# Analysis Report

## Team: AI-6:

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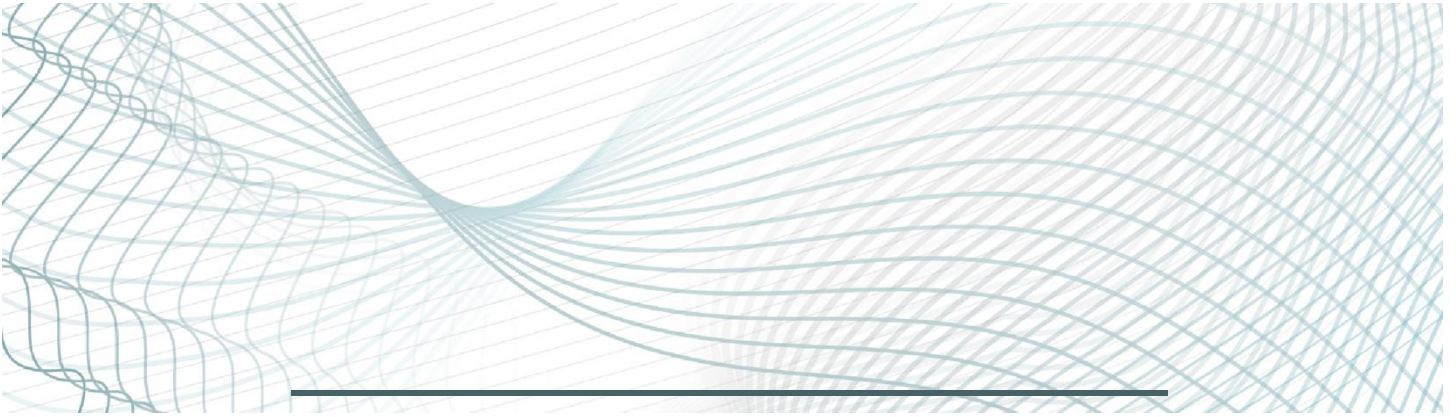El-Baraa Gamal
Mahmoud Sayed

14/5/2024

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Neural Networks

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Project

## Preprocessing:

- Augmentation: spinning in 3 directions and horizontal belt flipping.
- The new training set contains 2100 images rather than 350 images.
- The 2100 images are split into a training set, a validation set, and a testing set.
- Scaling: divided the pixel value by 255.

# Model 1: Dense Net

Here is the accuracy and loss of the training set and the validation set for each epoch while fitting the model:

```
...  Epoch 1/30
     10/10 ───────────── 77s 8s/step - accuracy: 0.8560 - loss: 0.4630 - val_accuracy: 0.8724 - val_loss: 0.4589
     Epoch 2/30
     10/10 ───────────── 75s 8s/step - accuracy: 0.8788 - loss: 0.4018 - val_accuracy: 0.8802 - val_loss: 0.4032
     Epoch 3/30
     10/10 ───────────── 73s 7s/step - accuracy: 0.8927 - loss: 0.3573 - val_accuracy: 0.8880 - val_loss: 0.3537
     Epoch 4/30
     10/10 ───────────── 76s 8s/step - accuracy: 0.9182 - loss: 0.2989 - val_accuracy: 0.9193 - val_loss: 0.3121
     Epoch 5/30
     10/10 ───────────── 77s 8s/step - accuracy: 0.9208 - loss: 0.2891 - val_accuracy: 0.9141 - val_loss: 0.2844
     Epoch 6/30
     10/10 ───────────── 78s 8s/step - accuracy: 0.9214 - loss: 0.2689 - val_accuracy: 0.9401 - val_loss: 0.2400
     Epoch 7/30
     10/10 ───────────── 80s 8s/step - accuracy: 0.9360 - loss: 0.2330 - val_accuracy: 0.9141 - val_loss: 0.2716
     Epoch 8/30
     10/10 ───────────── 81s 8s/step - accuracy: 0.9154 - loss: 0.2655 - val_accuracy: 0.8984 - val_loss: 0.3137
     Epoch 9/30
     10/10 ───────────── 80s 8s/step - accuracy: 0.9433 - loss: 0.2189 - val_accuracy: 0.9557 - val_loss: 0.2101
     Epoch 10/30
     10/10 ───────────── 80s 8s/step - accuracy: 0.9512 - loss: 0.1857 - val_accuracy: 0.9453 - val_loss: 0.1983
     Epoch 11/30
     10/10 ───────────── 82s 8s/step - accuracy: 0.9636 - loss: 0.1714 - val_accuracy: 0.9583 - val_loss: 0.1633
     Epoch 12/30
     10/10 ───────────── 83s 8s/step - accuracy: 0.9572 - loss: 0.1708 - val_accuracy: 0.9505 - val_loss: 0.1772
     Epoch 13/30
     ...
     Epoch 29/30
     10/10 ───────────── 77s 8s/step - accuracy: 0.9824 - loss: 0.0867 - val_accuracy: 0.9948 - val_loss: 0.0836
     Epoch 30/30
     10/10 ───────────── 80s 8s/step - accuracy: 0.9914 - loss: 0.0670 - val_accuracy: 0.9818 - val_loss: 0.0788
```

# Highest score for the model on Kaggle:

```
⊘  predictions.csv                                            0.80392    ☐
   Complete · 19h ago
```

# Model 2: Custom CNN Model

Here is the accuracy and loss of the training set and the validation set for each epoch while fitting the model:

```
...    Epoch 1/30
       10/10 ──────────────── 216s 17s/step - accuracy: 0.2109 - loss: 1.9734 - val_accuracy: 0.1849 - val_loss: 1.6103
       Epoch 2/30
       10/10 ──────────────── 177s 17s/step - accuracy: 0.1986 - loss: 1.6094 - val_accuracy: 0.1823 - val_loss: 1.6106
       Epoch 3/30
       10/10 ──────────────── 201s 20s/step - accuracy: 0.2009 - loss: 1.6094 - val_accuracy: 0.2135 - val_loss: 1.6093
       Epoch 4/30
       10/10 ──────────────── 261s 24s/step - accuracy: 0.2033 - loss: 1.6104 - val_accuracy: 0.1745 - val_loss: 1.6098
       Epoch 5/30
       10/10 ──────────────── 278s 26s/step - accuracy: 0.1971 - loss: 1.6097 - val_accuracy: 0.2214 - val_loss: 1.6093
       Epoch 6/30
       10/10 ──────────────── 234s 22s/step - accuracy: 0.1832 - loss: 1.6107 - val_accuracy: 0.2005 - val_loss: 1.6093
       Epoch 7/30
       10/10 ──────────────── 221s 22s/step - accuracy: 0.2264 - loss: 1.6091 - val_accuracy: 0.2292 - val_loss: 1.6091
       Epoch 8/30
       10/10 ──────────────── 215s 21s/step - accuracy: 0.1957 - loss: 1.6095 - val_accuracy: 0.2031 - val_loss: 1.6094
       Epoch 9/30
       10/10 ──────────────── 240s 24s/step - accuracy: 0.2123 - loss: 1.6076 - val_accuracy: 0.1979 - val_loss: 1.6101
       Epoch 10/30
       10/10 ──────────────── 222s 22s/step - accuracy: 0.2145 - loss: 1.6100 - val_accuracy: 0.2005 - val_loss: 1.6098
       Epoch 11/30
       10/10 ──────────────── 228s 23s/step - accuracy: 0.2041 - loss: 1.6095 - val_accuracy: 0.1667 - val_loss: 1.6097
       Epoch 12/30
       10/10 ──────────────── 221s 21s/step - accuracy: 0.2115 - loss: 1.6107 - val_accuracy: 0.1615 - val_loss: 1.6101
       Epoch 13/30
       ...
       Epoch 29/30
       10/10 ──────────────── 166s 17s/step - accuracy: 0.1944 - loss: 1.6023 - val_accuracy: 0.1927 - val_loss: 1.6106
       Epoch 30/30
       10/10 ──────────────── 166s 16s/step - accuracy: 0.2018 - loss: 1.6117 - val_accuracy: 0.1458 - val_loss: 1.6112
```

# Model 3: Custom CNN Model 2

```
...    Epoch 1/30
       10/10 ──────────────── 216s 17s/step - accuracy: 0.2109 - loss: 1.9734 - val_accuracy: 0.1849 - val_loss: 1.6103
       Epoch 2/30
       10/10 ──────────────── 177s 17s/step - accuracy: 0.1986 - loss: 1.6094 - val_accuracy: 0.1823 - val_loss: 1.6106
       Epoch 3/30
       10/10 ──────────────── 201s 20s/step - accuracy: 0.2009 - loss: 1.6094 - val_accuracy: 0.2135 - val_loss: 1.6093
       Epoch 4/30
       10/10 ──────────────── 261s 24s/step - accuracy: 0.2033 - loss: 1.6104 - val_accuracy: 0.1745 - val_loss: 1.6098
       Epoch 5/30
       10/10 ──────────────── 278s 26s/step - accuracy: 0.1971 - loss: 1.6097 - val_accuracy: 0.2214 - val_loss: 1.6093
       Epoch 6/30
       10/10 ──────────────── 234s 22s/step - accuracy: 0.1832 - loss: 1.6107 - val_accuracy: 0.2005 - val_loss: 1.6093
       Epoch 7/30
       10/10 ──────────────── 221s 22s/step - accuracy: 0.2264 - loss: 1.6091 - val_accuracy: 0.2292 - val_loss: 1.6091
       Epoch 8/30
       10/10 ──────────────── 215s 21s/step - accuracy: 0.1957 - loss: 1.6095 - val_accuracy: 0.2031 - val_loss: 1.6094
       Epoch 9/30
       10/10 ──────────────── 240s 24s/step - accuracy: 0.2123 - loss: 1.6076 - val_accuracy: 0.1979 - val_loss: 1.6101
       Epoch 10/30
       10/10 ──────────────── 222s 22s/step - accuracy: 0.2145 - loss: 1.6100 - val_accuracy: 0.2005 - val_loss: 1.6098
       Epoch 11/30
       10/10 ──────────────── 228s 23s/step - accuracy: 0.2041 - loss: 1.6095 - val_accuracy: 0.1667 - val_loss: 1.6097
       Epoch 12/30
       10/10 ──────────────── 221s 21s/step - accuracy: 0.2115 - loss: 1.6107 - val_accuracy: 0.1615 - val_loss: 1.6101
       Epoch 13/30
       ...
       Epoch 29/30
       10/10 ──────────────── 166s 17s/step - accuracy: 0.1944 - loss: 1.6023 - val_accuracy: 0.1927 - val_loss: 1.6106
       Epoch 30/30
       10/10 ──────────────── 166s 16s/step - accuracy: 0.2018 - loss: 1.6117 - val_accuracy: 0.1458 - val_loss: 1.6112
```

Finally, here are some screenshots of the accuracy we got on Kaggle:
Our highest 3 submissions:

**0.58823**

**0.80392**

**0.50980**

Our attempts with different models:

Public Score

0.58823

0.80392

0.29411

0.29411

0.58823

0.41176

0.15686

0.33333