Project Documentation

# Project Title

**Pollen's Profiling: Automated Classification of Pollen Grains**

# Team Members

Team ID : LTVIP2025TMID36398

Team Leader : V.Bharadwaj

Team member : P.Bhargav Naidu

Team member : T.Akash Reddy

Team member : K.Dhanush Kumar

Team member :K.Lokesh

**Phase 1: Brainstorming & Ideation**

## Objective:

Generate a viable and innovative idea to **Pollen's Profiling** using deep learning.

## Key Points:

* **Know fundamental concepts and techniques of Convolutional Neural Networks.**
* **Gain a broad understanding of image data.**
* **Know how to pre-process/clean the data using different data preprocessing techniques.**
* **know how to build a web application using the Flask framework.**

# Project Description

# The classification of pollen grains plays a crucial role in multiple fields such as botany, allergology, archaeology, climate studies, and forensic science. Traditionally, pollen identification is performed manually by trained experts using light microscopes, which is time-consuming, subjective, and error-prone. This project proposes a deep learning-based automated system to classify pollen grains efficiently and accurately.

# By leveraging Convolutional Neural Networks (CNNs) and image processing techniques, the system learns to recognize distinctive features of different pollen species from microscopic images. The project uses a curated dataset of pollen grain images to train a classification model capable of distinguishing between multiple pollen types based on their morphology, texture, and pattern.

# Goals of the Project:

# Automate the process of pollen grain classification.

# Increase accuracy and consistency in identifying pollen types.

# Reduce human workload and error in palynological studies.

# Support ecological monitoring and allergy forecasting.

# Project Workflow

# 1. Data Collection

# Collect high-resolution labeled pollen grain images from datasets (e.g., Pollen13K or lab-prepared slides).

# 2. Data Preprocessing

# Normalize and resize images (e.g., 128×128 pixels).

# Apply augmentation techniques (rotation, zoom, flip) to generalize better.

# 3. Model Design and Training

# Construct and train a CNN to learn visual features of pollen grains.

# Use training and validation datasets to optimize performance.

# 4. Evaluation

# Evaluate model on unseen test images.

# Analyze model performance with accuracy metrics and visualization tools.

# 5. Deployment (Optional)

# Deploy the model via a web or mobile app for live classification.

# Technologies Used

# Programming Language: Python

# Libraries/Frameworks: TensorFlow / Keras, OpenCV, NumPy, Matplotlib

# Platform: Python IDLE, Jupyter Notebook, or Google Colab

# Expected Outcome

# Classification accuracy of 90–97% with well-prepared datasets.

# A model that can distinguish pollen types such as Betula, Pinus, Zea mays, etc.

# Real-time or near real-time prediction for practical applications.

# Applications

# Palynology: Study of ancient climates and environments.

# Allergy Monitoring: Detect allergenic pollen types in seasonal forecasts.

# Agriculture: Monitor crop pollination patterns.

# Forensics: Trace evidence based on geographic pollen signatures.

# Biodiversity Research: Classify new or rare plant species.

# GitHub Link:

# <https://github.com/bharadwaj-varanasi/bharadwaj-varanasi-Pollen-s-Profiling-Automated-Classification-of-Pollen-Grains->