

Programme: PID - Plant Identification Programme | Aloe Ferox

Proj No: PID-ALOE-S001-001

Suite: Plant Phenology

Date: June 3, 2024

Project: Machine Learning Phenology of Aloe Ferox

Supervisor: Dino Giovannoni

1 Research Programme

Plant Identification Programme [PID]: This programme aims to identify different plants and or their characteristics.

1.1 Species

Aloe Ferox: *Aloe Ferox*, commonly known as **Cape Aloe** or **bitter aloë**, is indigenous to Southern Africa, found in the Southern Cape, Eastern Cape and southern parts of KwaZulu/Natal, the Free State and Lesotho. Aloe ferox is known for its medicinal properties and serves as an important source of income for rural communities.

1.2 Project Suite

Plant Phenology: This is a suite of projects related to the phenology of the Aloe ferox. **Phenology** is the study of the timing of nature's cyclical events, such as the emergence of leaves, flowers and fruits. By tracking things like flowering time, botanists can see how aloes react to environmental factors like temperature, daylight hours, and rainfall. This knowledge helps predict future growth patterns and potential stresses.

2 Project Definition

Title: Machine Learning Phenology of Aloe Ferox

The aim of the project is to identify and characterize the different stages of the phenology of Aloe Ferox (bud/flower/fruit) using machine learning.





Machine learning and or AI algorithms should be used to identify the various flowering stages of development based on the labelled data provided, together with the associated images. Each of the images would be classified as being bud, flower or fruit, (or some combination of these), or having no evidence of flowering.

2.1 Objectives

The objectives of this project are:

- To identify if a photograph of an Aloe Ferox plant has buds, flowers or fruit (or a combination of them).
- To tag the image in the spreadsheet/atabase with the appropriate phenology classification label.

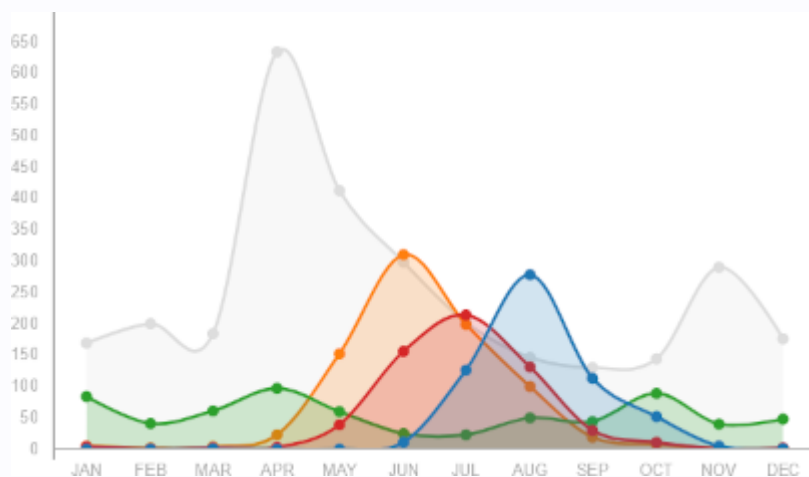
	<h1>Project Charter</h1>		Pg: 2/3
			Rev: 24a
Programme: PID - Plant Identification Programme Aloe Ferox		Proj No: PID-ALOE-S001-001	
Suite: Plant Phenology		Date: June 3, 2024	
Project: Machine Learning Phenology of Aloe Ferox		Supervisor: Dino Giovannoni	

- To use dates, seasonal and location data to identify the weather and or geographical characteristics of the phenology.

2.2 Scope

The project scope will require:

- Collecting images of Aloe Ferox from iNaturalist based on the phenological classification identifier in the provided spreadsheet).
- Using the labels of the data (from the tabs in the spreadsheet) together with the associated images to create a training dataset for a machine learning /deep learning algorithm
- Selection of an appropriate machine learning/deep learning algorithm that can be used to identify and categorize the various flowering stages (bud/flower/fruit) of the Aloe Ferox.
- Training of the ML model and then applying the model to a test dataset. The test data should be validated to confirm accuracy of prediction.
- A calculation of the estimate of the model prediction.
- Obtain weather data for the particular location of the images from the South African weather service, Google Earth Engine or other sources.
- Perform some basic data analytics to characterize the phenology of the data. This could be used to identify the time of year for each stage of flowering, the relationship between various weather data for the various stages of development.



For example, the above time-based identification of the stages of flowering could be generated to illustrate the distribution of budding, flowering and fruiting from the data.

2.3 Deliverables

The following deliverables are to be provided as part the project:

- A machine learning model that can be used to categorize the phenology of Aloe Ferox.
- An easy to use user interface for loading and suitable display of the image data with the relevant phenological characterization.
- Provide for exporting of the model prediction data to an Excel file, together with an accuracy estimate.



Programme: PID - Plant Identification Programme | Aloe Ferox

Proj No: PID-ALOE-S001-001

Suite: Plant Phenology

Date: June 3, 2024

Project: Machine Learning Phenology of Aloe Ferox

Supervisor: Dino Giovannoni

2.4 Tools & Techniques

The following tools and techniques may be required for the execution of the project:

- **File I/O:** Importing and exporting of data files.
- **Image Processing:** Selection and application of suitable image processing algorithms.
- **Machine Learning:** Selection and application of suitable machine learning algorithms.
- **User Interface Design:** Developing appropriate application with suitable user interface.

2.5 Stakeholders

- **Project co-supervisor:** *Mr. Philip van Huyssteen.* Technology Aided Biocontrol Group (TAB), Belgium Campus Itiversity.
- **Project supervisor:** *Mr. Dino Giovannoni.* Technology Aided Biocontrol Group (TAB), Belgium Campus Itiversity.
- **Project sponsor:** *Prof. Craig Peter.* Department of Botany (RUBOT), Rhodes University.