**Title:** A comparison between two CNN models to classify Potato leaf disease

1. **Contribution:**
   1. Providing own feature extraction method
   2. Developing two CNN models to classify Potato leaf disease
   3. Comparing with the developed models
   4. Comparing with an existing model
2. **Methodology:**

We proposed two CNN models to detect potato leaf disease. Figure 1 shows the steps we have followed in our methodology.

Diagram

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Fig 1: Methodology

1. ***Dataset:*** Dataset: [Potato Leaf Disease Dataset -Kaggle](https://www.kaggle.com/datasets/muhammadardiputra/potato-leaf-disease-dataset?resource=download). There are 3 classes of potato leaf where 2 have leaf images with 2 different diseases such as early blight and late blight and 1 is the healthy leaf. The training data set has 900 images (300 in each class) and 300 for the test dataset (100 for each category).

Diagram

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Fig 2: Image of dataset

1. ***Feature Extraction:*** The next step is to extract the features from the images. After reading the image, it is converted from BGR to RGB before resizing to 64 x 64. Then before sending it to the CNN model it is converted from class vector (integers) to binary class matrix.

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Fig 3: Feature extraction

1. ***Convolutional neural network (CNN):*** We have three 3 x 3 Convolution layers with three 2 x 2 Maxpooling layers in figure 4 and four 3 x 3 Convolution layers with three 2 x 2 Maxpooling layers in figure 5.

We have used 4 dense layers in both cases following a flattened layer.

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Fig 4: CNN model with 3 layers

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Fig 5: CNN model with 4 layers

Table 1 shows the summary of these models

**Table** **1:** Summary of the model's

| **Hyperparameter** | **Description** |
| --- | --- |
| # convolution layer | 3 and 4 |
| # max pooling layer | 3 and 4 |
| Activation function | Relu |
| Learning rate | 0.001 |
| Number of epochs | 75 |
| Batch Size | 128 |
| Optimizer | Adam |
| Dropout | 0.4 |

1. Result analysis:

Table 2 shows the accuracy of the proposed two models.

Table 2: Accuracy of the proposed models

| CNN Models | Train accuracy | Test Accuracy |
| --- | --- | --- |
| With 3 layers | 99.72 | 98.33 |
| With 4 layers | 99.86 | 98.33 |

The result shows that for both models, the test accuracy is the same whereas there is an insignificant difference between train accuracy which is 0.14.

Fig 6 shows the accuracy and loss curve of the CNN model with 3 layers and Fig 7 shows the CNN model with 4 layers.

Chart, line chart

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1. (b)

Fig 6: (a) Accuracy curve (b) Loss curve for CNN model with 3 layers

Chart, line chart

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1. (b)

Fig 7: (a) Accuracy curve (b) Loss curve for CNN model with 4 layers