ApisVM Script User Manual

1. Introduction

The **ApisVM** script is designed for analyzing bee wings according to the DAWINO methodology. This manual will guide you step-by-step on how to use the script for analyzing the front (Frontwing) and back (Backwing) wings, including calibration, saving results, and performing analyses.

2. Requirements

- Python 3.x
- Libraries: `customtkinter`, `tkinter`, `matplotlib`, `pandas`, `cv2`, `numpy`, `xlwings`, `openpyxl`, `scipy`

3. Installation

Before using the script, you need to install all the required libraries. You can do this using the following command:

```
pip install customtkinter matplotlib pandas opencv-python numpy xlwings openpyxl scipy
```

4. Running the Application

Run the script with the command:

```
python ApisVM.py
```

5. User Interface

After running the script, a graphical user interface (GUI) will open with the following options:

Sidebar

- **Frontwing**: For analyzing the front wing.
- **Backwing**: For analyzing the back wing.
- **Excel**: For merging Excel files and calculating probabilities.
- **XY points**: For displaying point coordinates and for Geometric analysis.Coming soon.

Main Content

- **Calibration**: Set calibration based on the selected image.
- **Save**: Set the path for saving results.
- **Analysis**: Start the wing analysis.
- **Recalibrate**: Reset the calibration.
- **Reset Save**: Reset the save path.

6. Analysis Procedure

1. Calibration

1. Click the **Calibration** button.
2. Select an image of the wing for calibration.
3. Double-click the image and mark out a distance of 1mm using the two points of the calibration ruler to calculate the scale.
4. After successful calibration, a message will appear indicating successful calibration.

2. Setting the Save Path

7. Click the **Save** button.
8. Select the directory where the analysis results will be saved.
9. After successfully setting the path, a message will appear indicating successful save.

3. Wing Analysis

1. Please study the sample point location images in the Images folder before the analysis.
2. Click the **Frontwing analysis** or **Backwing analysis** button depending on which wing you want to analyze.
3. Select an image of the wing for analysis.
4. Double-click to mark points on the image according to the DAWINO methodology.
5. The script will calculate distances, angles, and other parameters and save the results to an Excel file.
6. After the analysis of the front wing, an Excel file of Front and GeometricF is created. After the analysis of the back wing, an Excel file Back and GeometricB will be created.

   GeometricF and GeometricB are created in preparation for making future analysis of the XY points button available.

4. Merging Excel Files

1. In the next steps, only the Front or Back file is used.
2. In the next steps, only the Front or Back file is used.
3. Click the **Excel** button.
4. Select the **Front excel merger** or **Back excel merger** option.
5. Select the Excel files you want to merge.
6. The script will create a new Excel file with average and median values.

5. Calculating Probabilities

1. Click the **Excel** button.
2. Select the **Posterior probability (Frontwing)** or **Posterior probability (Backwing)** option.
3. Select the Excel file with the analysis results.
4. The script will calculate and display posterior probabilities for various standards.