

## CHAPTER 5

### IMPLEMENTATION AND RESULTS

Based on the fitting model which is done with 50 epochs on five variants of training and validation data, the results of loss, accuracy, val\_loss, val\_accuracy on the 50th epoch were obtained as follows (Table 5.1.):

| Train | Validation | Loss   | Val_Loss | Accuracy | Val_Acc |
|-------|------------|--------|----------|----------|---------|
| 50 %  | 10 %       | 0.0671 | 0.1649   | 0.9841   | 0.9333  |
| 50 %  | 20 %       | 0.0722 | 0.1400   | 0.9806   | 0.9512  |
| 60 %  | 20 %       | 0.0431 | 0.1854   | 0.9919   | 0.9401  |
| 70 %  | 10 %       | 0.0288 | 0.1644   | 0.9924   | 0.9600  |
| 80 %  | 10 %       | 0.0291 | 0.1869   | 0.9945   | 0.9556  |

**Table 5.1.** Loss, Val\_Loss, Accuracy, Val\_Accuracy in epoch 50

The loss and val\_loss values (Table 5.1.) which produced in 50% training data and 10% validation data reached 0.0671 and 0.1649, while in the accuracy and val\_accuracy values reached 0.9841 and 0.9333 at the 50th epoch. In 50 % training data and 20% validation data, resulting 0.0722 of loss and 0.1400 of val\_loss, while in the accuracy and val\_accuracy values, obtained 0.9806 of accuracy and 0.9512 of val\_accuracy at the 50th epoch. In 60% training data and 20% validation data, resulting 0.0431 of loss and 0.1854 of val\_loss, while in the accuracy and val\_accuracy values, obtained 0.9919 of accuracy and 0.9401 of val\_accuracy at the 50th epoch. In 70% training data and 10% validation data resulting 0.0288 of loss and 0.1644 of val\_loss, while in the accuracy and val\_accuracy values obtained 0.9924 of accuracy and 0.9600 val\_accuracy at the 50th epoch and on 80% training data and 10% validation data resulting 0.0291 of loss and 0.1869 of val\_loss, while in the accuracy and val\_accuracy values obtained 0.9945 of accuracy and 0.9556 of val\_accuracy at the 50th epoch. After the fitting model process was done, the next step is to carry out the testing process on testing data in accordance with the training data and validation data.

Based on 40% of testing data which accordance with 50% of training data and 10% of validation data, the testing results are produced in the confusion matrix below:

| Confusion Matrix              | Fresh (Actual Values) | Half Fresh (Actual Values) | Spoiled (Actual Values) |
|-------------------------------|-----------------------|----------------------------|-------------------------|
| Fresh (Predicted Values)      | 317                   | 21                         | 4                       |
| Half Fresh (Predicted Values) | 16                    | 273                        | 28                      |
| Spoiled (Predicted Values)    | 0                     | 1                          | 249                     |

**Table 5.2.** Confusion Matrix Of 40% Testing Data From 50% Training Data and 10% Validation Data

A 317 of images data which contained in the "fresh" class was detected fresh, while another image, which is 21 images was detected half fresh and there four images of meat was detected in spoiled condition. In "half fresh" class, there was 16 images detected fresh, 273 images detected half fresh and 28 images detected in spoiled condition. In class "spoiled" there was one image detected half fresh and 249 images detected in spoiled condition (Table 5.2).

After determining the result through the confusion matrix, the next step is calculate the precision, recall, F1-score, accuracy result as follows:

| Precision | Recall | F1-Score | Accuracy |
|-----------|--------|----------|----------|
| 0.9245    | 0.9229 | 0.9224   | 0.9229   |

**Table 5.3.** Precision, Recall, F1-Score, Accuracy of 50:10:40 Data

Based on 30% of testing data which accordance with 50% of training data and 20% of validation data, the testing results are produced in the confusion matrix below.

| Confusion Matrix              | Fresh (Actual Values) | Half Fresh (Actual Values) | Spoiled (Actual Values) |
|-------------------------------|-----------------------|----------------------------|-------------------------|
| Fresh (Predicted Values)      | 229                   | 25                         | 3                       |
| Half Fresh (Predicted Values) | 10                    | 220                        | 8                       |
| Spoiled (Predicted Values)    | 0                     | 10                         | 178                     |

**Table 5.4.** Confusion Matrix Of 30% Testing Data From 50% Training Data and 20% Validation Data

A 229 images data which contained in the "fresh" class was detected fresh, while another image, which is 25 images was detected half fresh and there three images of meat was detected in spoiled condition. In "half fresh" class, there was 10 images detected fresh, 220 images detected half fresh and eight images detected in spoiled condition. In class "spoiled", there was 10 images detected half fresh and 178 images detected in spoiled condition (Table 5.3.).

After determining the result through the confusion matrix, the next step is calculate the precision, recall, F1-score, accuracy result as follows:

| Precision | Recall | F1-Score | Accuracy |
|-----------|--------|----------|----------|
| 0.9204    | 0.9180 | 0.9183   | 0.9180   |

**Table 5.5.** Precision, Recall, F1-Score, Accuracy of 50:20:30 Data

Based on 20% of testing data which accordance with 60% training data and 20% validation data, the testing results are produced in the confusion matrix below.

| Confusion Matrix              | Fresh (Actual Values) | Half Fresh (Actual Values) | Spoiled (Actual Values) |
|-------------------------------|-----------------------|----------------------------|-------------------------|
| Fresh (Predicted Values)      | 162                   | 7                          | 3                       |
| Half Fresh (Predicted Values) | 4                     | 149                        | 6                       |
| Spoiled (Predicted Values)    | 0                     | 1                          | 125                     |

**Table 5.6.** Confusion Matrix Of 20% Testing Data From 60% Training Data and 20% Validation Data

A 162 images data which contained in the "fresh" class was detected fresh, while the other seven images was detected half fresh and there three images of meat was detected in spoiled condition. In "half fresh" class there was four images detected fresh, 149 images detected half fresh and six images detected in spoiled condition. In "spoiled" class there was one image detected half fresh and 125 images detected in spoiled condition (Table 5.4.).

After determining the result through the confusion matrix, the next step is calculate the precision, recall, F1-score, accuracy result as follows:

| Precision | Recall | F1-Score | Accuracy |
|-----------|--------|----------|----------|
| 0.9546    | 0.9540 | 0.9539   | 0.9540   |

**Table 5.7.** Precision, Recall, F1-Score, Accuracy of 60:20:20 Data

Based on 20% of testing data which accordance with 70% of training data and 10% of validation data, the test results are produced in the confusion matrix as below.

| Confusion Matrix              | Fresh (Actual Values) | Half Fresh (Actual Values) | Spoiled (Actual Values) |
|-------------------------------|-----------------------|----------------------------|-------------------------|
| Fresh (Predicted Values)      | 159                   | 9                          | 3                       |
| Half Fresh (Predicted Values) | 2                     | 152                        | 5                       |
| Spoiled (Predicted Values)    | 0                     | 2                          | 124                     |

**Table 5.8.** Confusion Matrix Of 20% Testing Data From 70% Training Data and 10% Validation Data

A 159 images data which contained in the "fresh" class was detected fresh, while the other nine images was detected as half fresh and there three images of meat was detected in spoiled condition. In "half fresh" class there was two images detected fresh, 152 images detected half fresh and five images detected in spoiled condition. In "spoiled" class there was two half-fresh detected images and 124 detected in spoiled condition (Table 5.5.).

After determining the result through the confusion matrix, the next step is calculate the precision, recall, F1-score, accuracy result as follows:

| Precision | Recall | F1-Score | Accuracy |
|-----------|--------|----------|----------|
| 0.9550    | 0.9539 | 0.9539   | 0.9539   |

**Table 5.9.** Precision, Recall, F1-Score, Accuracy of 70:10:20 Data

Based on 10% of testing data which accordance with 80% of training data and 10% of validation data, the testing results are produced in the confusion matrix below.

| Confusion Matrix              | Fresh (Actual Values) | Half Fresh (Actual Values) | Spoiled (Actual Values) |
|-------------------------------|-----------------------|----------------------------|-------------------------|
| Fresh (Predicted Values)      | 83                    | 1                          | 2                       |
| Half Fresh (Predicted Values) | 1                     | 77                         | 2                       |
| Spoiled (Predicted Values)    | 0                     | 1                          | 62                      |

**Table 5.10.** Confusion Matrix Of 10% Testing Data From 80% Training Data and 10% Validation Data

A 83 images data which contained in the "fresh" class was detected fresh, while one other image was detected as half fresh and there two images of meat was detected in spoiled condition. In "half fresh" class there was one image detected fresh, 77 images detected half fresh and two meat images detected in spoiled condition. In "spoiled" class, there was one image detected half fresh and 62 images detected in spoiled condition (Table 5.6.).

After determining the result through the confusion matrix, the next step is calculate the precision, recall, F1-score, accuracy result as follows:

| Precision | Recall | F1-Score | Accuracy |
|-----------|--------|----------|----------|
| 0.9700    | 0.9694 | 0.9695   | 0.9694   |

**Table 5.11.** Precision, Recall, F1-Score, Accuracy of 80:10:10 Data