

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Literature Study

Literature study is the stage of collecting existing research journals or research that has been done before. The collected journals are then studied to obtain reference which can be used in making this project. The journals use in making this project are ten journals related to the object classification using the Convolutional Neural Network method. Based on the ten journals, obtained the reference regarding the understanding of how Convolutional Neural Networks work in classifying objects such as the freshness of meat done on this project.

3.2. Data Prepare and Preprocess

The prepared data which used in this classification project was obtained from the Kaggle website named Meat Freshness Image Dataset (Shanawad, 2022). Meat Freshness Image Dataset is an image data that contains images of meat with a variety of freshness. The meat image in the "Meat Freshness Image Dataset" has 416×416 pixels size with the color format "RGB" (Red, Green, and Blue). The number of meat images contained in the "Meat Freshness Image Dataset" amounts to 2.266 images divided into three types of freshness classes. The first class there is an image of meat in a fresh state, second class there is an image of meat in a half-fresh state, and the last one, the third class has an image of the meat in a spoiled state. After the data prepared, the next step is processed data in preprocessing section.

Data preprocessing is done in three steps. The first step is divided the data into training data, validation data, and testing data in five variants. The first variant, the data used in the training and validation data is 50% and 10%, while for the testing data it is 40%. The second variant, the data used in the training and validation data is 50% and 20%, while for the testing data it is 30%. In the third variant, the data used in training and validation data was 60% and 20%, while for testing data it was 20%. In the fourth variant, the data used in training and validation data is 70% and 10%, while for testing data it is 20%. In the fifth variant, the data used in the training and validation data was 80% and 10%, while for the testing data it was 10%.

This training data and validation data is used in the classification process on the specified Convolutional Neural Network model, while the testing data is used in determining

of meat freshness using the Convolutional Neural Network model that has been built. After the dividing data process was done, the next step is to rescale the image and resize the image to 128×128 pixels.

3.3. Building The CNN Model & Fitting Model

The designed Convolutional Neural Network model consists of convolution layers, max pooling layers, flatten layer, and dense layers. The convolution layers designed on the Convolutional Neural Network architecture are four layers with 32, 64, 128, and 256 filters. The assigned filter size in each filter is 3×3. On each convolution layer, it uses the activation function ReLu to activate the matrix value of the image features. After that, there is a max pooling layer designed with a 2×2 kernel size, then there's a flatten layer and two dense layers with 512 units and three units. In dense layers with 512 units, using ReLu as activation function with dropout regularization ($p = 0.5$), while dense layers with a number of three units, the dense layer using the Softmax activation function. After the CNN architecture design was done, then the model compiled using the Adam optimizer with a learning-rate of 1e-4 to be processed at the fitting model section using 50 epoch, and 64 batch size.

3.4. Testing & Result

Based on the testing section that has been done, the testing data that was sampled at the preprocessing stage of the image, determined using the CNN model that had been built. The results of the determination were carried out using a confusion matrix to determine true positive, false positive, true negative, and false negative for calculate the precision, recall, F1-score and accuracy on the Convolutional Neural Network model in determining the freshness of meat.