Dog images for CNN input.

1. I downloaded dog image files from:
   https://www.kaggle.com/code/karolgu/dog-emotion-classifier/input

2. The download contains dog images in categories of 'angry', 'happy', 'relaxed' and 'sad'. There is a lot of images that are not appropriate for input to the CNN because they contain humans and dogs dressed up, etc. There were also several duplicate and triplicate images that I removed. I curated the images and merged 'relaxed' and 'sad' groups together because I had difficulty in distinguishing them apart. I also used Resnet50 as preprocessing step to obtain a cleaner image of the dog's face (Figure1; find_dog_face.ipynb). The final data analyzed by CNN consisted 'angry' and 'happy' dogs, and dogs faces that somewhere between these too extremes.

Figure 1. An example of before and after Resnet50 processing. This dog was categorized in Group "Relaxed_Sad".

3. Figures 1 and 2 show the training/validation accuracies and losses by epochs, respectively. Figures 3 and 4 show the confusion matrices for the training/validation accuracies.

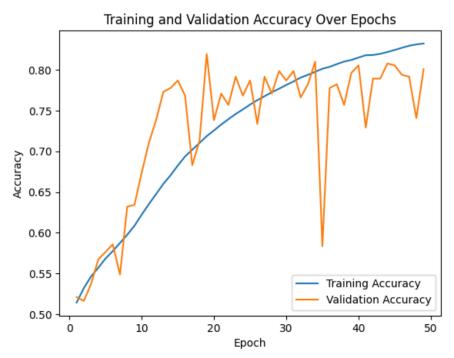**Figure 2. Accuracy for training and validation data sets by epochs.**
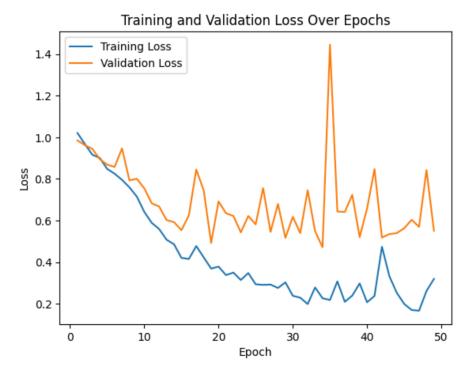

Figure 3. Loss for training and validation data sets by epochs.

```
Test Accuracy: 79.7%
Angry: Correctly classified 53/73 (72.6%)
Relaxed_Sad: Correctly classified 180/225 (80.0%)
Happy: Correctly classified 112/135 (83.0%)
```
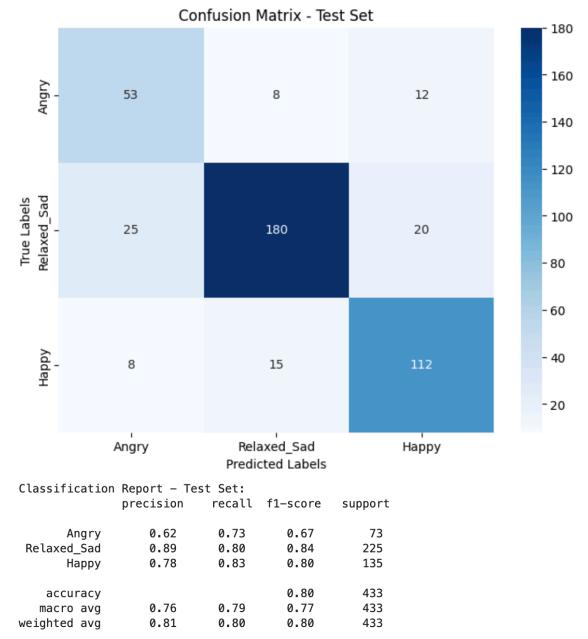

Confusion Matrix – Test Set

```
Classification Report — Test Set:
              precision    recall   f1-score    support

       Angry       0.62      0.73       0.67         73
 Relaxed_Sad       0.89      0.80       0.84        225
       Happy       0.78      0.83       0.80        135

    accuracy                            0.80        433
   macro avg       0.76      0.79       0.77        433
weighted avg       0.81      0.80       0.80        433
```
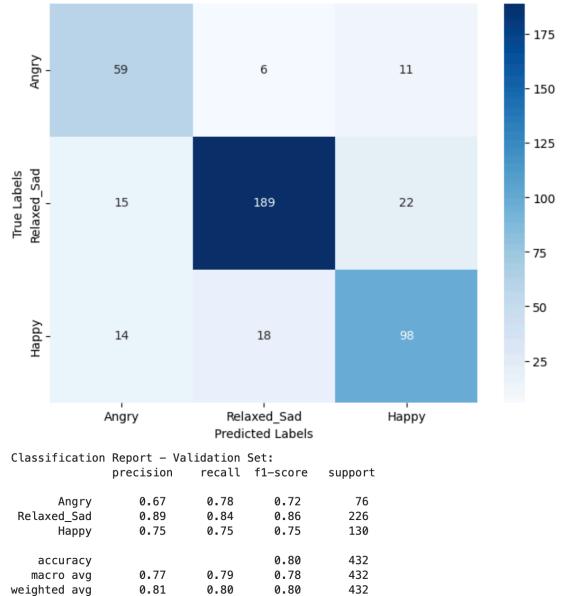
Figure 4. Statistical analysis of the test data set (hold back – not used in training).

```
Validation Accuracy: 80.1%
Angry: Correctly classified 59/76 (77.6%)
Relaxed_Sad: Correctly classified 189/226 (83.6%)
Happy: Correctly classified 98/130 (75.4%)
```

Confusion Matrix - Validation Set


```
Classification Report - Validation Set:
              precision    recall  f1-score   support

       Angry       0.67      0.78      0.72        76
 Relaxed_Sad       0.89      0.84      0.86       226
       Happy       0.75      0.75      0.75       130

    accuracy                           0.80       432
   macro avg       0.77      0.79      0.78       432
weighted avg       0.81      0.80      0.80       432
```

Figure 5. Statistical analysis of the validation data set.