

CNN PARAMETER TUNER

Comprehensive Handbook

Gokul Kottilapurath Surendran & Martin Mokroš

CNN Parameter tuner

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by

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CHAPTER

1

INTRODUCTION

Welcome to CNN Parameter Tuner! We are thrilled to introduce you to this powerful application designed to assist you in discovering the optimal parameter values for your Convolutional Neural Network Model, specifically tailored for image classification on your unique dataset.

Our comprehensive handbook has been meticulously crafted to offer you a seamless and insightful guide on navigating and harnessing the full potential of this software. We are confident that this tool will enhance your experience and streamline the process of fine-tuning your network.

Should you have any questions or require assistance along the way, please do not hesitate to reach out. We're here to ensure your journey with CNN Parameter Tuner is both productive and enjoyable.

1.1. KEY FEATURES

- Load and analyze images in various formats, including JPG, JPEG and PNG.
- Customize image dimensions as needed, such as 150x150 or 250x250 pixels etc.
- A wide range of preprocessing options is available, including normalization, standardization, and augmentations.
- Build CNN models tailored to user preferences, with options to add or remove convolutional layers.
- Customize the Train-Test-Val Split according to your preferences.
- Define Number of epochs for training.
- Adjust the batch size based on your specific requirements.
- Choose your preferred activation function for the final dense layer.
- Select the optimizer function that best suits your needs.
- Pick a loss function that suits your needs.
- Visualize results with interactive confusion matrices.
- Explore and analyze results through interactive graphs.
- Access detailed classification reports for in-depth insights.
- Save the last trained model for future use, with support for integration into Python scripts and other applications.
- Option to generate a customizable Jupyter Notebook script based on selected inputs.

1.2. SYSTEM REQUIREMENTS

For basic classification purposes, we recommend utilizing any Windows-based system. To ensure optimal performance, we suggest a minimum of 16 Gigabytes of RAM. Additionally, for enhanced processing capabilities, it is highly recommended to consider systems equipped with an Intel i5 or i7 processor or later model.

In scenarios involving the processing of substantial amounts of data, we advise opting for systems with a higher memory capacity, preferably a minimum of 32 or 64 Gigabytes of RAM. This will significantly enhance the efficiency and speed of data processing, ensuring a seamless experience with large datasets.

Your attention to these hardware specifications will undoubtedly contribute to a smoother and more productive computing environment.

Note: To install this software on university computers, administrative access is required. Due to its development for research purposes, it may be flagged by system firewalls as coming from an unknown source, which could block installation. However, on personal computers, the software can be installed without any issues.

CHAPTER

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INSTALLATION

For a smooth installation process, we kindly request you to follow the provided instructions diligently. Your attention to detail during this phase will greatly contribute to the successful setup of our application.

Thank you for your cooperation, and we appreciate your commitment to ensuring a seamless installation experience.

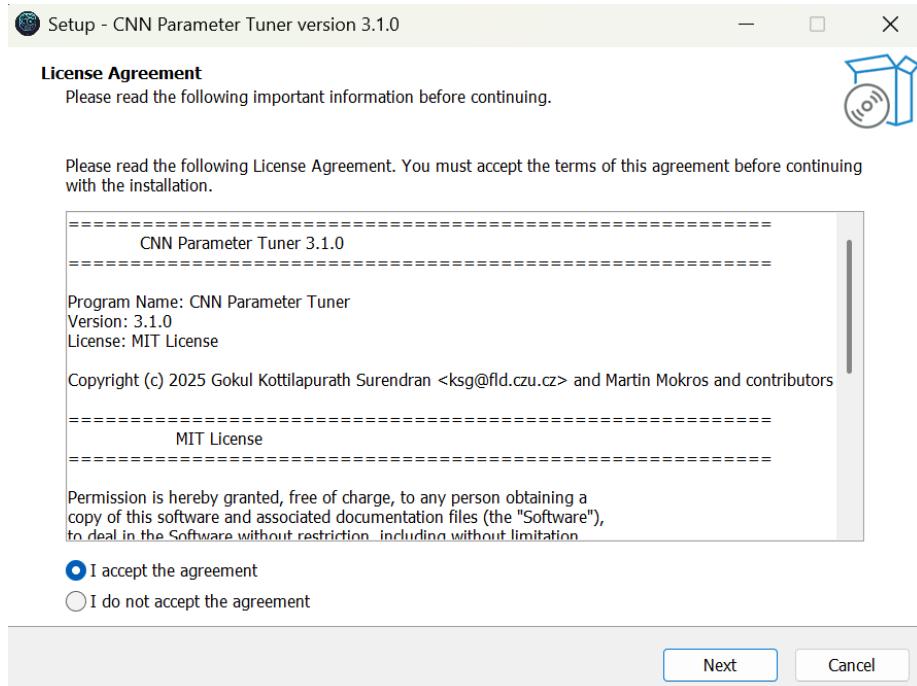
2.1. DOWNLOADING THE INSTALLER

Visit the official website or repository to download the CNN Parameter Tuner installer.

<https://github.com/Gokultcr>

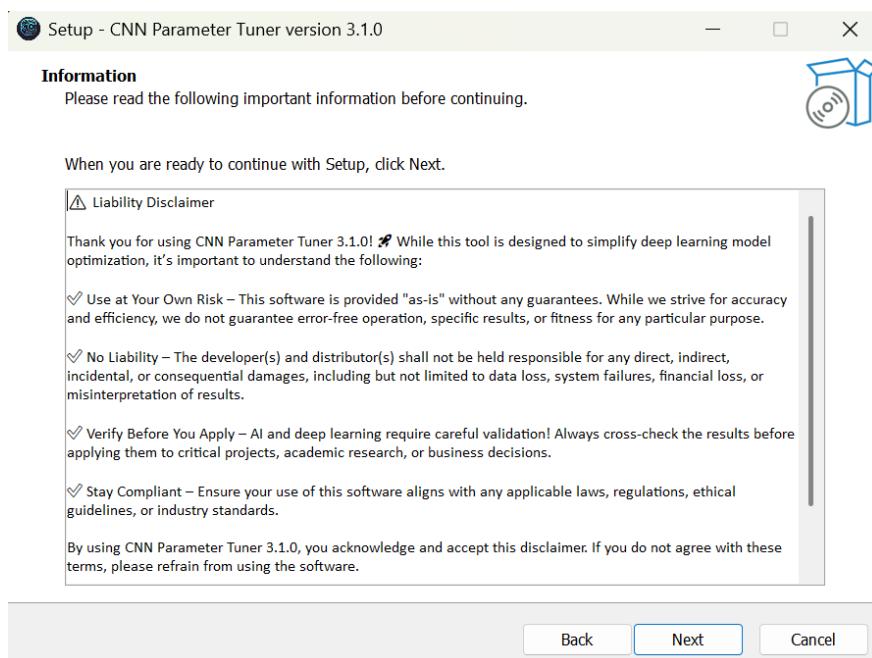
2.2. INSTALLATION PROCESS

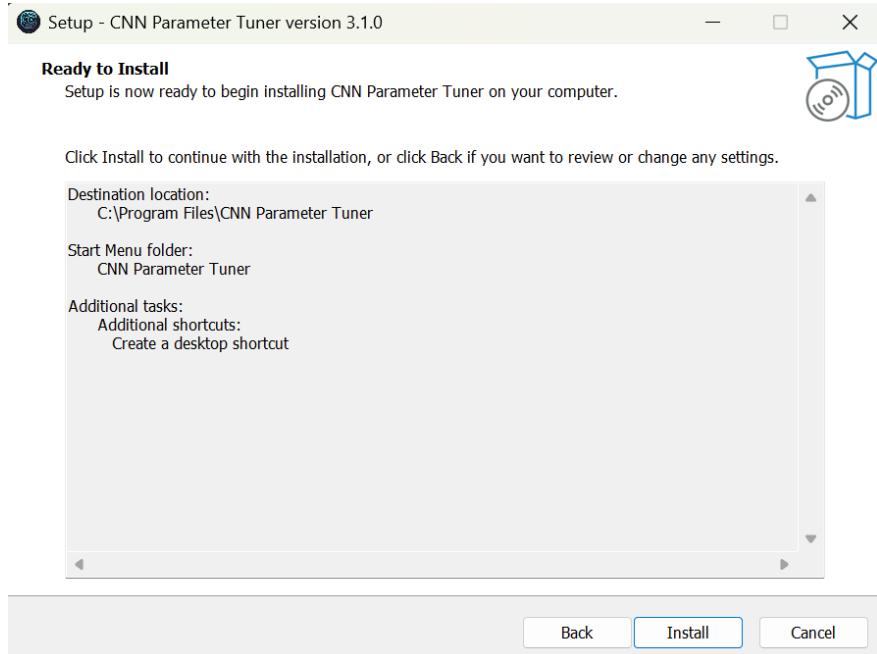
Run the installer and follow on-screen instructions for a seamless installation process.



Kindly proceed by selecting the “I accept” option and then click on the ‘Next’ button

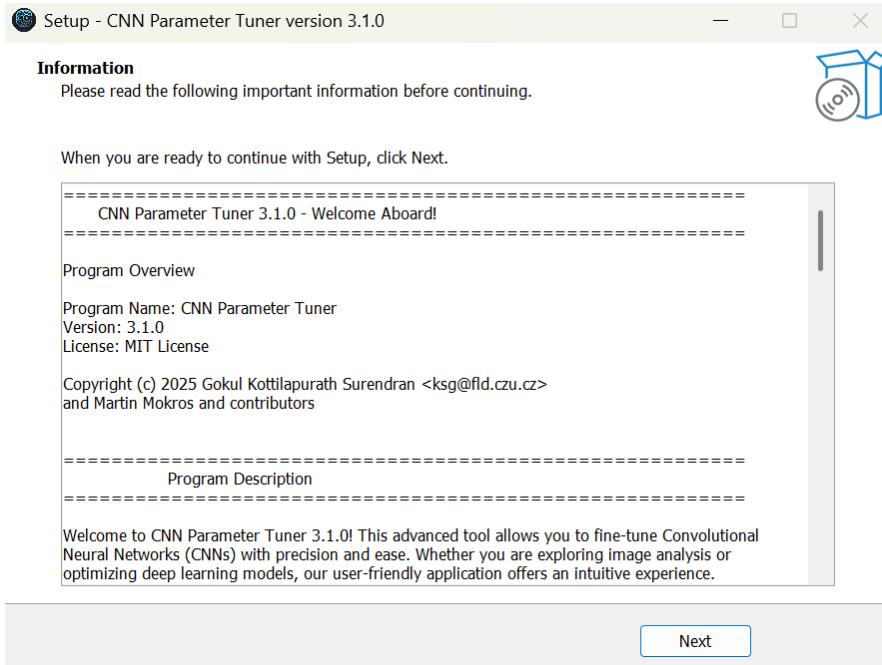
Kindly ensure that you read the liability disclaimer before installing the software.





Kindly proceed by clicking on the “Install” option to initiate the application installation.

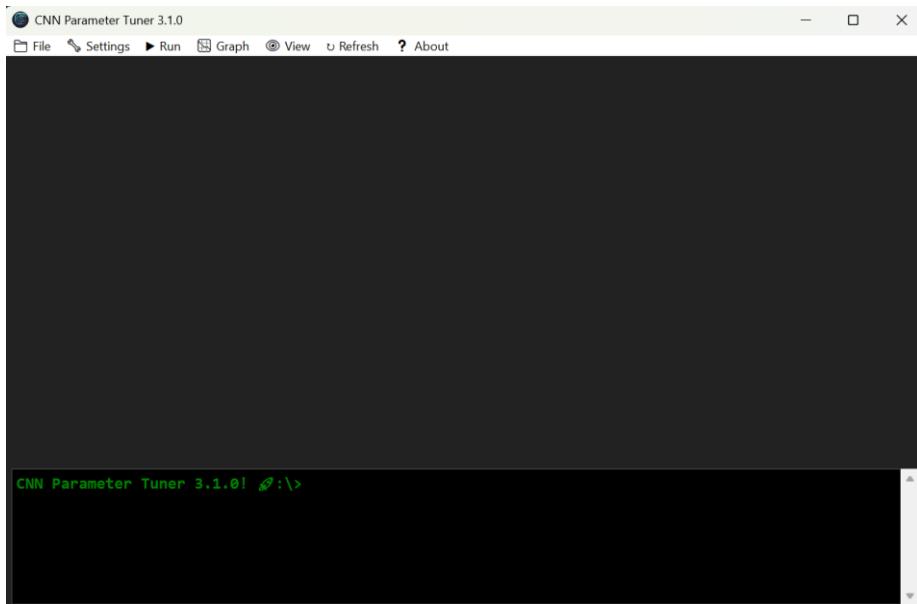
CNN PARAMETER TUNER



Please take a moment to review the fundamental operational details provided. Your attention to this basic working information is greatly appreciated.

2.3. LAUNCHING THE PROGRAM

Upon successful installation, we kindly invite you to launch the program to commence your experience.



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3

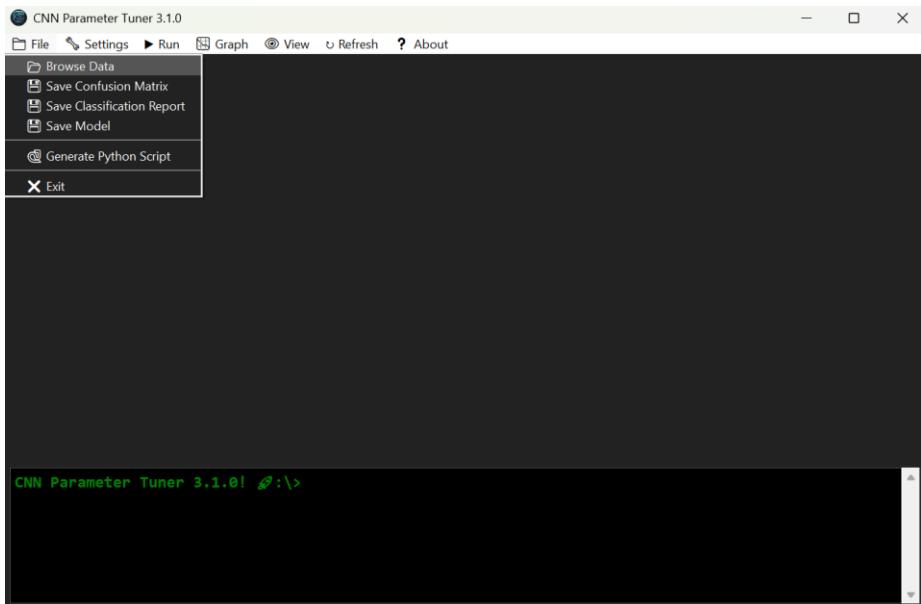
GETTING STARTED

3.1. RUNNING THE APPLICATION

While running the application, you will notice a command prompt area at the bottom of the software. This section is designed to display important information, such as the parameters you've selected, background processes, loaded data names, and a preview of the results. It serves as an initial indicator of the application's functionality.

3.2. LOADING IMAGE DATA

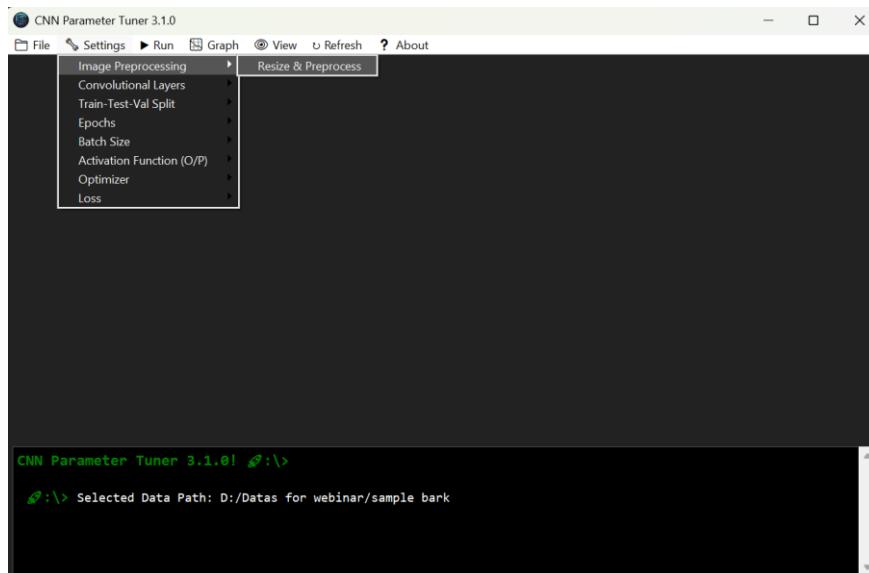
Please navigate to the “File” menu and select “Browse Data” to access the option for opening a folder containing image data. Please ensure that the images are organized into separate folders, with the folder names representing the class labels for the classification task. Once the data is loaded, the software will automatically recognize the folder names as the class labels.



Upon selecting the datapath, you will find it displayed in the command prompt area within the main application.

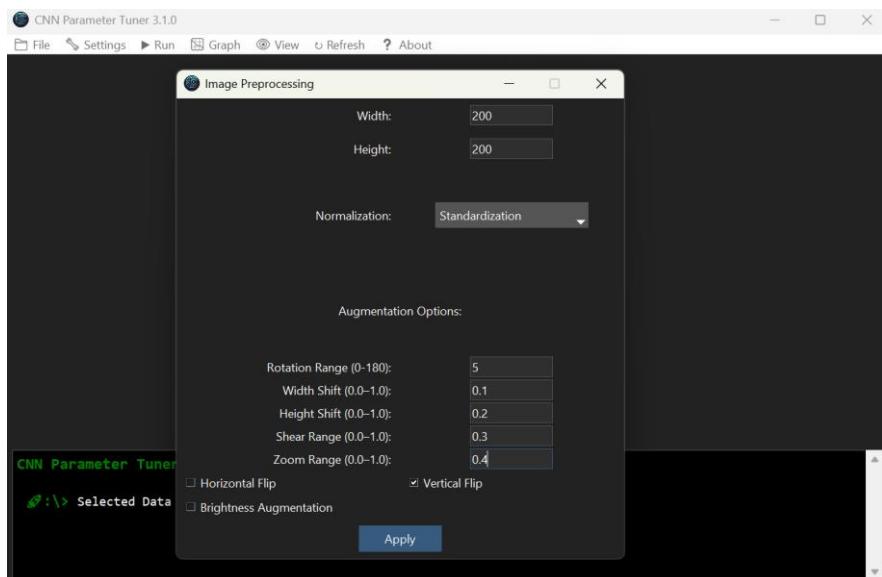
3.3. IMAGE PREPROCESSING

Kindly navigate to the “Image Preprocessing” option under the “Settings” menu and set the desired image size by selecting “Resize & Preprocess.”



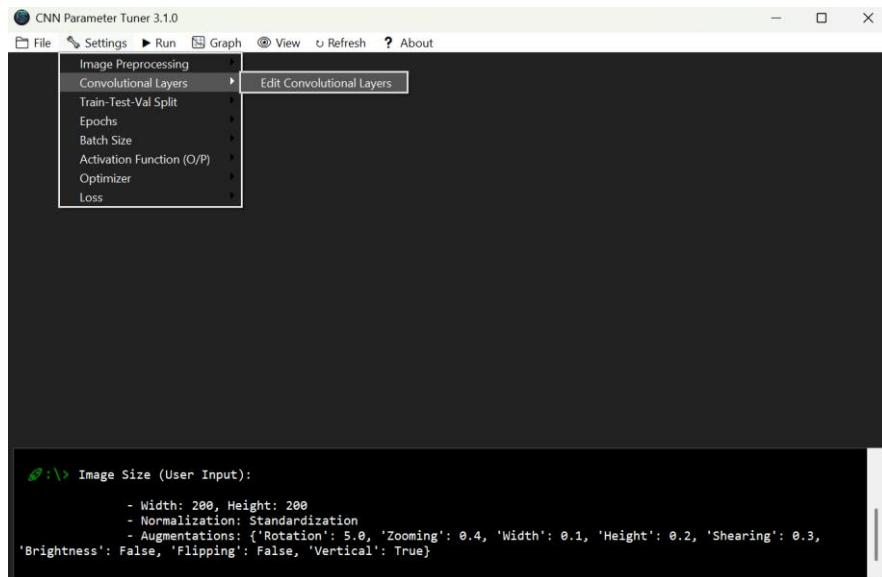
Once the “Image Preprocessing” window is open, set the desired image dimensions, such as 150x150, 250x250, and so on. Choose various preprocessing techniques, including:

- Normalization: None, 0-1 Scaling, -1 to 1 Scaling, Standardization
- Augmentations: Rotation Range, Width Shift, Height Shift, Shear Range, Zoom Range, Brightness Augmentation, and various Flipping options



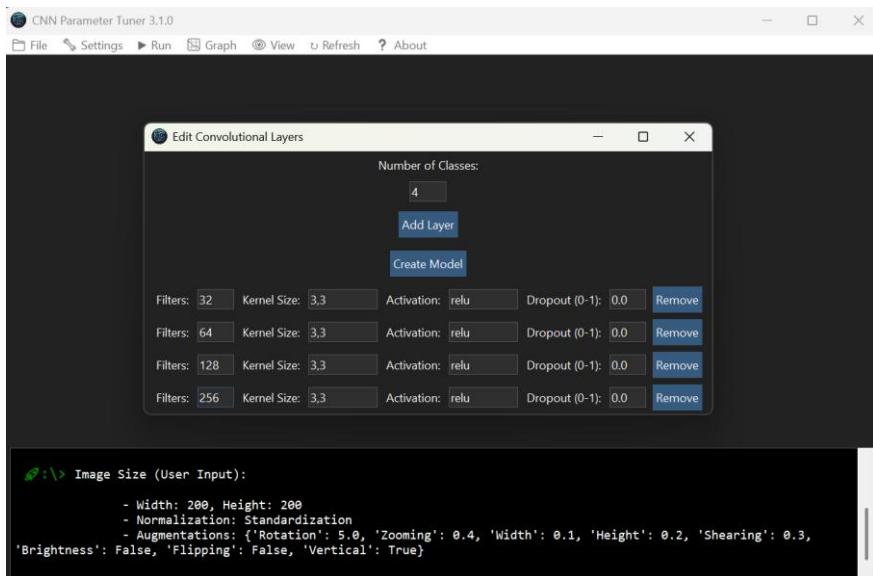
3.4. CNN MODEL (CONVOLUTIONAL LAYERS)

Please click on the “Convolutional Layers” option under the “Settings” menu and select “Edit Convolutional Layers” to create a CNN model for the classification task.



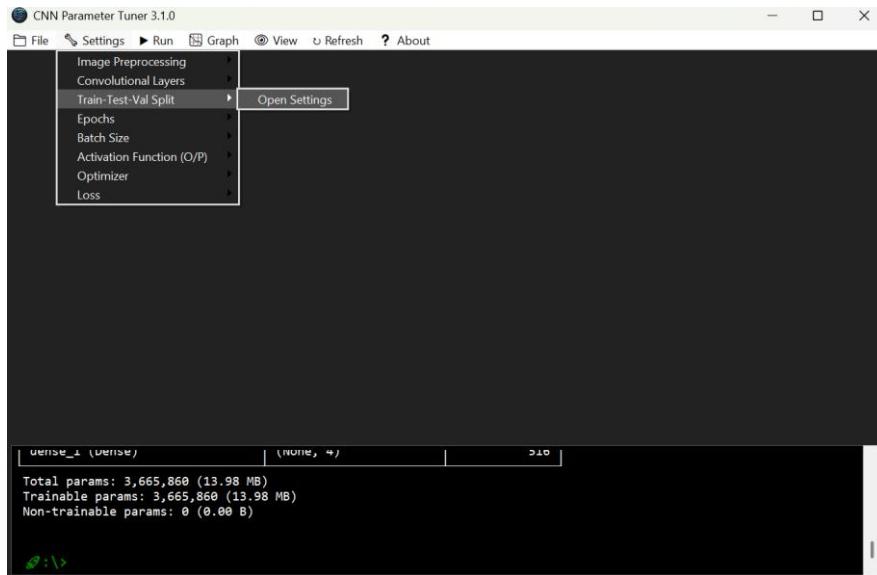
The “Edit Convolutional Layers” window allows you to specify the number of classes for your classification process. Simply enter the number of classes and click on the “Add Layer” button to add new convolutional layers with default values. You can then customize the filter values (e.g., 64, 128, 512), kernel size, and activation function for each layer as needed. Additionally, you can set the dropout rate for each layer, such as 0.1 for 10% and 0.3 for 30%. If you wish to remove any layers, click on the “Remove” button. Once you have finalized the model configuration, click on the “Create Model” button to proceed.

Note: After all user-defined convolutional layers are added, the system will automatically append a **Dense layer with 128 units (ReLU activation)** followed by a **Dropout layer with a dropout rate of 0.2**. These layers are added by default to help improve generalization and reduce overfitting, and they will appear after your last convolutional layer in the final model structure.



3.5. TRAIN-TEST-VALIDATION SPLIT SETTINGS

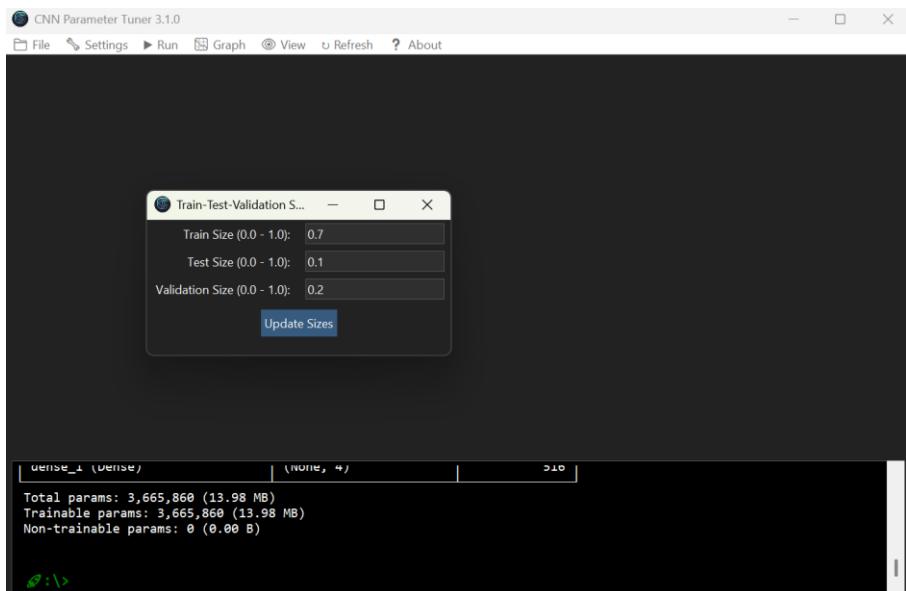
Kindly consider adjusting the training, testing and validation size percentages by navigating to the “Train-Test-Val Split” menu. However, it’s worth noting that by default, the system is set to allocate 70% for training, 10% for testing and 20% for validation.



Should you opt for a 70% split, kindly input 0.7, and for a 60% split, please input 0.6. It’s important to note that the total sum of training, testing and validation sizes must equate to 100% (1.0). In the event that the total size exceeds this limit, the system will automatically

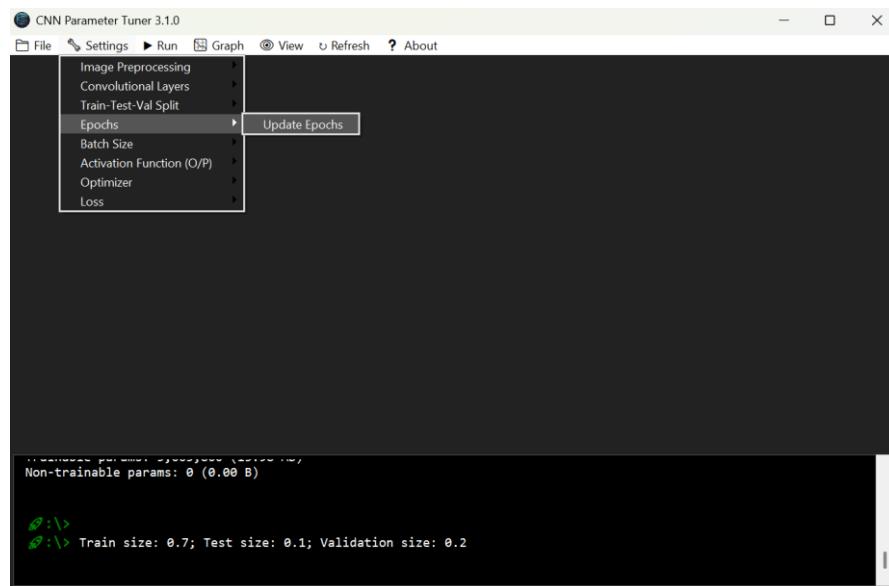
clear all inputted details. Your careful consideration of these parameters is genuinely appreciated.

Enter the train, test, and validation sizes:

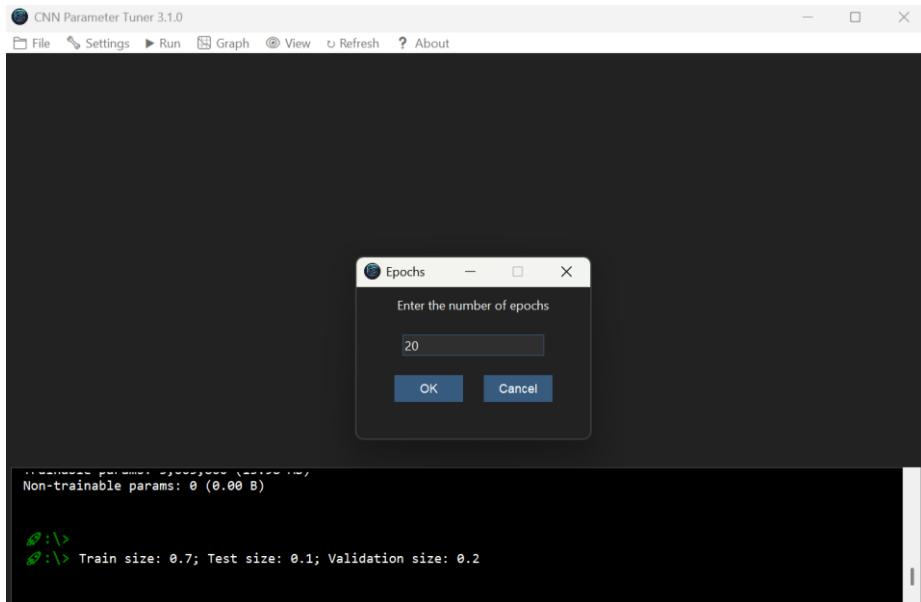


3.6. EPOCHS

Kindly set the number of epochs by accessing the “Epochs” menu and entering the desired value. Your input here will determine the number of training iterations, guiding the model towards optimal performance.

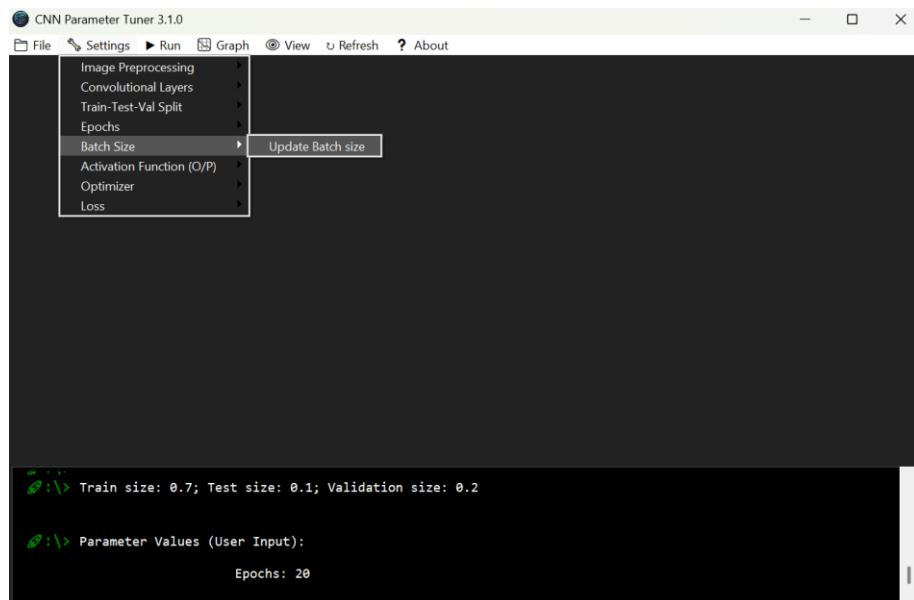


Enter the desired number of Epochs:

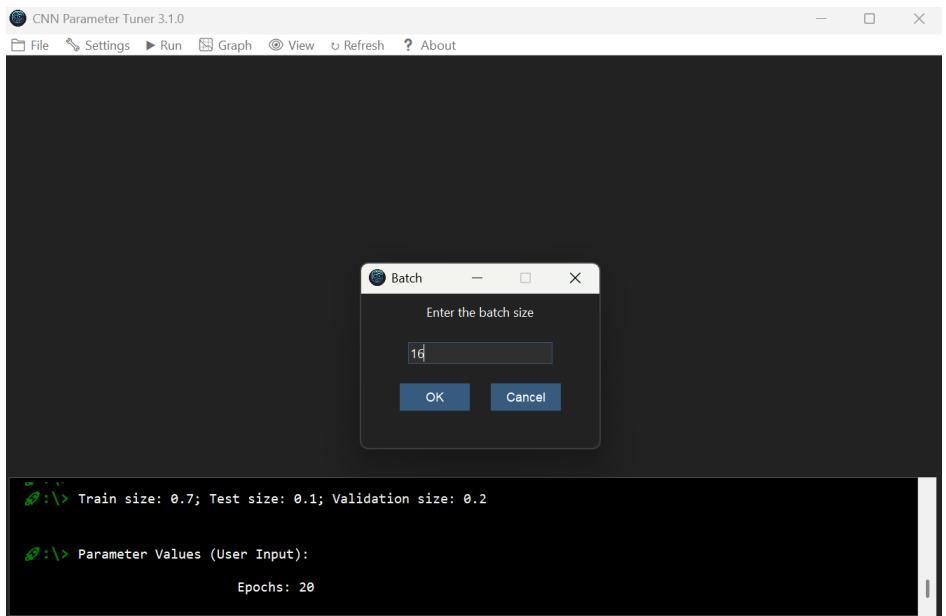


3.7. BATCH SIZE

To specify the batch size, kindly navigate to the “Batch Size” menu and input your preferred value. This parameter plays a crucial role in the training process, and tailoring it to your specific requirements can significantly impact the model’s efficiency.

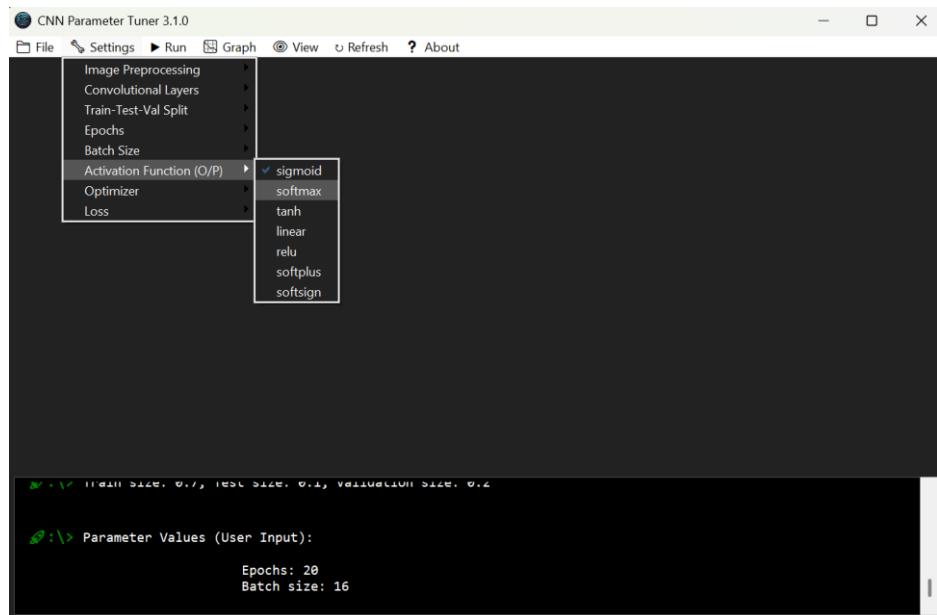


Enter the batch size:



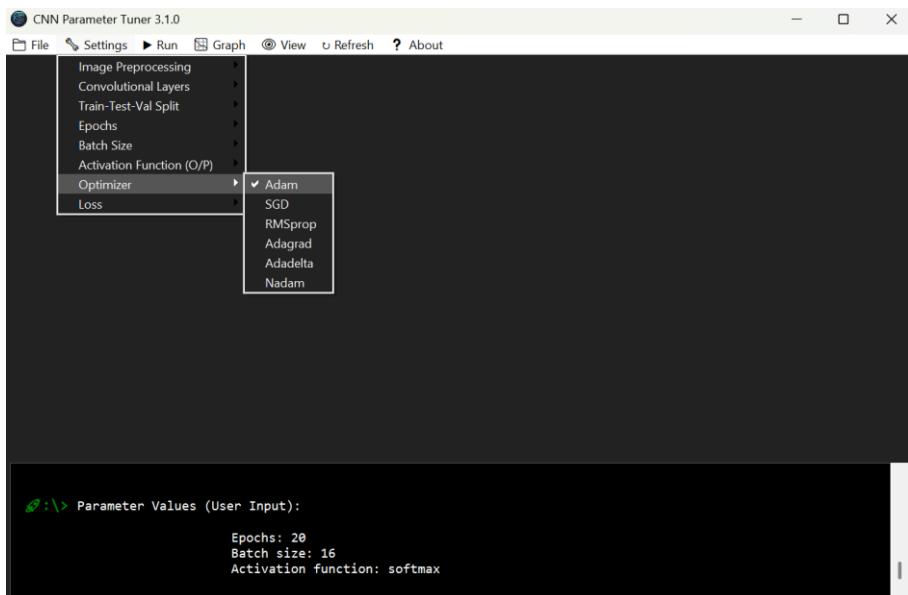
3.8. ACTIVATION FUNCTION

The “Activation Function (O/P)” menu, you have the option to choose your preferred activation function for the output dense layer. This selection is pivotal in shaping the final output of your model. Feel free to explore and select the activation function that aligns best with your objectives.



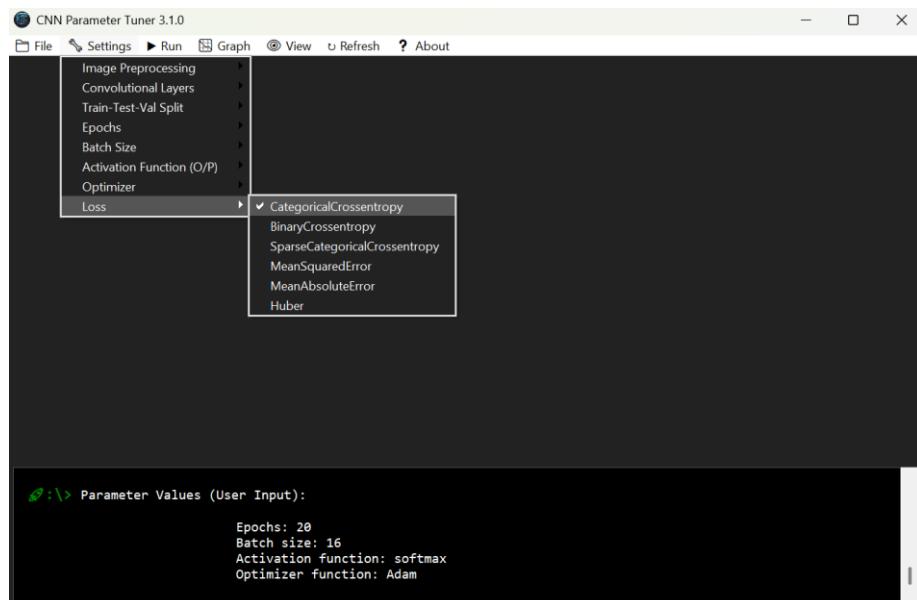
3.9. OPTIMIZER

To customize your model's optimization process, simply access the “Optimizer” menu and choose your preferred optimizer. This selection is key to enhancing the efficiency and convergence speed of your Convolutional Neural Network.



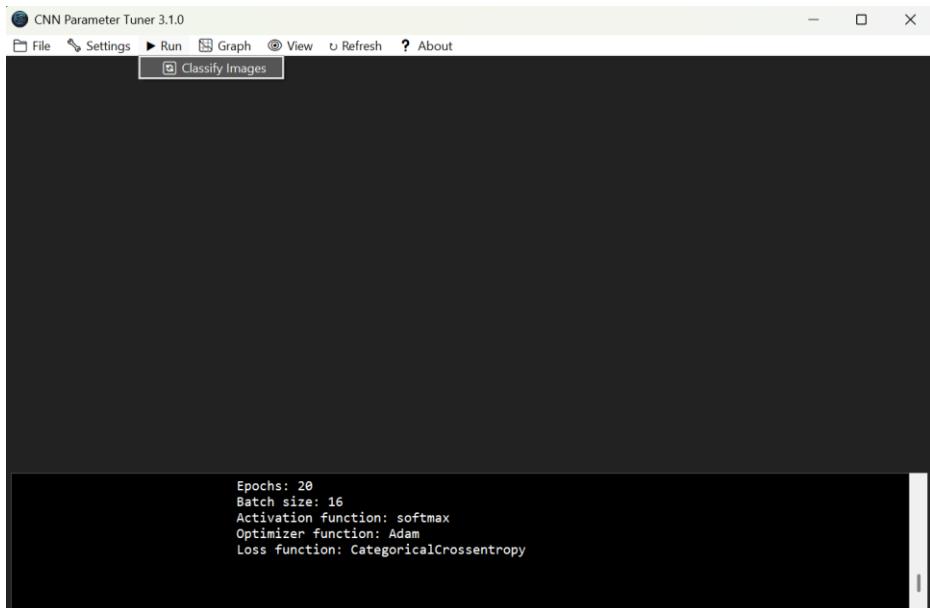
3.10. Loss

To tailor the training process further, kindly navigate to the “Loss” menu and select the loss function that aligns with your specific objectives. This choice plays a pivotal role in guiding the model towards optimal performance and accurate predictions.

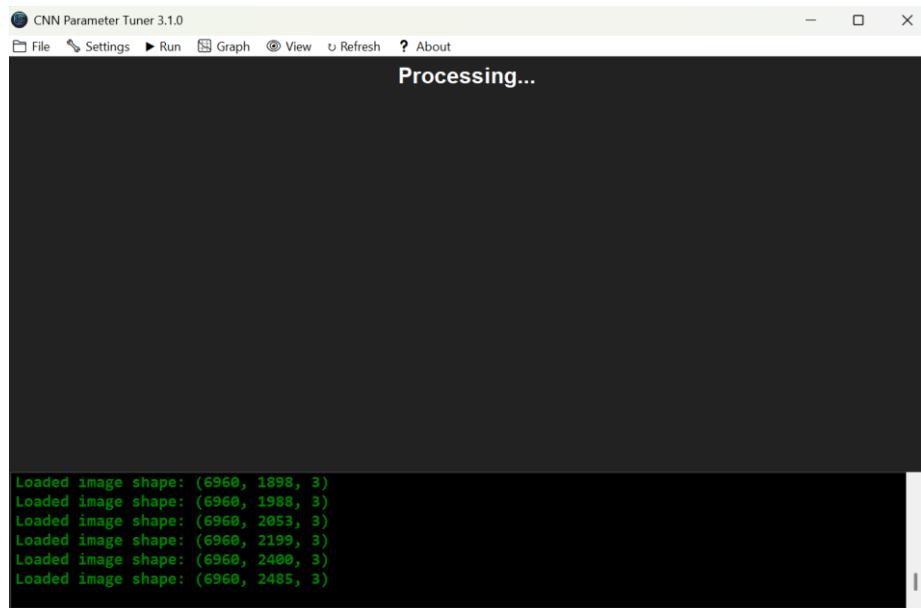


3.11. INITIATING THE CLASSIFICATION

Kindly proceed by clicking on the “Run” menu, and then select “Classify Images” to initiate the classification process.



Upon initiation of the processing, the system will indicate “Processing” to signify that the operation has commenced. Your patience during this phase is greatly appreciated.

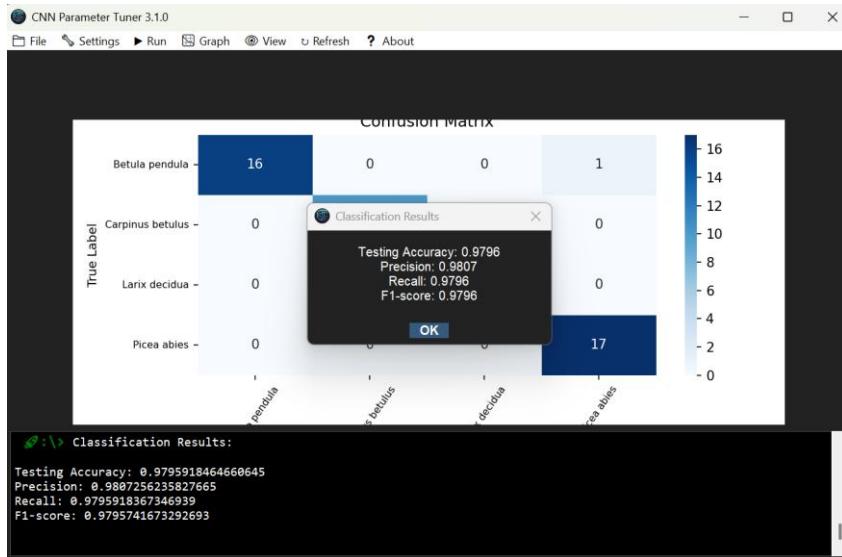


CHAPTER

4

RESULTS

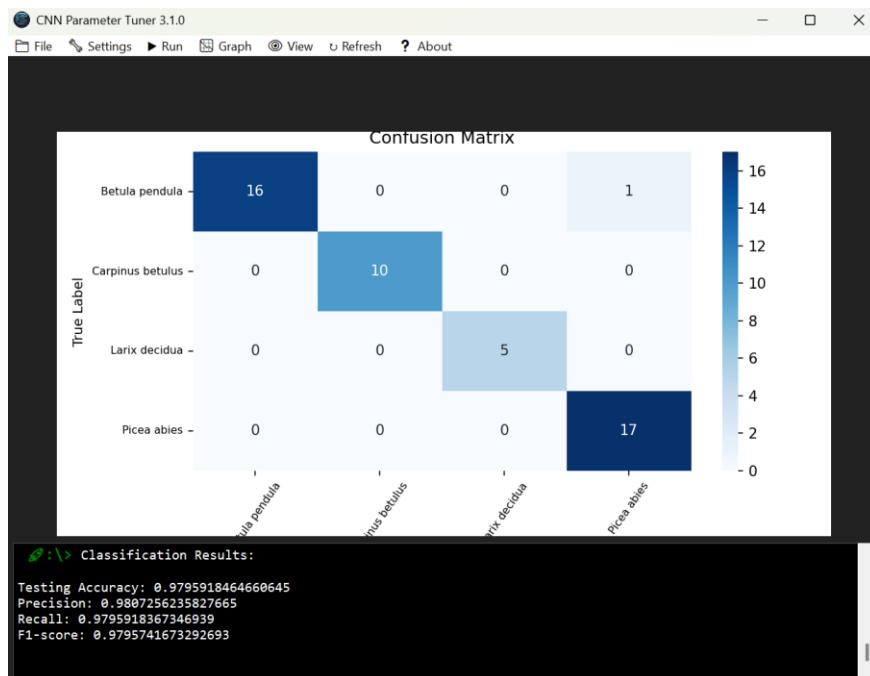
After the completion of processing, a popup will display the main accuracy scores. Kindly click “OK” to finalize the process and access the results.



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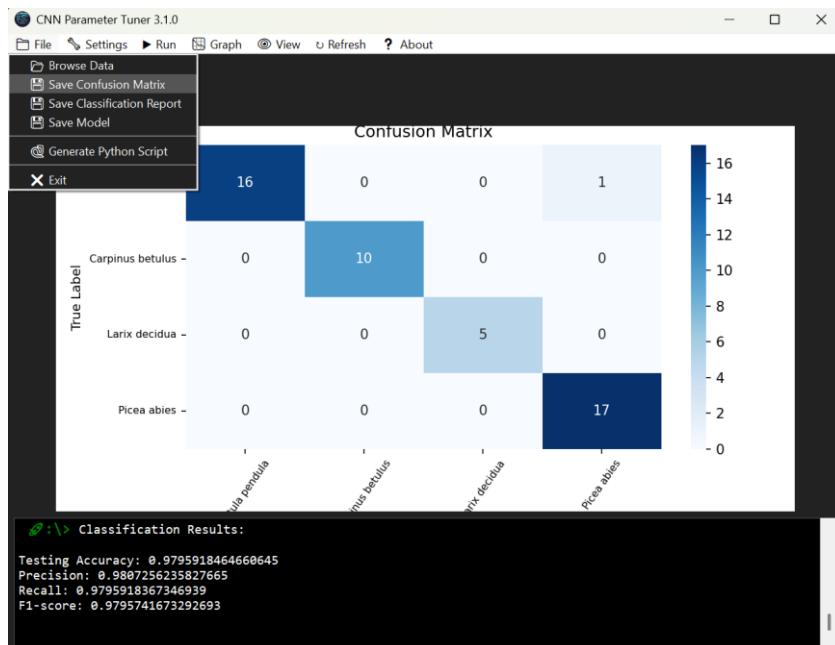
The confusion matrix will be presented in the main application window. Your attention to this crucial element is highly valued.

Additionally, the command prompt in the main application window will display essential information such as the selected data path, training-testing size, CNN model, accuracy matrices, epochs and their corresponding results and so on.



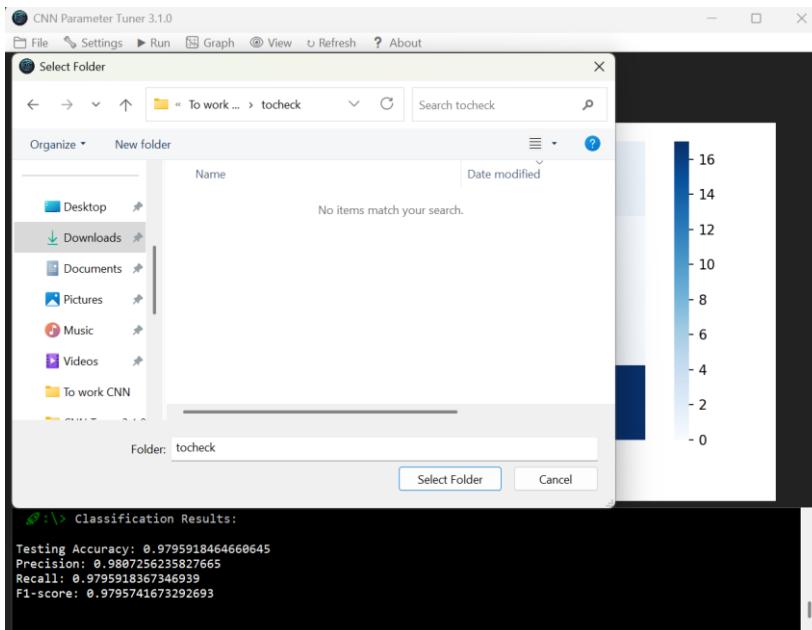
4.1. INITIATING THE CONFUSION MATRIX

To save the confusion matrix as a PNG image, kindly navigate to the “File” menu and select the “Save Confusion Matrix” sub-menu. The system will prompt you to choose a folder for saving; please select the desired folder for the storage of the confusion matrix image.



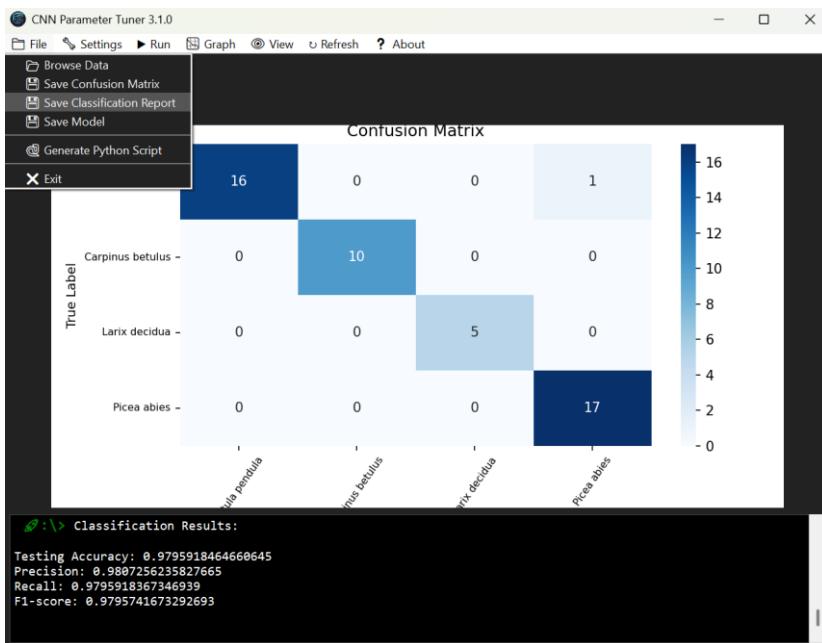
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Select the folder:



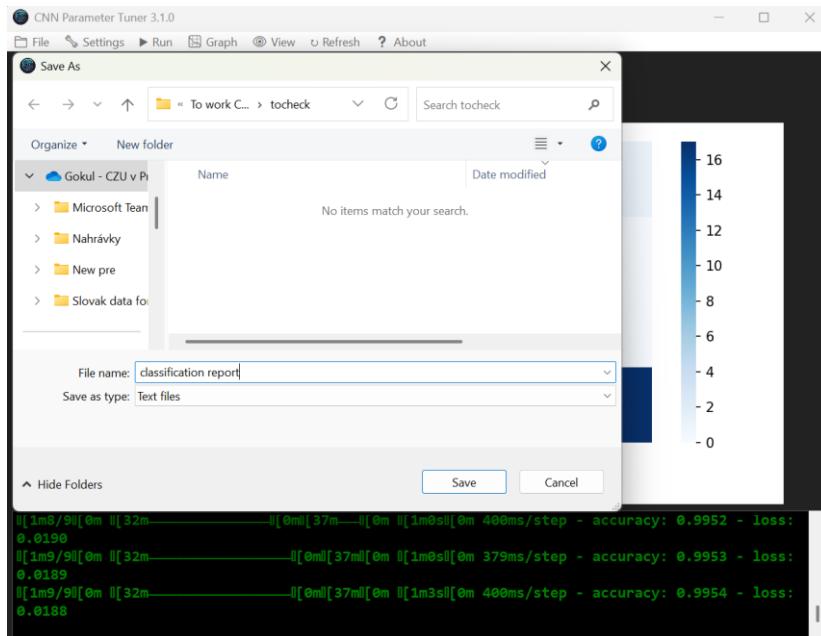
4.2. INITIATING THE CLASSIFICATION REPORT

To retain the detailed classification report as a TXT file for future reference, please navigate to the “File” menu and select the sub-menu “Save Classification Report.” You will be prompted to choose a location for saving, kindly select the desired folder, and provide a suitable file name.



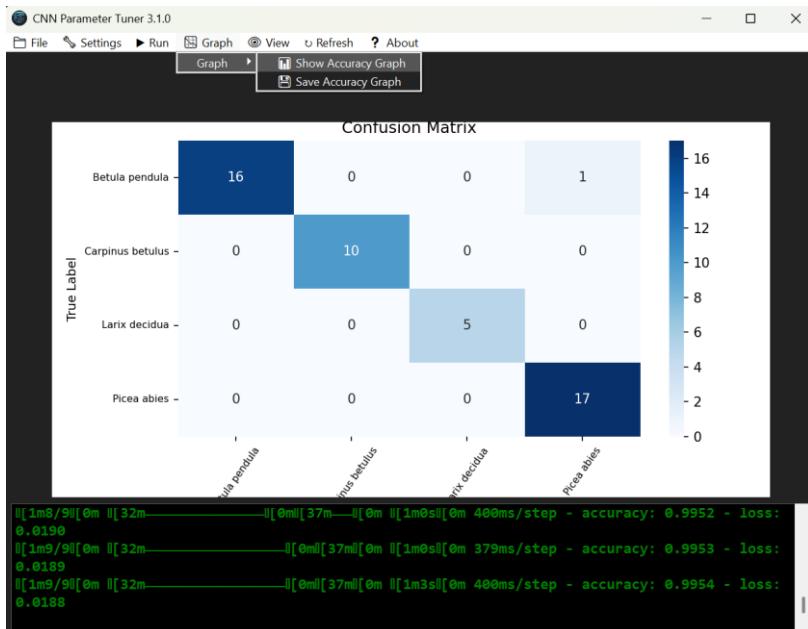
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Provide the file name for Classification report:

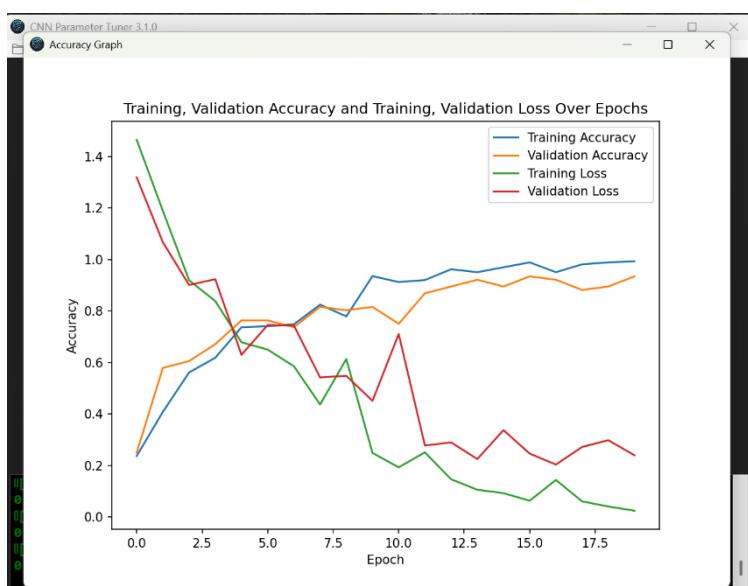


4.3. SAVING THE ACCURACY GRAPH

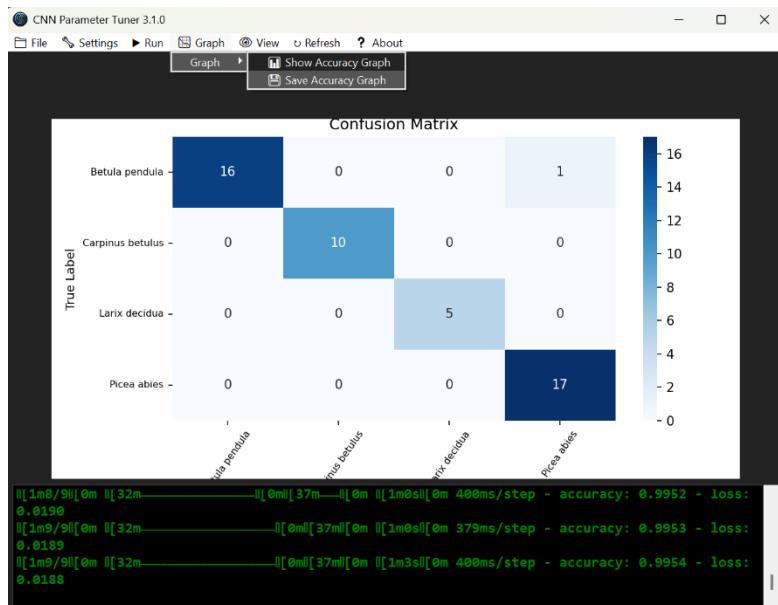
For a comprehensive overview of your model's accuracy, simply click on the “Graph” menu and then select “Show Accuracy Graph.” This will provide you with a visual representation of the accuracy trends, allowing you to assess the performance of your Convolutional Neural Network more effectively.



Displays the graph :

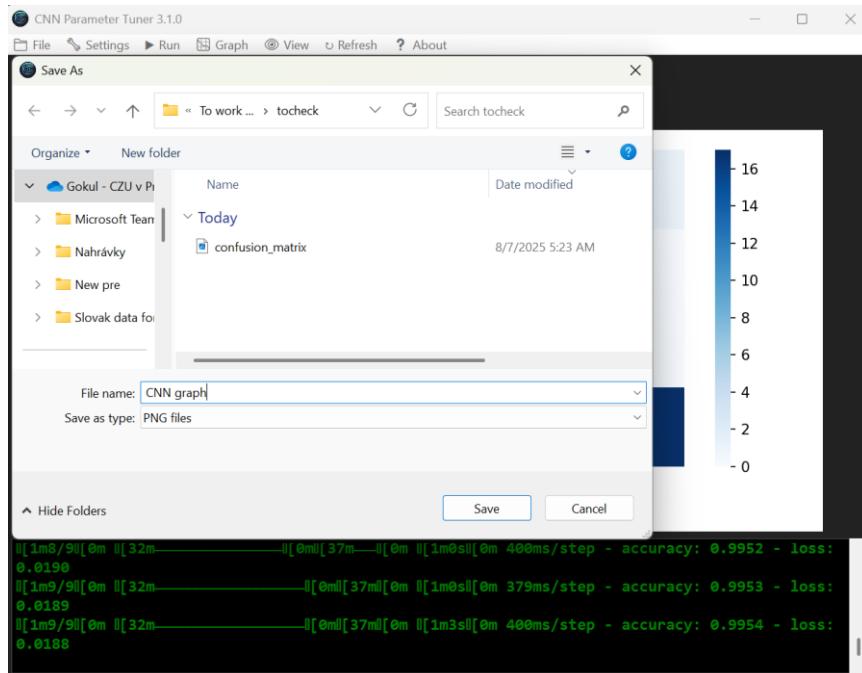


To save the graph as png file, click on “Save Accuracy Graph” :



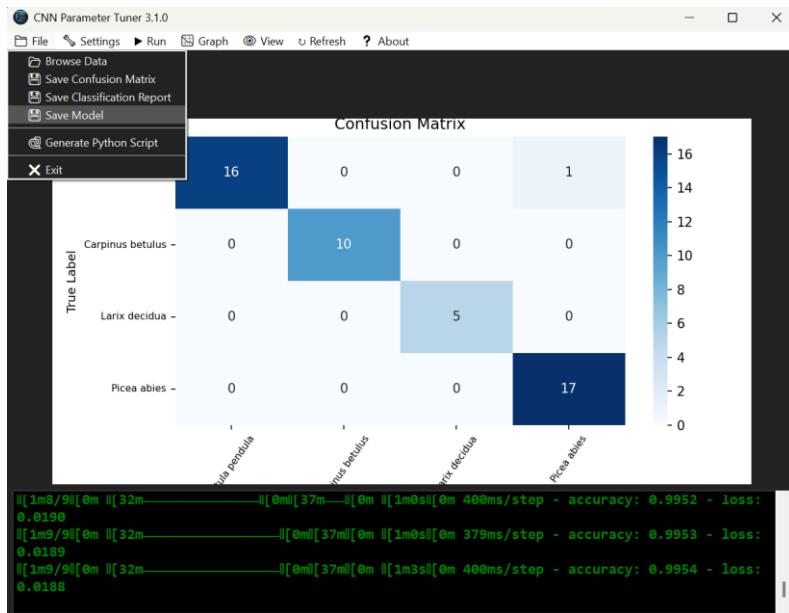
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Select the folder and provide file name:



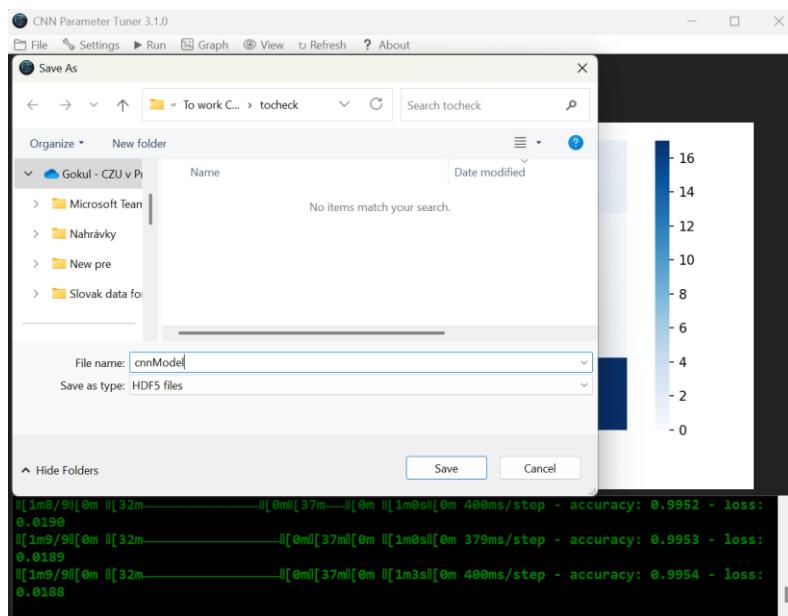
4.4. SAVING THE MODEL

For saving the model for future use, please navigate to the “File” menu and select the sub-menu “Save Model.” You will be prompted to choose a location for saving, kindly select the desired folder, and provide a suitable file name.



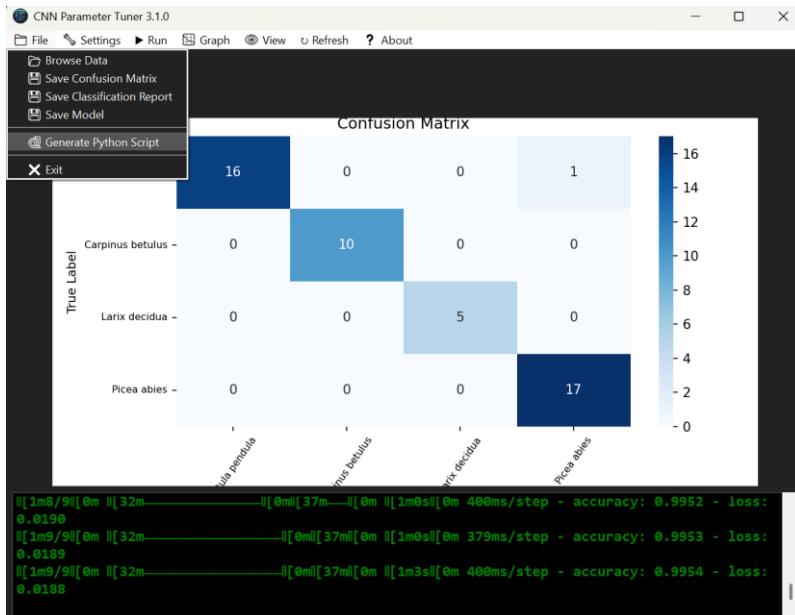
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Provide the file name for model:



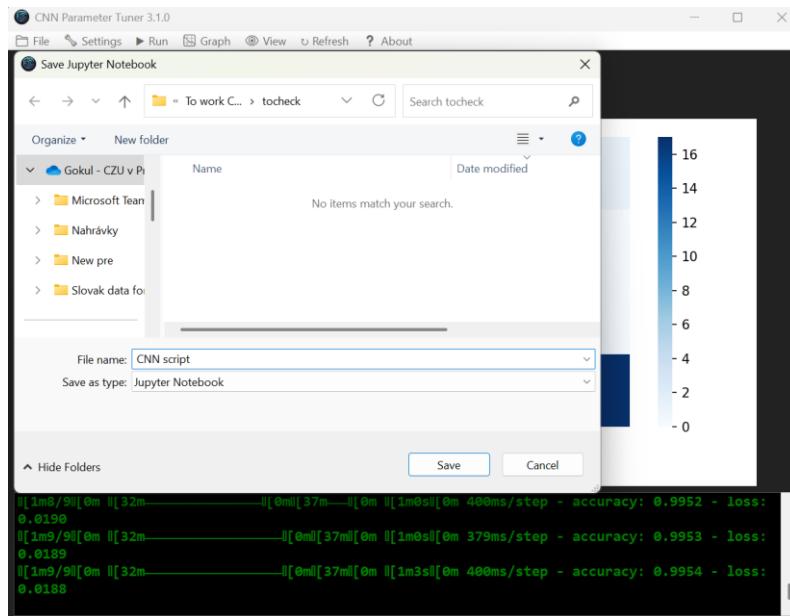
4.5. GENERATE PYTHON SCRIPT

To generate a python script (Jupyter Notebook) for future use, please navigate to the “File” menu and select the “Generate Python Script” option from the sub-menu. A prompt will appear asking you to choose a location for saving the file, kindly select the appropriate folder and provide a suitable name for the notebook in the designated field.



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Provide the file name for generated notebook:

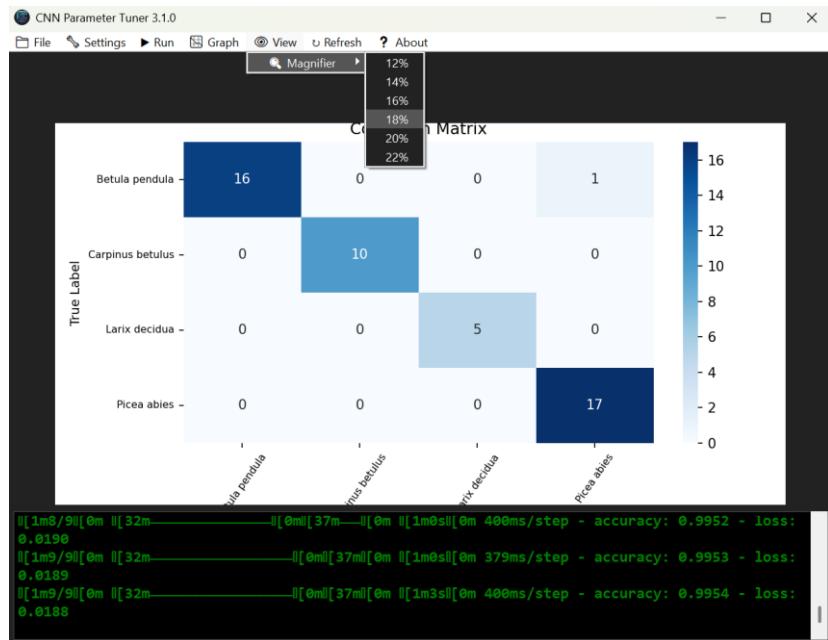


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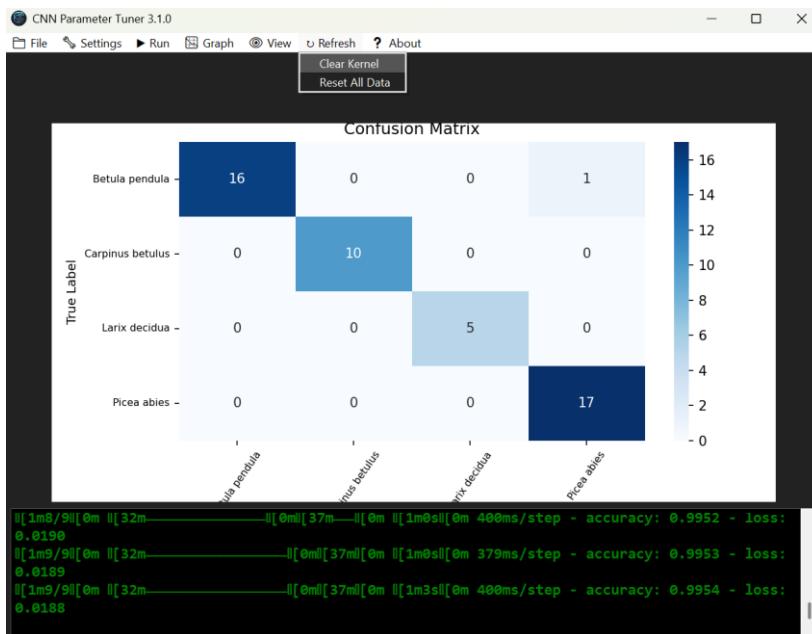
5

MAGNIFIER & REFRESH

To enlarge the application command prompt area for better visibility, kindly access the “View” menu and click on “Magnifier” sub-menu and select the desired font size.



The “Refresh” menu offers valuable options for managing loaded results. Clicking on the “Clear Kernel” sub-menu will effectively clear the kernel and refresh the command prompt area in the application. Alternatively, selecting the “Reset All Data” sub-menu will erase all information stored in the main arrays, including the confusion matrix and other relevant data.

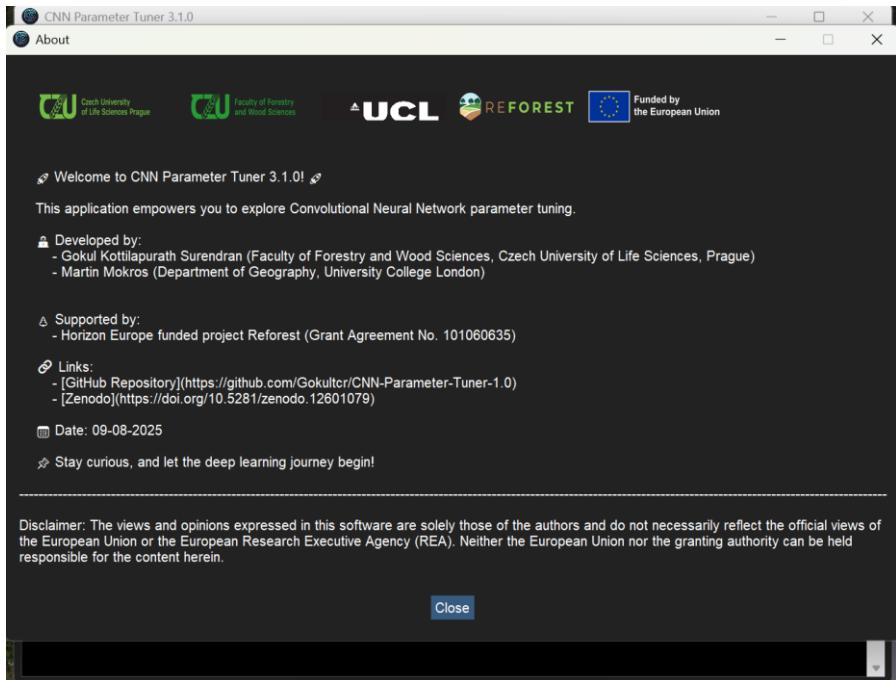


CHAPTER

6

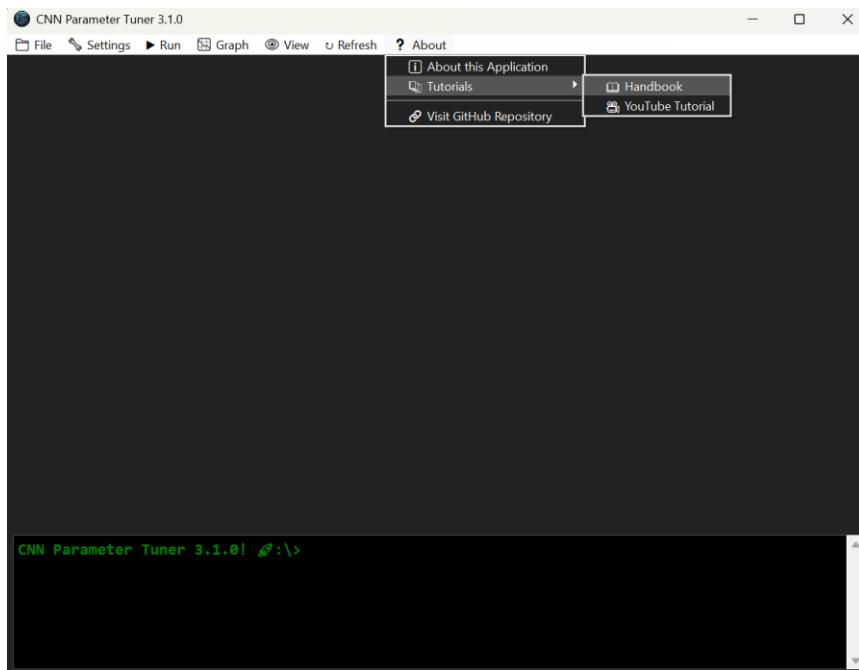
ABOUT & EXIT

The “About” menu serves as a valuable resource, providing information about the application.

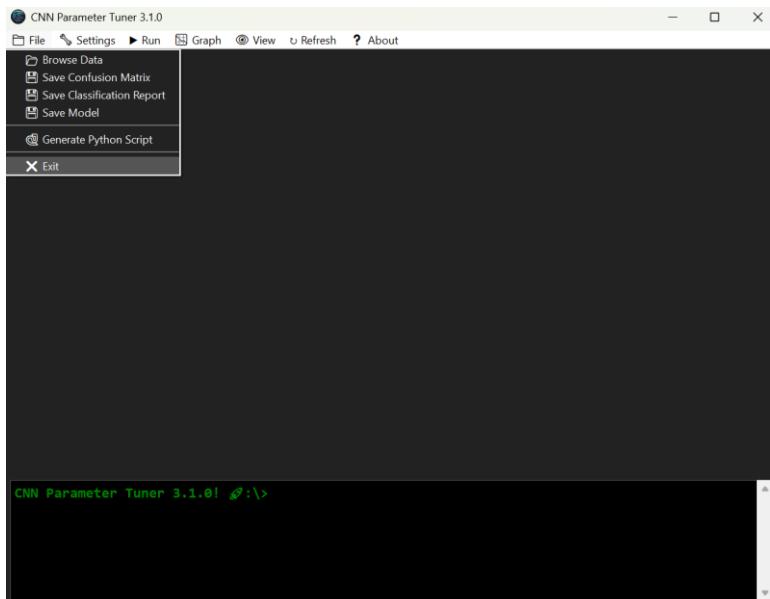


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The Tutorials section in the “About” menu provides links to access the handbook and YouTube tutorial on how to use this software.



To gracefully exit the application, kindly navigate to the “File” menu and select the option “Exit.” Alternatively, you can close the main application window.



Thank you 😊