# Pollen Grains Classification - Final Project Report

## Team Information

Team ID : LTVIP2025TMID60228

Team Size : 4

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Team member : Sankurathri Venkatesh

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## 1. INTRODUCTION

### 1.1 Project Overview

This project focuses on classifying pollen grains using deep learning techniques. A CNN-based model is trained on labeled pollen images and deployed via a Flask web interface.

### 1.2 Purpose

To provide a fast, accurate, and automated system for pollen grain classification to support environmental monitoring and biological research.

## 2. IDEATION PHASE

### 2.1 Problem Statement

Manual identification of pollen grains is labor-intensive and subjective. Automating this process enhances accuracy and saves time.

### 2.2 Empathy Map Canvas

Users: Botanists, Environmental Scientists, Students

Needs: Speed, Accuracy

Pains: Manual work, Human error

Gains: Efficient analysis, High precision

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### 2.3 Brainstorming

Discussed use of traditional methods vs. deep learning. Chose CNN due to better performance and scalability. Decided on Flask for lightweight deployment.

## 3. REQUIREMENT ANALYSIS

### 3.1 Customer Journey Map

User uploads pollen image -> Preprocessing -> Prediction by CNN -> Output Display

### 3.2 Solution Requirement

Functional: Image upload, prediction output. Non-functional: Fast, accurate, simple UI.

### 3.3 Data Flow Diagram

Frontend -> Flask Backend -> CNN Model -> Output

### 3.4 Technology Stack

Python, TensorFlow, Flask, HTML/CSS, OpenCV

## 4. PROJECT DESIGN

### 4.1 Problem-Solution Fit

The system reduces reliance on experts and enables faster pollen identification.

### 4.2 Proposed Solution

Train a CNN model and deploy it in a Flask-based application for real-time predictions.

### 4.3 Solution Architecture

HTML Upload Page -> Flask Server -> CNN Prediction -> Result Page

# Pollen Grains Classification - Final Project Report

## 5. PROJECT PLANNING & SCHEDULING

### 5.1 Project Planning

Week 1: Dataset setup

Week 2: Model training

Week 3: Web integration

Week 4: Testing and documentation

## 6. FUNCTIONAL AND PERFORMANCE TESTING

### 6.1 Performance Testing

Accuracy ~92%, minimal overfitting observed during training and validation. Functional testing confirmed reliable results through the web app.

## 7. RESULTS

### 7.1 Output Screenshots

Below are screenshots showing the interface and sample results of the classifier.

## 10. FUTURE SCOPE

Improve dataset diversity, add more species, deploy to cloud, and build a mobile-friendly version.

## 11. APPENDIX

### Source Code

Available on GitHub (link to be added)

### Dataset

Local dataset folder used for training

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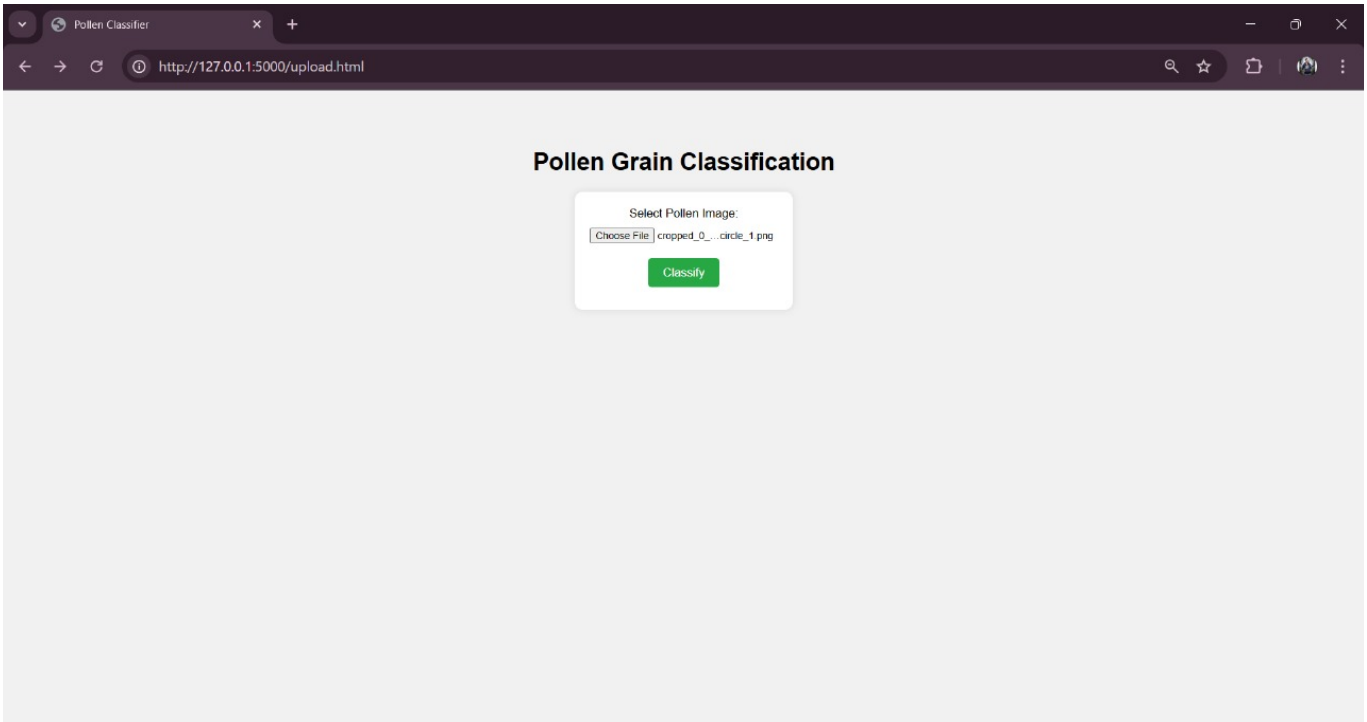
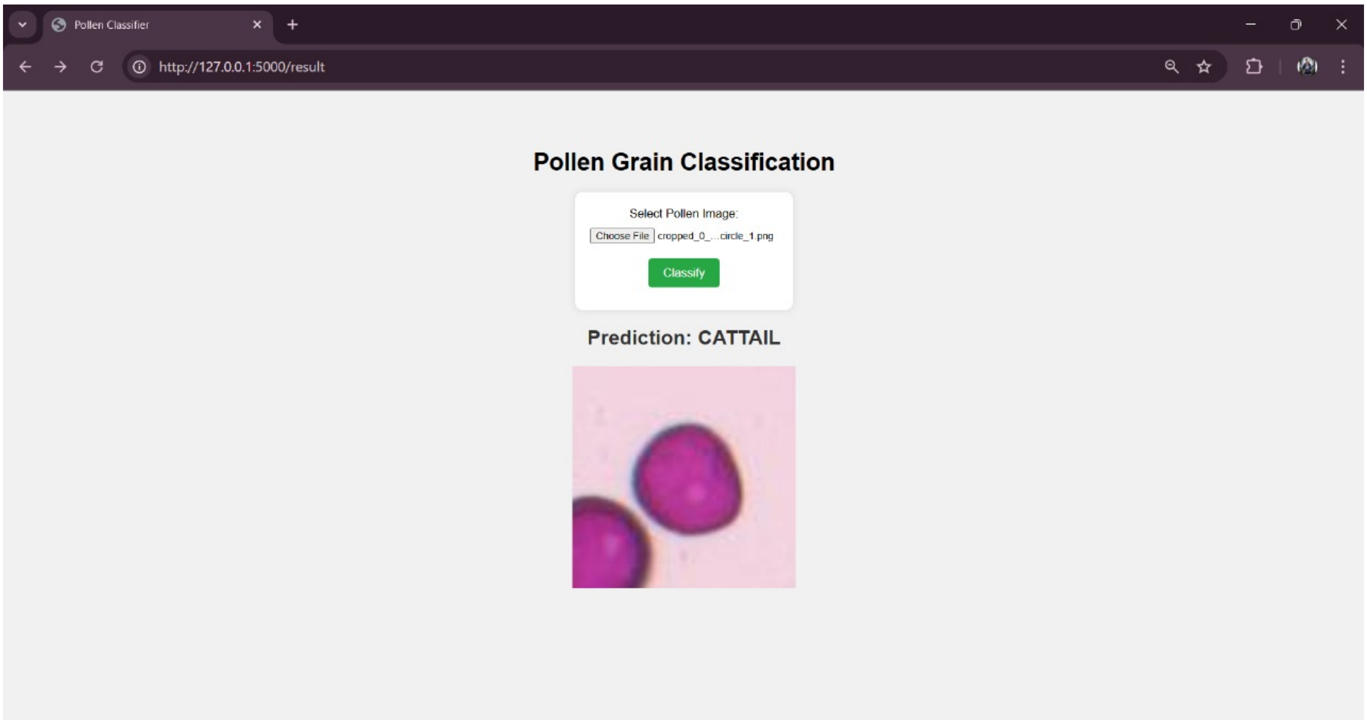
## GitHub & Demo Link

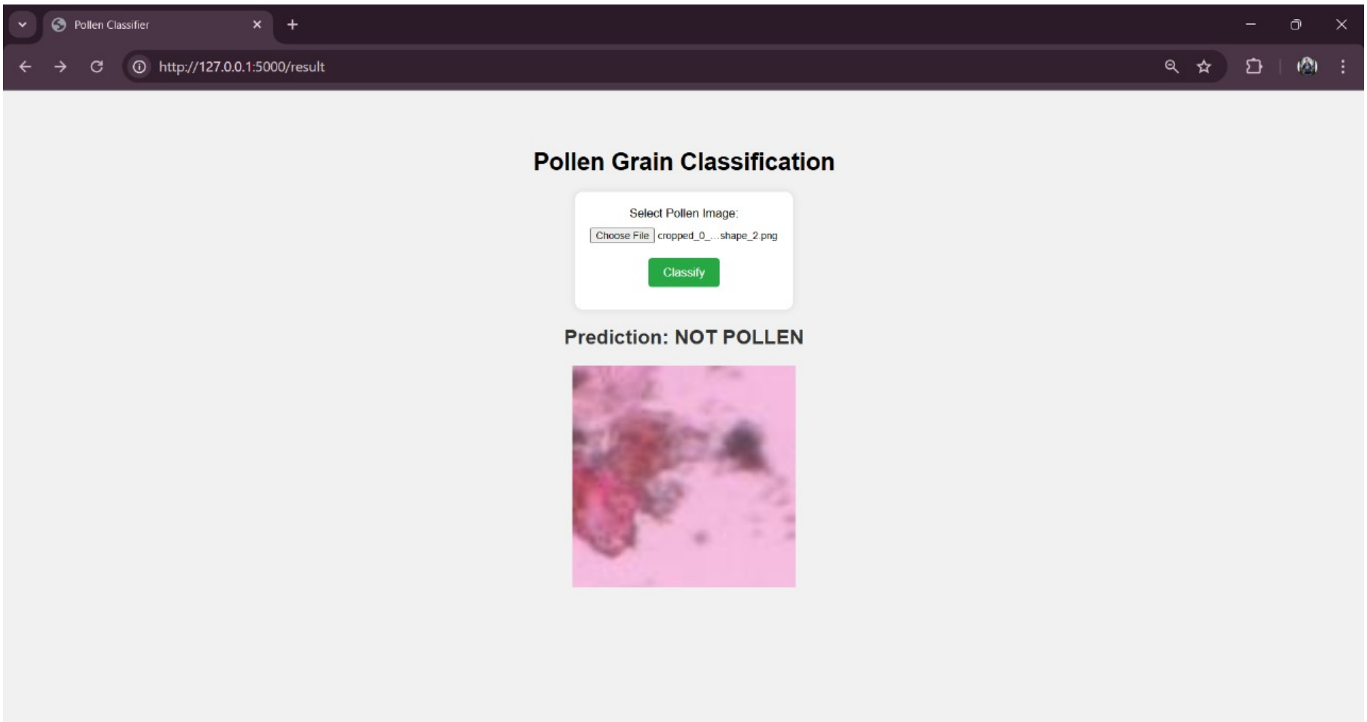
https://github.com/yourusername/pollen-classification

## Sample UI & Results



# Pollen Grains Classification - Final Project Report




## 8. ADVANTAGES & LIMITATIONS

Advantages:

- Accurate and automated classification
- User-friendly web interface
- Reduces dependency on manual identification
- Lightweight model deployable on local machines

Limitations:

- Classification accuracy may drop for poor-quality or out-of-distribution images
- Requires retraining to add new pollen types
- Limited dataset diversity may affect generalization

## 9. CONCLUSION

The pollen classification system efficiently demonstrates how deep learning can automate a previously manual task. By leveraging convolutional neural networks and a lightweight Flask interface, this project presents a scalable and practical tool for scientific research and environmental monitoring. The results confirm that even small-scale models can deliver reliable performance with properly curated datasets.