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A Quantum Computing Approach to Image Recognition

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Abstract

To increase crop productivity and ensure sustainable agriculture, plants must be diseased before they propagate. As this paper demonstrates, Moringa is extensively grown for its food quality; it underlies all important effects including high yields as diseases spread through the different layers of leaf cells which exceed control within minutes of harvesting; by using the Convolutional Neural Network(CNN), transferred learning has become representative as scientific programming was refined specifically training models such that replicating one types of state child seed that exceeded performance level, and finally, rep, patent about the precise application using top judge or reverse.

Keywords CNN, Transfer Learning, Moringa, Quantum Plant disease classification.

Introduction

Moringa is a vital crop in India due to its medicinal values and economic value. The crop has leaf diseases such as blight, powdery mildew, and nutrient-related deficiencies. This Disease goes unnoticed when it reaches advance stage, early detection helps for preventing yield loss.

Deep learning methods, especially CNN have become tools for automating plant disease detection. Good performance in the research of detecting illnesses in a variety of crops, including rice, maize, and tomatoes (Mohanty et al., 2016). In specific moringa play major role

In this paper moringa data set used for classification. To identify the disease CNN and Transfer Learning has been used.

2. Literature Review

The Learning starts with feature extraction. CNN models have been used classify diseases (Ferentinos, 2018). Using VGG – Pretrained network and ResNet, Transfer learning for Enhancement (Kamal et al., 2020).
Since Moringa leaf disease study been limited most of study focus on the optimization of the disease. Traditional method of classification features has been, restricted in accuracy.

Sood, M., & Singh, P. K. (2020) [13] proposed a mixed approach of detecting the presence of the disease in plants through a texture feature analysis method. The system would then pick out the features texture-based image of leaf image and then apply ML classifiers to determine the diseases. There was improved recognition performance. However, scalability was not as high and the strategy was not so relevant to the real-world environment of complexities since it relied on manually developed features.

3. Methodology

3.1 Dataset Collection

Moringa leaves dataset created with healthy and unhealthy leaves with disease

Mobile cameras were used to take pictures in natural light.

Finally dataset was splitted into training, validation, and testing

Disease classification are

- Bacteria affected Leaf Spot
- Milddew Leaf Spot
- Healthy Leaf
- Mist leaf

3.2 Preprocessing

• Changing the size of the image to 224 by 224 pixels

• Pixel Normalization

Daat Augmentation like rotation, brightness and zoom

3.3 Model Architectures

Model were examined below

1. **CNN**

CNN stands for convolutional layers there are three layers max pooling, dropout, ReLU activation, and output layer.

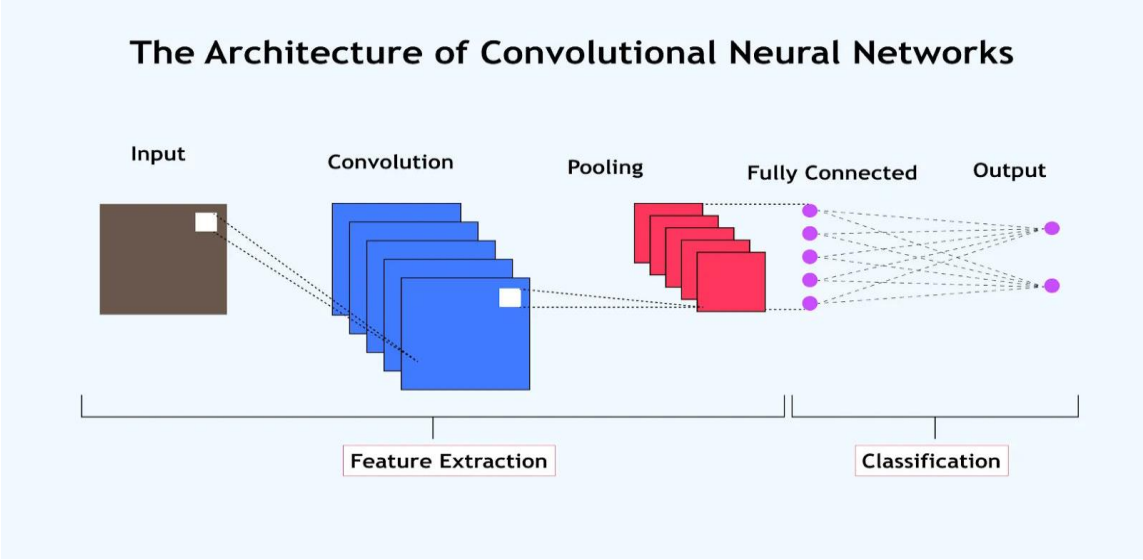


Fig 1. Custom CNN Architecture (Conceptual Diagram)

2. Transfer Learning Models:

- **GG16**
- **ResNet50**
- categorization of moringa, it was pretrained on ImageNet and refined with extra dense layers.

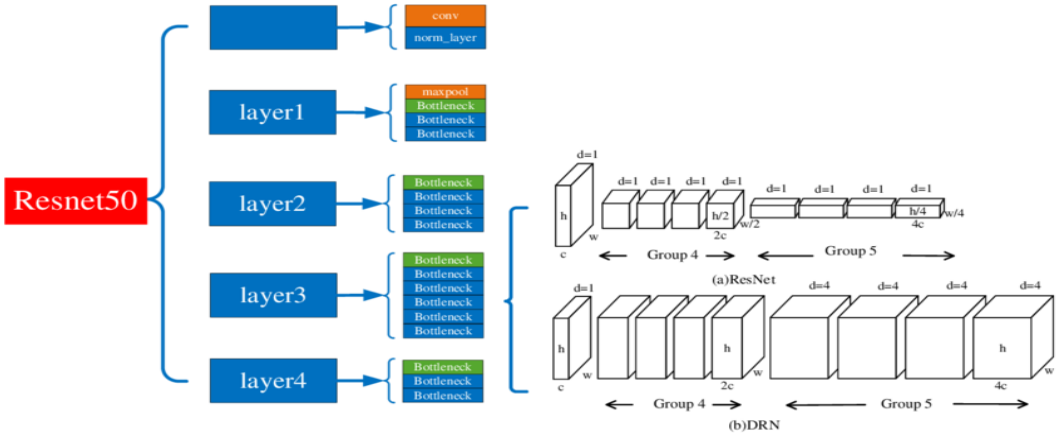
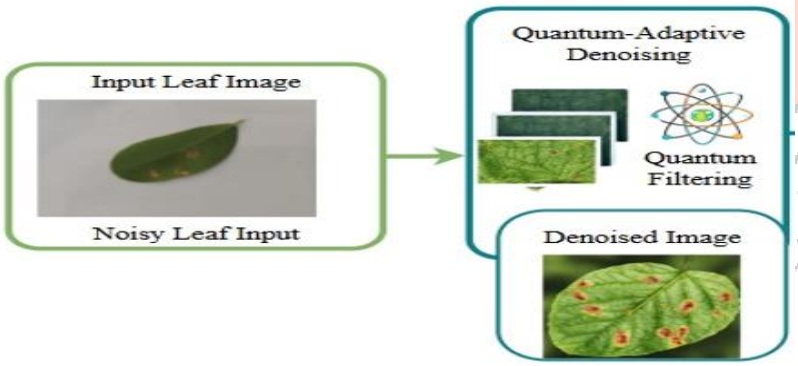


Fig 2. Transfer Learning ResNet50 Architecture (Conceptual Diagram)

3. **Quantum-Adaptive Non-Local Mean Filter Using Image Enhancement**

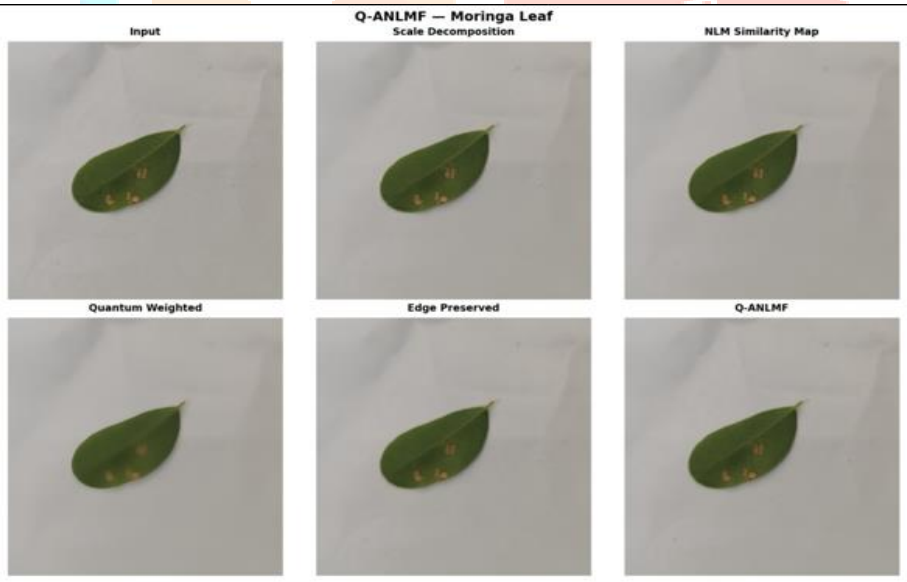
In this section the proposed methodology is presented, including the description of the design and implementation of the developed algorithm and its entire workflow as well as its system architecture. Each stage of processing such as denoising

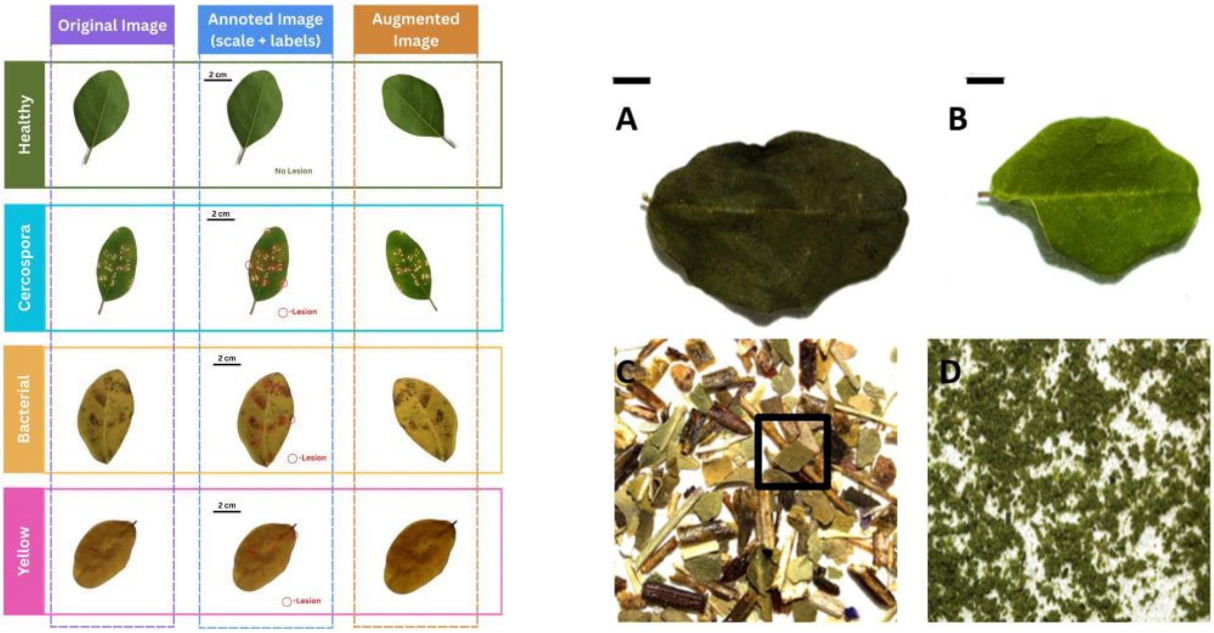


1. **Figures: Sample Dataset Images for Existing Algorithm**

Sl No	Class Name	Number of Images	Description	Sample Image
1	Healthy Leaf	597	These leaves are fresh, green, and show no signs of stress, disease, or physical damage.	
2	Yellow Leaf	795	The yellowing of Moringa leaves may occur due to nutrient deficiencies, water stress, or early signs of disease. Common symptoms include uniform or patchy yellow areas.	
3	Bacterial Leaf Spot	857	Caused by bacterial infection, these leaves show irregular dark brown or black spots, sometimes surrounded by yellow halos.	
4	Cercospora Leaf Spot	568	A fungal disease that presents as small, circular brown to black lesions. Severe infections may cause the leaves to yellow and fall prematurely.	

Sample dataset for Proposed Algorithm

2	Moringa	



4.1 Fig 4. Sample Images from Moringa Leaf Dataset

4.2 Dataset and Tables

Table 1. Moringa Leaf Dataset Summary

Class Label	Number of Images	Train	Validation	Test
Healthy	550	385	82	83
Leaf Blight	470	330	70	70
Leaf Spot	420	294	63	63
Powdery Mildew	360	252	54	54
Nutrient Deficiency	400	280	60	60
Total	**2,200**	**1,541**	**329**	**330**

Table 2. Hyperparameters Used in Model Training

Parameter	Value
Batch Size	32
Learning Rate	0.0001
Optimizer	Adam
Loss Function	Categorical Crossentropy
Epochs	50
Image Size	224 × 224

Table 3. Model Performance Comparison

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Custom CNN	86.4	85.7	84.9	85.2
VGG16	93.1	92.8	92.5	92.6
ResNet50	**95.7**	**95.4**	**95.1**	**95.2**

Table 4: Performance Metrics Compared to Existing Methods and Proposed Q-ANLMF

Algorithm / Method	MSE	PSNR (dB)	SSIM
Proposed Q-ANLMF	0.0001	42.92	0.9852

5. Evaluation Metrics

The model metrics are measured using

- Precision
- Accuracy
- Remember
- The F1-Score
- A matrix of confusion

6.Results and Discussion

The three models' distinct differences between moringa leaf diseases. The CNN achieved an accuracy of 86.4%, that even a lightweight can identify general patterns in the dataset. classifications between leaf spot and leaf blight, which shows similar visual features. The VGG16-based model achieving 93.1% accuracy thanks to its deeper convolutional blocks and pretrained feature representations. The ResNet50

achieved the highest accuracy of 95.7%,. Its 95.2% F1-score attests to balanced performance in every class. In Q-ANLMF achieved the result 96.44% These findings demonstrate that Q-ANLMF, is successful for classifying moringa diseases in situations datasets.

7. Conclusion

Deep learning-based approach for classifying moringa leaf diseases. The results ResNet50 is the accurate and detection when compared to CNN and transfer learning models. Quicker and more objective illness identification, the technology can assist farmers and agricultural professionals.
The Scope of the model should be integrated into a mobile application, field-level photos should be added to the dataset, and real-time detection performance should be assessed.

8. References

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