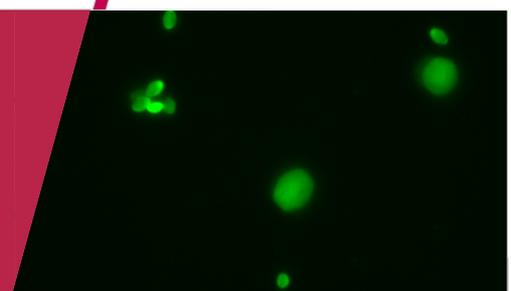


# Student project

## Identify pollen particles using machine learning



### Introduction

Over the past 30 years there has been a significant increase in the prevalence of allergies in the world, and allergic reactions have been identified as the most important factor causing asthma. While the severity of allergic rhinitis and asthma in patients with airborne pollen allergy is quantitatively related to pollen concentration, even concentrations as low as  $\approx 10$  pollen grains/ $m^3$  in the air can cause allergic diseases in patients.

Thus, being able to accurately detect such low concentrations of pollen grains is of the utmost importance. In our lab we are working on a highly automated instrument for real-time monitoring of pollen concentrations in air, to be realized via a combination of pollen injection, enrichment, detection and self-cleaning.

### Identifying pollen types

However, merely measuring pollen concentrations by counting pollen particles is not enough. We would also like to be able to identify and distinguish different pollen types.

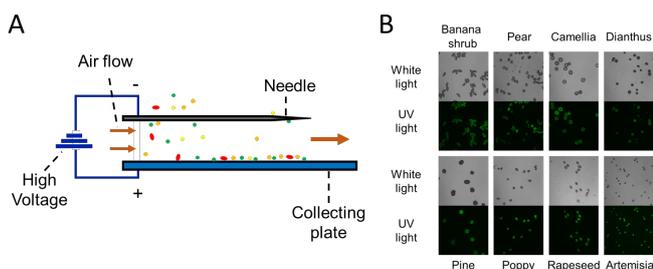


Figure 1: Schematic depiction of the system and pictures of captured pollen grains. (A) Electrical field generated by metal needle(cathode) and transparent ITO glass(anode). (B) Pictures of various types of pollen grains under white light and UV light.

### Project

In this project you will develop methods for identifying pollen types from images of captured pollen particles. The project is suitable for a student with an interest in both practical work in the lab and in the application of image

analysis and machine learning methods (previous experience with these is a plus but not a prerequisite).

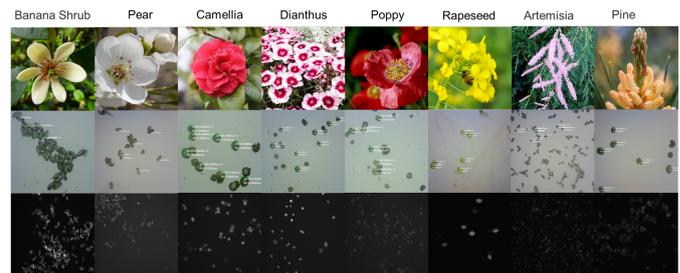


Figure 2: Different shapes, sizes and fluorescence of various pollen grains.

The main **goals** of your project are:

- Obtain pictures of pollen grains captured in our existing detection system.
- Investigate image analysis methods to accurately count the number of particles (dealing with overlapping particles, clusters, impurities, etc.)
- Identify a suitable machine learning model and adapt/implement it to our needs. Train the model with your acquired images of different types of pollen.
- Test the performance of the machine learning model on pictures containing a mix of different pollen types.

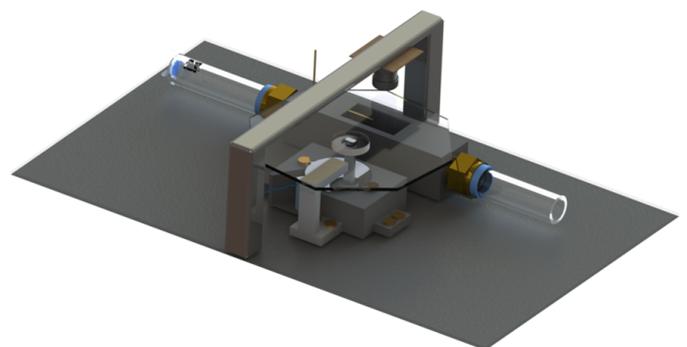


Figure 3: Schematic illustration of the pollen detecting system.