 - val_loss: 0.
   5575 - val_accuracy: 0.8400
39 Epoch 19/50
40 125/125 [==============================] - 8s 60ms/
   step - loss: 0.2812 - accuracy: 0.8886 - val_loss: 0.
   5781 - val_accuracy: 0.8461
41 Epoch 20/50
42 125/125 [==============================] - 8s 60ms/
   step - loss: 0.2829 - accuracy: 0.8898 - val_loss: 0.
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6824 - val_accuracy: 0.8249
Epoch 21/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2641 - accuracy: 0.8883 - val_loss: 0.
   5843 - val_accuracy: 0.8421
Epoch 22/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2556 - accuracy: 0.8911 - val_loss: 0.
   6332 - val_accuracy: 0.8400
Epoch 23/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2503 - accuracy: 0.8956 - val_loss: 0.
   6392 - val_accuracy: 0.8199
Epoch 24/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2663 - accuracy: 0.8893 - val_loss: 0.
   6853 - val_accuracy: 0.8249
Epoch 25/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2548 - accuracy: 0.8951 - val_loss: 0.
   6297 - val_accuracy: 0.8270
Epoch 26/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2511 - accuracy: 0.8976 - val_loss: 0.
   6907 - val_accuracy: 0.8249
Epoch 27/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2561 - accuracy: 0.8936 - val_loss: 0.
   6968 - val_accuracy: 0.8249
Epoch 28/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2502 - accuracy: 0.8953 - val_loss: 0.
   7276 - val_accuracy: 0.8129
Epoch 29/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2634 - accuracy: 0.8918 - val_loss: 0.
   7507 - val_accuracy: 0.8068
Epoch 30/50
125/125 [==============================] - 8s 60ms/
   step - loss: 0.2450 - accuracy: 0.8979 - val_loss: 0.
   6233 - val_accuracy: 0.8260
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Epoch 31/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2415 - accuracy: 0.9019 - val_loss: 0.6242 - val_accuracy: 0.8410
Epoch 32/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2470 - accuracy: 0.8991 - val_loss: 0.6991 - val_accuracy: 0.8260
Epoch 33/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2535 - accuracy: 0.8908 - val_loss: 0.6793 - val_accuracy: 0.8260
Epoch 34/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2414 - accuracy: 0.8989 - val_loss: 0.6735 - val_accuracy: 0.7978
Epoch 35/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2274 - accuracy: 0.9079 - val_loss: 0.8050 - val_accuracy: 0.8300
Epoch 36/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2338 - accuracy: 0.9042 - val_loss: 0.6912 - val_accuracy: 0.8350
Epoch 37/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2474 - accuracy: 0.8981 - val_loss: 0.6652 - val_accuracy: 0.8350
Epoch 38/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2347 - accuracy: 0.9026 - val_loss: 0.6277 - val_accuracy: 0.8209
Epoch 39/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2160 - accuracy: 0.9052 - val_loss: 0.7741 - val_accuracy: 0.8410
Epoch 40/50
125/125 [==============================] - 8s 60ms/step - loss: 0.2427 - accuracy: 0.9024 - val_loss: 0.7384 - val_accuracy: 0.8159
Epoch 41/50
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 84 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2345 - accuracy: 0.9042 - val_loss: 0
    .5949 - val_accuracy: 0.8400
 85 Epoch 42/50
 86 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2347 - accuracy: 0.9036 - val_loss: 0
    .7171 - val_accuracy: 0.8260
 87 Epoch 43/50
 88 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2192 - accuracy: 0.9127 - val_loss: 0
    .6979 - val_accuracy: 0.8189
 89 Epoch 44/50
 90 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2132 - accuracy: 0.9137 - val_loss: 0
    .7980 - val_accuracy: 0.8179
 91 Epoch 45/50
 92 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2132 - accuracy: 0.9177 - val_loss: 0
    .7082 - val_accuracy: 0.8028
 93 Epoch 46/50
 94 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2417 - accuracy: 0.9069 - val_loss: 0
    .6792 - val_accuracy: 0.8239
 95 Epoch 47/50
 96 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2206 - accuracy: 0.9157 - val_loss: 0
    .7243 - val_accuracy: 0.7928
 97 Epoch 48/50
 98 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2148 - accuracy: 0.9155 - val_loss: 0
    .6813 - val_accuracy: 0.8360
 99 Epoch 49/50
100 125/125 [==============================] - 8s 60ms/
    step - loss: 0.1946 - accuracy: 0.9235 - val_loss: 0
    .7538 - val_accuracy: 0.8038
101 Epoch 50/50
102 125/125 [==============================] - 8s 60ms/
    step - loss: 0.2043 - accuracy: 0.9162 - val_loss: 0
    .7229 - val_accuracy: 0.8229
103 Model: "vgg16"
104 _________________________________________________
```

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104 _________________________________________________________________
105  Layer (type)                 Output Shape              
                Param #   
106 =================================================================
    =============
107  vgg16 (Functional)           (None, 3, 3, 512
    )         14714688  
108 
109  flatten (Flatten)            multiple                  
                    0         
110 
111  dense (Dense)                multiple                  
                    9439232   
112 
113  dense_1 (Dense)              multiple                  
                    2573544   
114 
115  dropout_1 (Dropout)          multiple                  
                    0         
116 
117  dense_2 (Dense)              multiple                  
                    8799      
118 
119 =================================================================
    =============
120 Total params: 26,736,263
121 Trainable params: 12,021,575
122 Non-trainable params: 14,714,688
123 _________________________________________________________________
    _____________
124 None
125 125/125 [==============================] - 6s 45ms/
    step - loss: 0.1508 - accuracy: 0.9452
126 CNN for train: [0.1507636159658432, 0.
    9451572299003601]
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39/39 [==============================] - 3s 81ms/step - loss: 0.8860 - accuracy: 0.8166
CNN for test: [0.8860440850257874, 0.8165727853775024]
125/125 [==============================] - 6s 44ms/step
32/32 [==============================] - 1s 44ms/step
39/39 [==============================] - 2s 44ms/step
KNN classification report for validation data:
              precision    recall  f1-score   support

           0       0.86      0.88      0.87       165
           1       0.00      0.00      0.00        22
           2       0.98      0.98      0.98       296
           3       0.89      0.96      0.92       161
           4       0.44      0.41      0.42        27
           5       0.64      0.65      0.65       161
           6       0.69      0.69      0.69       162

    accuracy                           0.82       994
   macro avg       0.64      0.65      0.65       994
weighted avg       0.81      0.82      0.81       994

KNN classification report for train data:
              precision    recall  f1-score   support

           0       1.00      0.99      1.00
```

```
150 666
151              1       1.00      1.00      1.00
    73
152              2       1.00      1.00      1.00
    1136
153              3       1.00      1.00      1.00
    681
154              4       0.83      0.68      0.75
    130
155              5       0.84      0.85      0.85
    644
156              6       0.87      0.90      0.88
    645
157
158     accuracy                           0.95
    3975
159    macro avg       0.93      0.92      0.92
    3975
160 weighted avg       0.95      0.95      0.95
    3975
161
162 KNN classification report for test data:
163                precision    recall  f1-score
    support
164
165              0       0.86      0.83      0.85
    223
166              1       0.00      0.00      0.00
    26
167              2       0.96      0.98      0.97
    357
168              3       0.85      0.97      0.91
    193
169              4       0.43      0.39      0.41
    31
170              5       0.67      0.66      0.67
    210
171              6       0.68      0.69      0.69
    203
172
173     accuracy                           0.82
```

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173 1243
174    macro avg       0.64      0.65      0.64
    1243
175 weighted avg       0.80      0.82      0.81
    1243
176
177
178 Process finished with exit code 0
179
```