# Harnessing Convolutional Neural Networks for Enhanced Detection of Potato Plant Diseases


Submitted by:

| Name | CWID |
| --- | --- |
| Jay Damani | A20539619 |
| Minal Kyada | A20544029 |
| Saurin Patel | A20539366 |

Under the guidance of:
Prof Binghui Wang

# AGENDA

1) Introduction
2) Problem Statement
3) Methodology
4) Project Design
5) Convolutional Neural Network (CNN)
6) PPDDNN model
7) Results and Outputs
8) Comparative Analysis
9) References

# INTRODUCTION

- Farmers face economic losses due to potato plant diseases.
- Diseases like Early Blight (fungal) and Late Blight (microorganism) are difficult to distinguish manually.
- Our solution: A machine learning model to detect diseases instantly and accurately.

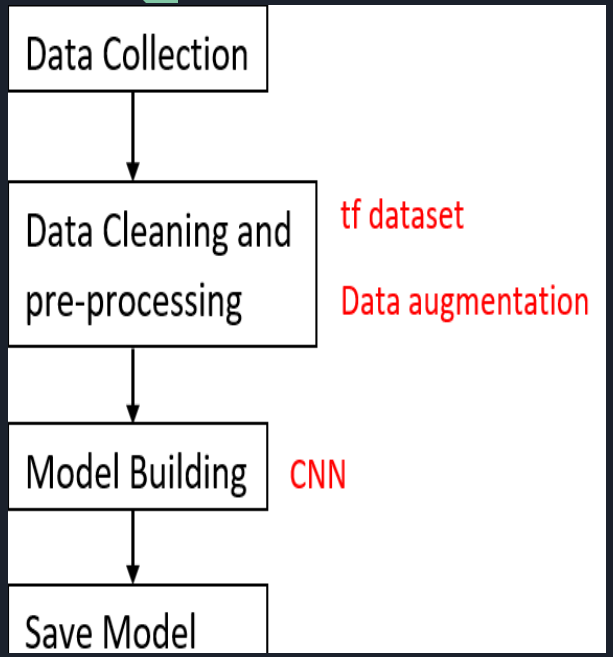
# PROBLEM STATEMENT

- Early and accurate detection can prevent crop losses.
- Misdiagnosis leads to incorrect treatments, escalating costs.
- Current methods are labor-intensive and time-consuming.
- Our system offers an automated, user-friendly alternative.

# Methodology

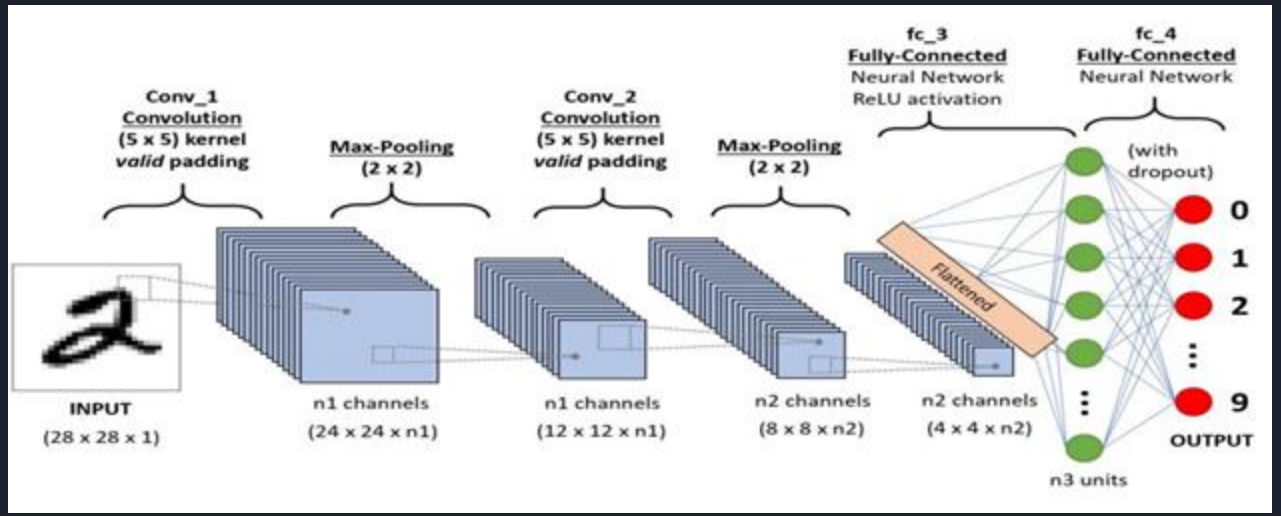
1. Input: Image of the potato plant.
2. Image preprocessing: Resizing, normalization, and segmentation.
3. CNN-based model: Trained to classify leaves into three categories:
    1. Healthy
    2. Early Blight
    3. Late Blight
4. Deployment: Accessible on web and mobile platforms.

# PROJECT DESIGN




- **Input Image of Potato Plant**: Farmers or users upload an image of the potato plant's leaf.
- **Data Pre-processing**:
  - **Resizing**: All images are resized to 256x256 pixels for uniformity.
  - **Normalization**: Pixel values are scaled between 0 and 1 to facilitate faster and stable model training.
  - **Data Augmentation**: Techniques like random flips and rotations are applied to artificially increase dataset diversity.
- **Model Architecture**:
  - **Convolutional Layers**: Extract features from input images
  - **Max-Pooling Layers**: Down-sample features for computational efficiency.
  - **Fully Connected Layer**: Consolidates features for classification.
  - **SoftMax Activation**: Outputs probabilities for each category.
- **Model Training**:
  - **Adam Optimizer**: Used for efficient gradient descent.
  - **50 Epochs**: Model trained iteratively for higher accuracy.
  - **Dataset Split**: 70% training, 20% validation, 10% testing.
- **Evaluation and Inference**:
  - Evaluates model performance using accuracy and loss metrics.
  - Predicts disease category with confidence scores for test images.

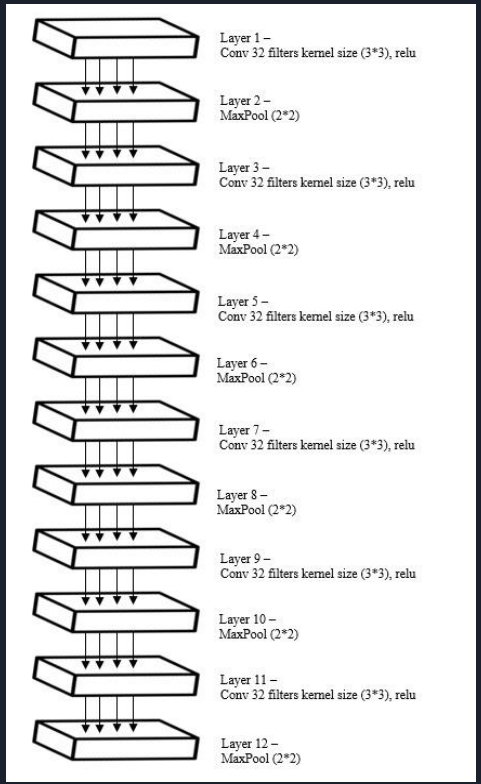
# CONVOLUTIONAL NEURAL NETWORK



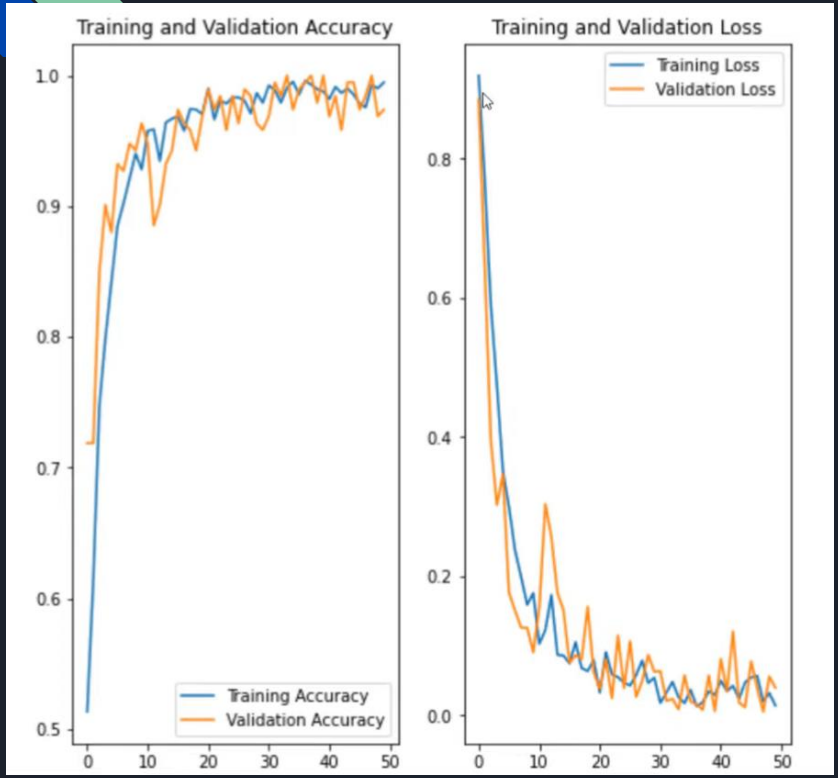

- A convolutional neural network (CNN or ConvNet), is a network architecture for deep learning which learns directly from data, eliminating the need for manual feature extraction.
- CNNs are particularly useful for finding patterns in images to recognize objects, faces, and scenes.
- They can also be quite effective for classifying non-image data such as audio, time series, and signal data.
- Applications that call for object recognition and computer vision — such as self-driving vehicles and face-recognition applications — rely heavily on CNNs.

# Potato Plant Disease Detection neural network (PPDDNN) model

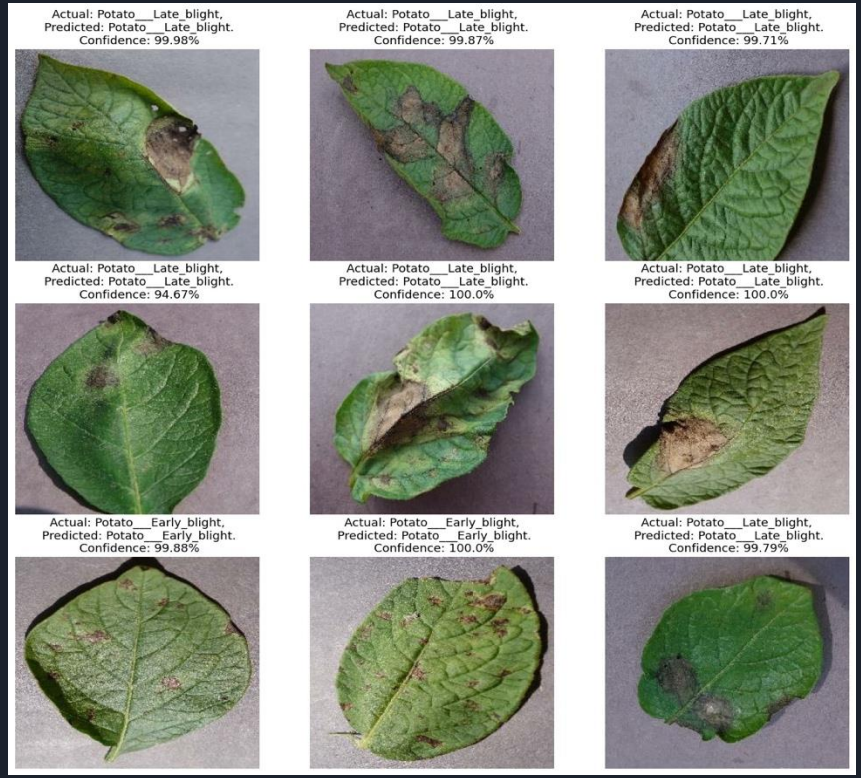
- The Potato Plant Disease Detection neural network (PPDDNN) model is used to classify the plants into three categories namely healthy, early-light affected and late-blight affected.
- This model was created entirely from scratch so that the study would solely focus on photographs of plant diseases.
- The model will likely classify certain attributes that are present in the subject image (Background information) into a different class after learning them during training.
- Thus, we trained our model from scratch by feeding it only the respected images in a segmented way, allowing it to focus solely on the plants and its forms of ailments.



# Accuracy and loss chart




# Output



# COMPARITIVE ANALYSIS

| Types of Neural Networks | Artificial Neural Networks (ANN) | Convolutional Neural Networks (CNN) | Recurrent Neural Networks (RNN) |
|---|---|---|---|
| Type of Data | • Tabular Data<br>• Text Data | Image Data | Sequence Data |
| Parameter Sharing | ✗ | ✓ | ✓ |
| Fixed Length input | ✓ | ✓ | |
| Recurrent Connections | ✗ | ✗ | ✓ |
| Vanishing and Exploding Gradient | ✓ | ✓ | ✓ |
| Spatial Relationship | ✗ | ✓ | ✗ |
| Performance | ANN is less powerful than RNN, CNN | CNN is more powerful than ANN, RNN | When compared to CNN, RNN has fewer feature compatibility. |
| Application | Facial recognition and Computer vision. | Facial recognition, text digitalization and Natural language processing | Text-to-speech conversations. |

# References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# THANK YOU