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**GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR**

**Department of Computer Science & Engineering**

**Monthly Project Progress Review Report (July 15-August 15) ,2025**

**Month: July 15 – August 15**

## Student Group Details

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| S. No. | Roll Number | Registration Number | Student Name |
| 1 | 22CSE080 | 22UG010167 | ABINASH BHARAT JYOTI RATHA |
| 2 | 22CSE139 | 22UG010272 | RAJAT KUMAR DASH |
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## Project Information

Project Title: \_Edge-Aided Plant Species Identification Using Leaf Image Analysis and Hybrid Classification Techniques

Domain / Area: Machine Learning, Deep Learning,Data Analytics,Computer Vision

Faculty Supervisor: Mr.Sitanshu kar

## Tasks and Progress

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| Tasks Planned | Tasks Completed | Remarks / Challenges |
| **1. Problem Statement & Objectives**  1.1 Briefly explain the problem statement.  1.2 Mention the objectives set at the beginning. | Most plant recognition systems still fail in real situations — they confuse random objects for leaves and often get the plant species wrong, making their results unreliable.  Objective: Create an algorithm that detects real leaves in images and classifies plant species using edge detection, texture features, and machine learning. | While defining the problem, we found it difficult to clearly separate our scope from existing works since most plant recognition systems already attempt similar tasks.  Setting objectives was also challenging because we had to balance traditional methods (edges, textures) with ML approaches to make the solution both practical and novel. |
| **2. Literature Survey Progress** 2.1 Summary of at least 10 relevant literature papers (APA/IEEE format).  2.2 Literature gap identified (how existing work falls short). | 1. “Plant Leaf Recognition Using Shape, Color, and Texture Features” by M. Arora, A. Gupta, and S. Singh, published in International Journal of Advanced Computer Science and Applications in 2012.  2. “Plant Species Identification Using Digital Image Processing of Leaf Morphological Features” by A. Cruz, D. Green, and S. Marshall, published in Computational Botany in 2017.  3. “Automatic Plant Identification System Based on Plant Leaf Image” by S.-B. Lee and W.-C. Chen, published in Signal Processing and Information Technology Journal in 2015.  4. “Enhanced Edge Detection Techniques for Plant Leaf Disease Identification” by S. Saini, G. Kaur, and A. Sharma, published in International Journal of Image Processing in 2020.  5. “Hybrid Machine Learning Models for Plant Species Classification” by R. Kumar, D. Gupta, and P. Singh, published in Expert Systems with Applications in 2021.  6. “Plant Species Identification Using Computer Vision Techniques: A Review” by J. Wäldchen and P. Mäder, published in Ecological Informatics in 2018.  7. “Evaluation of Plant Identification Techniques Using Leaf Shape Features” by S. S. Sutar, J. A. Kulkarni, and D. S. Yadav, published in Pattern Recognition Letters in 2018.  8. “Deep Learning for Plant Identification Using Vein Morphological Patterns” by G. L. Grinblat, L. C. Uzal, M. G. Larese, and P. M. Granitto, published in Computers and Electronics in Agriculture in 2016.  9. “Data Augmentation Techniques for Improving Plant Species Recognition” by A. Rehman, M. Imran, and N. Kanwal, published in Applied Sciences in 2019.  10. “Plant Leaf Recognition Using Texture Features and Neural Networks” by J. Chaki and R. Parekh, published in Procedia Computer Science in 2019.  Many existing systems struggle with real-world variations like complex backgrounds and lighting changes.  Most studies use limited features, lacking combined edge, texture, and deep learning features.  Multi-edge detection methods are rarely integrated into end-to-end classification workflows.  Data imbalance is often ignored, causing biased model performance.  Hybrid classification approaches combining traditional and deep learning models are underexplored. | Collecting 10 quality papers took time, as many were behind paywalls or irrelevant to our specific focus.  Summarizing different methodologies into a comparable format was challenging because each study used different datasets and metrics.  It was difficult to pinpoint a unique gap, since many works already focus on shape, texture, or deep learning.  After deeper analysis, we identified that very few studies combine edge, texture, and hybrid ML methods together. Highlighting this novelty took extra effort. |
| **3. Data Collection & Requirement Analysis** 3.1 Dataset description, source, and reason for selection.    3.2 Exploratory Data Analysis (EDA) and reports (graphs, missing values, distributions, correlations, etc.). | We brought together images from the PlantVillage and PlantWild datasets because they offer a good mix of shapes, lighting, and backgrounds, making them perfect for building a strong, versatile model. From these, we handpicked 10k images in total  An initial Exploratory Data Analysis (EDA) was conducted to examine class distribution, visualize representative samples, assess leaf shape diversity, identify background variations, and detect potential noise patterns within the dataset. | Combining PlantVillage (clean) and PlantWild (real-world) datasets was challenging, and class imbalance across species risked biasing the classifier.  EDA revealed high variations in lighting, background, and leaf structure, along with noisy images (damaged/overlapping leaves), making preprocessing complex. |
| **4. Preliminary Designs / Algorithms** 4.1 Initial workflow, block diagram, or conceptual framework showing the proposed approach.  4.2 Selection and brief justification of intended techniques, algorithms, or models to be used (no implementation yet).  4.3 Description of planned evaluation metrics and validation approach | Designed workflow:  we will develop a novel algorithm that will first determine whether the given input corresponds to a leaf, and subsequently classify the identified leaf into its respective plant species.  Edge detectors chosen to enhance vein and contour visibility; hybrid classifier to leverage both rule-based precision and ML adaptability.  1: Accuracy, Precision, Recall, F1-Score for leaf detection.  2: PSNR, SSIM for edge quality + Classification Accuracy for species ID. | Designing a workflow that first detects whether the input is a leaf and then classifies it into the correct species proved challenging to integrate smoothly into a single pipeline.  Selecting the right features and models was challenging, as we had to ensure the algorithm could first distinguish leaf from non-leaf objects and then classify species accurately without adding excessive computational cost.  Finalizing evaluation metrics was challenging, as the system needed to be evaluated both for accurate leaf detection and for correct species classification, while ensuring fair performance across imbalanced classes. |
| **5. Progress Status** 5.1 Percentage of work completed (overall and for each major stage | 30 % completed (Data Collection, Data Preprocessing , Data Balancing) |  |

**Supervisor Comments:**

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**Verified by:**

Signature of Supervisor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature of Class Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_