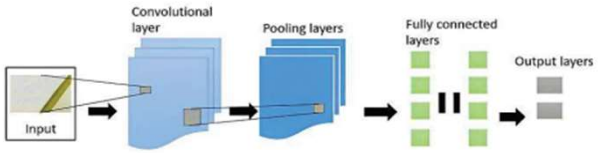
Paddy Leaf Disease Detection System

Preethi V, Amrita Viswa Vidyapeetham

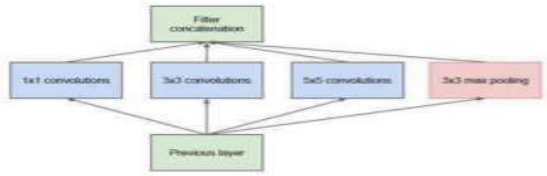
(A) GOAL & CONTRIBUTIONS

- The goal of the **Paddy Disease Detection System** is to automate the early identification and diagnosis of paddy plant diseases using computer vision and deep learning, enabling farmers to take timely action and reduce crop loss.
- It provides real-time, accurate diagnoses through mobile devices, offering accessible, expert-level disease detection.
- The system improves crop yield, promotes cost-effective and sustainable practices, and empowers farmers with data-driven insights and tailored recommendations.
- This solution reduces dependency on manual inspections, supports better disease management, and fosters overall agricultural efficiency.

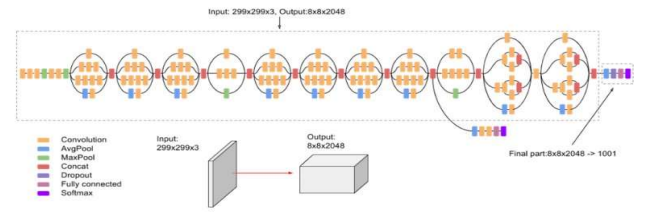
(B) CNN Architecture



A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. Pooling layers are used to reduce the dimensions of the feature maps.



(C) Architecture Diagram



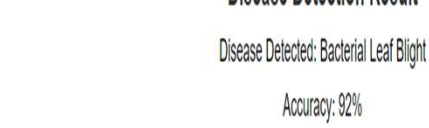
- The image depicts an **Inception architecture** (also known as Image Net), a deep learning model used for image classification and computer vision tasks.
- The architecture is composed of multiple **Inception modules**, each containing several parallel convolutional layers (shown in orange) with different filter sizes, followed by **max pooling** (green) and **average pooling** (blue) layers.
- These outputs are concatenated (red) to capture multi-scale features, and dropout layers (light red) help in regularization.
- The fully connected layer (purple) and SoftMax (violet) at the end provide classification over 1000 categories.
- The input image (299x299x3) passes through this network, and by the final layer, is reduced to a smaller representation (8x8x2048) for the classification task.
- This architecture is efficient in extracting features from images at multiple scales.

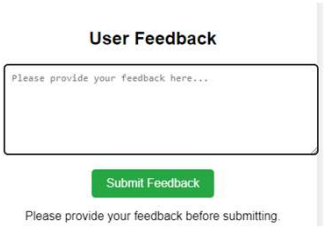
(D) Disease Detection

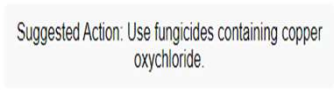
•**Bacterial Leaf Blight**: A bacterial disease causing yellowish lesions on leaf margins, leading to significant crop loss.
•**Bacterial Leaf Streak**: A bacterial infection that creates narrow, water-soaked streaks on rice leaves.
•**Bacterial Panicle Blight**: A bacterial disease affecting the panicles, causing grain discoloration and sterility.
•**Blast**: A fungal disease that creates grayish lesions on leaves, stems, and grains, potentially killing the plant.
•**Brown Spot**: A fungal disease that results in small, brown spots on leaves, leading to reduced yield.
•**Dead Heart**: A condition where the central shoot dies, often due to pest attack, leaving the outer leaves intact

• **Downy Mildew**: A fungal infection causing yellow patches on leaves and downy growth on the underside.
•**Hispa**: An insect pest that scrapes chlorophyll from leaves, leaving white streaks and holes.
•**Normal**: Healthy, disease-free rice plants with no visible signs of infection or stress.
•**Rice Sheath Blight**: A fungal disease affecting the leaf sheaths, causing large, oval, water-soaked lesions.
•**Smut**: A fungal disease that produces black, sooty masses on grains, leading to seed loss.
•**Tungro**: A viral disease transmitted by leafhoppers, causing yellowing and stunted growth in rice plants.

(E)User Interface







1.Users upload an image of a paddy leaf through a file input. This step ensures that users can easily submit images for disease detection.
2.Image Preview: The system provides an image preview, allowing users to confirm the correctness of the uploaded image before proceeding with detection.
3.Disease Detection: Using predefined disease categories (e.g., Bacterial Leaf Blight, Brown Spot), the system simulates detecting diseases in the uploaded image, providing an accuracy score for the diagnosis.
4.Result Display: Once the disease detection is completed, the system displays the detected disease and the accuracy score, offering insights into the potential health condition of the paddy leaf.
Each module includes **user feedback** and **suggested actions** to guide users, such as confirming file uploads, allowing image replacement, and providing additional resources on detected diseases. This enhances the overall user experience, making the detection process clear and interactive.

References

1) S. Ghosal et al., “An explainable deep machine vision framework for plant stress phenotyping,” *IEEE Transactions on Automation Science and Engineering*, vol. 19, no. 1, pp. 45-59, Jan. 2022, doi: 10.1109/TASE.2021.3067875.

2) K. S. S. Aravind, J. Nithya, and A. J. Jansi Rani, “Paddy leaf disease detection using deep learning techniques,” in *2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE)*, Vellore, India, 2020, pp. 1-6, doi: 10.1109/ic-ETITE47903.2020.110.

3) A. S. Sakai et al., “Identification of rice leaf diseases using CNN and transfer learning,” in *2021 International Conference on Artificial Intelligence and Machine Vision (AIMV)*, Lahore, Pakistan, 2021, pp. 1-5, doi: 10.1109/AIMV52191.2021.9477680.

4) A. N. Kaur, and A. Kaur, “Rice leaf disease detection using deep learning models,” in *2020 IEEE 17th India Council International Conference (INDICON)*, New Delhi, India, 2020, pp. 1-5, doi: 10.1109/INDICON49873.2020.9342571.

5) S. L. Amarasinghe, M. Manuja, and N. Thivvyan, “Deep learning approach for the identification of rice plant diseases using insect images,” in *2019 International Conference on Advancements in Computing (ICAC)*, Malabe, Sri Lanka, 2019, pp. 216-221, doi: 10.1109/ICAC49085.2019.9103465

6) S. T. Cruz, E. D. Neeraja, B. Krishnan, A. P. Yadav, and K. V. Rao, "Automatic detection and classification of rice diseases using deep learning algorithms," *IEEE Access*, vol. 8, pp. 118527–118539, 2020, doi: 10.1109/ACCESS.2020.2999347.