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Faculty of Computers & Artificial Intelligence

Computer Science Department

2021/2022

**CS 396 Selected Topics in CS-2**

**Research Project**

Report Submitted for Fulfillment of the Requirements and ILO’s for Selected Topics in CS-2 course for Fall 2021

**Team ID No.** 32

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* **Paper Details:**
* **Paper Name:** Plant Seedlings Classification Using Deep Learning.
* **Authors:**

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* **Year of Publication:** 1, January – 2019
* **Publisher Name:**

International Journal of Academic Information Systems Research (IJAISR)

* **Dataset Used:** Provided by the Aarhus University Signal Processing group, in collaboration with University of Southern Denmark, contains a set of **5608** images of approximately **960** unique plants belonging to **12** species at several growth stages.
* **Implemented Algorithms:**
* **Input Images Pre-processed by:**

1. Normalizing the pixel values to a [0,1] range.
2. Balance the **12** different species with data augmentation.

Data was augmented via several random transformations. The selected data augmentation techniques were (size re-scaling, rotations of **40**, horizontal shift, image zooming, and horizontal flipping).

1. Resizing images to **128x128** pixel.

* Then **VGG16** was used to train the model.
* Data was divided into training (**90%**), validation (**10%**).
* **Results:**

The Training accuracy was **100%**

The Validation accuracy was **99.48%**

* **Project Description:**
* **Dataset Name:** Plant Village Dataset.
* **Dataset Link:** <https://www.kaggle.com/datasets/emmarex/plantdisease>
* **Total Number of Samples:**

It includes **20.6k** images for (Training, Testing and Validation).

## **Plant Village Classes (15 Class):**

* Pepper bell Bacterial spot (997)
* Pepper bell healthy (1478)
* Potato Early blight (1000)
* Potato Late blight (1000)
* Potato healthy (152)
* Tomato Bacterial spot (2172)
* Tomato Early blight (1000)
* Tomato Late blight (1909)
* Tomato Leaf Mold (952)
* Tomato Septoria leaf spot (1771)
* Tomato Spider mites Two spotted spider mite (1676)
* Tomato Target Spot (1404)
* Tomato Tomato Yellow Leaf Curl Virus (3209)
* Tomato Tomato mosaic virus (373)
* Tomato healthy (1591)
* **Images Dimension:** 224\*224
* **Implementation Details:**

The dataset contains different healthy and unhealthy crop leaves. it is recreated using augmentation from the original dataset.   
Total number of images we have **20639** RGB images of healthy and diseased crop leaves​ which is categorized into **15** different classes.

The total dataset is divided into **80% 10% 10%** ratio of training, validation and test.

**Now we have:**

* Training **(16505)**
* Validation **(2057)**
* Testing **(2076)**
* **Our Model:**Diagram

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* **Model Architecture:**

1. Initialize **MobileNetV2** with input size **(224,224,3).**
2. **Adding Layers:**

* BatchNormalization.
* GlobalAveragePooling2D.
* 2 Dense layers with ‘***1024***’ and ‘***512***’ neurons with ‘***Relu***’ activation function.
* Dropout (**0.5**).
* 1 Dense layer with ‘***15***’ neuron - *based on Number of Classes in dataset* - with ‘***SoftMax***’ activation function.

1. Setting Minimum Learning Rate to ‘***0.0001***’ and patience to ‘***3***’.
2. Then, the model is trained for ‘***80***’ epochs using **‘*Adam***’optimizer  
   and batch size ‘***64***’.

* **Full Model Architecture Link:**

<https://github.com/H20180190/deep-learning/blob/main/Plant%20Village%20Disease%20Mobv2%20Architecture.pdf>

* **Hyperparameters Used in the Model:**

|  |  |
| --- | --- |
| Factor (s) | Value (s) |
| BatchNormalization Layer(s)  GlobalAveragePopling2d Layer(s)  Dense Layer(s) + RELU  Dense Layer(s) + SoftMax  Dropout Layer(s)  Dropout Rate  Patience  Minimum Learning Rate  Optimizers  Batch Size  No. of Epochs  Image Size | **1**, 2, 3  **1**, 2, 3  1, **2**, 3  **1**, 2  **1**, 2  0.25, **0.5**  1, 2, **3**  0.001, **0.0001**  **Adam**, SGD  16, 32, **64**  30, 50, **80**  128\*128, **224\*224** |

* **Testing Results:**
* **Accuracy:** 97.1%

**Text

Description automatically generated**

* **Visualization of Testing Data:**
* **Accuracy Graph:Shape

  Description automatically generated with medium confidence**
* **Loss Graph:**

A picture containing chart

Description automatically generated