

Summary

Many people have difficulties transitioning from physical to digital format, as current programs focus too much on a broad audience and offer multiple built-in tools. VectorizarT, the application developed and documented in this Final Degree Project, focuses on these users to provide them with a simple and effective tool to digitize their physical drawings.

To achieve this, OpenCV and VTracer have been used through Python for image processing and vectorization, respectively, and Qt Creator in C++, along with all its compilations tools, for designing and programming the graphical user interface. The entire process followed a combined methodological approach based on the V-Model and Kanban, and was documented using Visual Studio Code with LaTeX.

The result of the whole development process is a highly promising application, offering fast, clean, and efficient vectorizations that provide a more accessible and satisfying digitization experience compared to other, more complex tools. This application offers the community of novice digital artists a new way to enter the environment through their own hand-drawn work, without compromising the original quality.

Keywords: Vectorization, digitization, Qt Creator, Kanban, V-model, Windows application.

0.1. Installation Manual

The application **VectorizarT** works on all Windows devices and has no minimum prerequisites. The image generation and cleanup process may take longer than usual on low-spec devices or with large iamges, but its functionality is guaranteed.

To install the program, you will need any software on the computer that can extract “.zip” files. My personal recommendation is 7-Zip¹, a free and open-source program that can compress and extract in many formats (including .zip).

To download the application, go to the compiled project on Github². On the page, download the ZIP file using the green “<>Code” button.

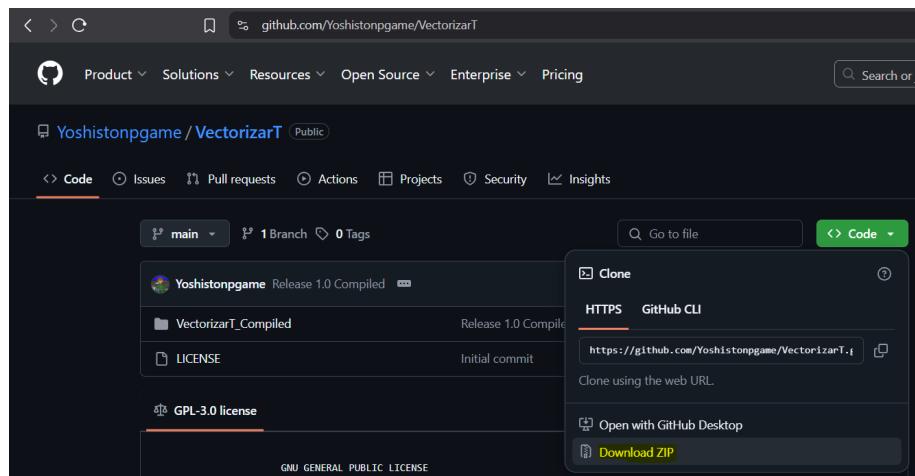


Figura 1: Download Github page.

Once the .zip file is downloaded and placed in the desired folder, **extract its contents** using the 7-zip extension (or any other program) by right-clicking on the file.

All files in that folder belong to the program and must be kept. Moving or deleting internal files may cause the program to malfunction (the whole folder can be moved anywhere as long as the application is not running).

At this point, the application is **downloaded and functional**. The compiled version is fully portable and does not require Qt, Python or any of their libraries to be installed.

Additionally, it is recommended to create a **shortcut to the executable** for easier access to the program without needing to enter the base folder.

¹www.7-zip.org

²[www.github.com/Yoshistonpgame/VectorizarT](https://github.com/Yoshistonpgame/VectorizarT)

SUMMARY

0.2. User Manual

Start the application by using the shortcut or by double-clicking the executable file “VectorizarT.exe”.

1. On the first screen, you’ll see the welcome step. We begin by clicking the button “Get Started” to start the process.

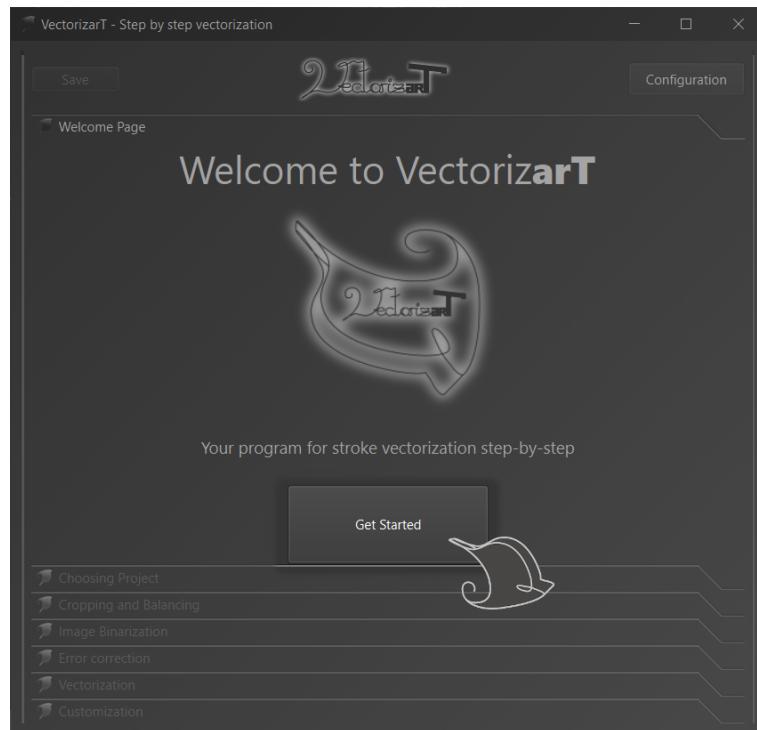


Figura 2: Welcome screen of the application.

2. In the first step, we are presented with the initial project setup. Here, we can choose the project name, its save location, and the image we want to process.

In this step, only the image selection is mandatory. The project name and its path are only necessary when saving the project.

When selecting the project directory, a window will open allowing the user to choose the desired folder. A similar window will open to select the image; only valid image files will be shown in this file system view.

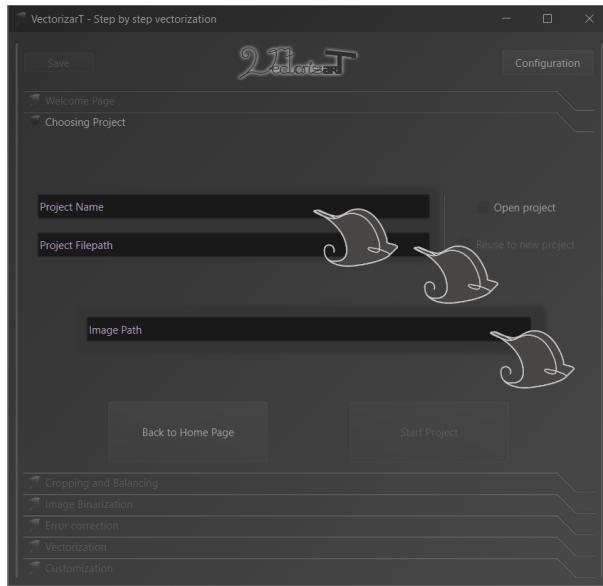


Figura 3: First step of the application.

Once a valid image is selected, the button is enabled to proceed to the next step.

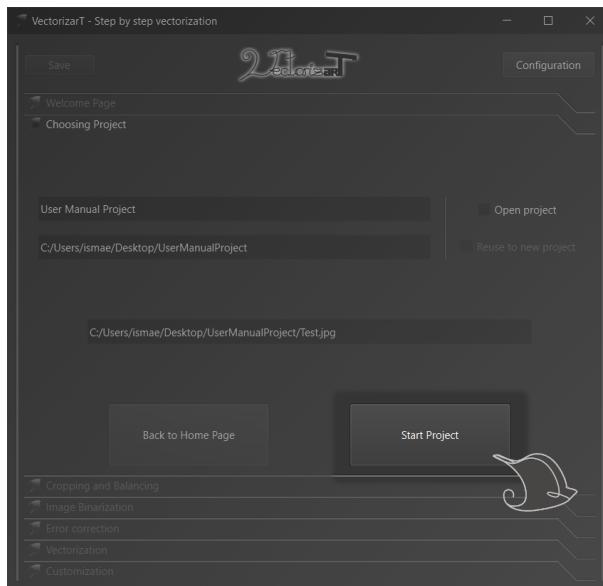


Figura 4: First step of the application. Transition to the next step.

In this initial step, we also have the option to “Open project”. This checkbox allows us to select a previously saved project via a helper window and continue from where we left off.

Loading a valid “.vectorizart” file will load the necessary data to continue to the next step (this process does not allow selecting a new image, project name, or path).

SUMMARY

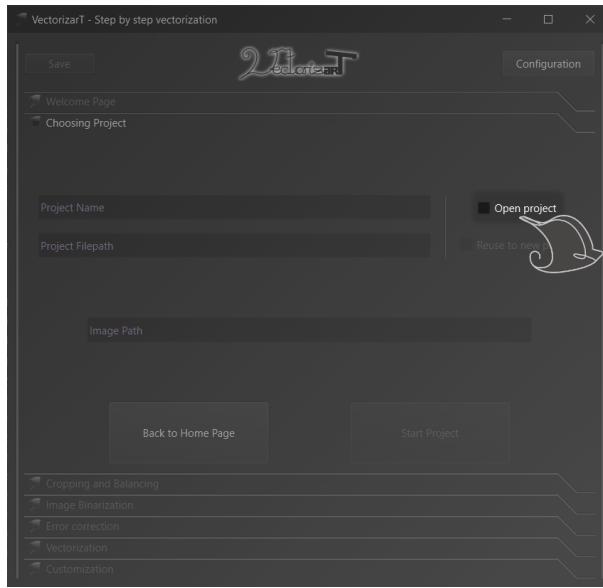


Figura 5: First step of the application. Using a saved project.

Likewise, we can now “Reuse project” after the checkbox became enabled, which will allow us to use the previously saved project values to generate a new process (this enables the option to change the configurations).

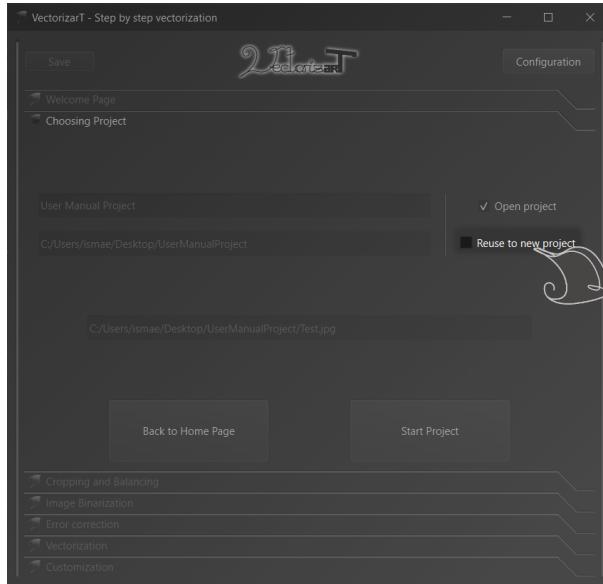


Figura 6: First step of the application. Reusing a project.

3. When moving to the second step, the save button becomes enabled. This button allows the user to save the project whenever it is active (if it's disabled, it means the file has already been saved and there are no new changes).

If a project name and path were selected in the first step, the button will simply save the file.

If no path was specified, a helper window will appear to let the user choose where to save the project file. The selected file name and save path will then be reused as the project name and directory, respectively.

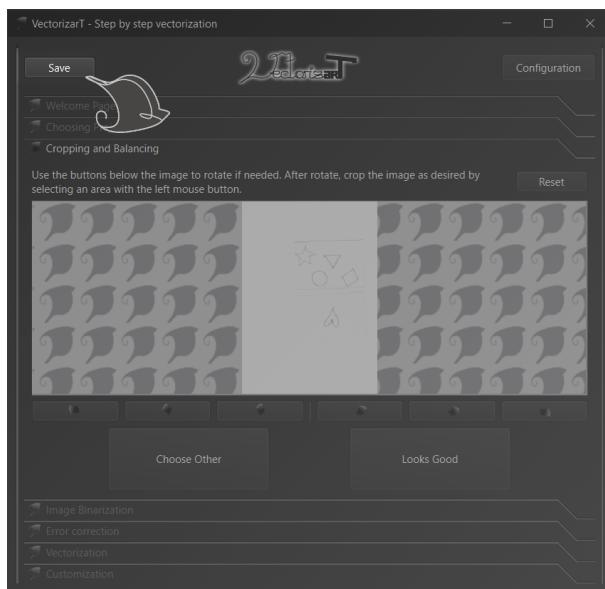


Figura 7: Saving the project.

4. In the second step, the selected image can be rotated using the six buttons located below the image view.

The user can rotate the image 25° , 5° and 1° to the left, and 1° , 5° and 25° to the right, using the corresponding buttons from left to right.

SUMMARY



Figura 8: Step two of the application. Rotate the image.

Inside the image viewer, the user can crop the image by selecting the exact area they want to vectorize. The crop will be applied after releasing the mouse click.

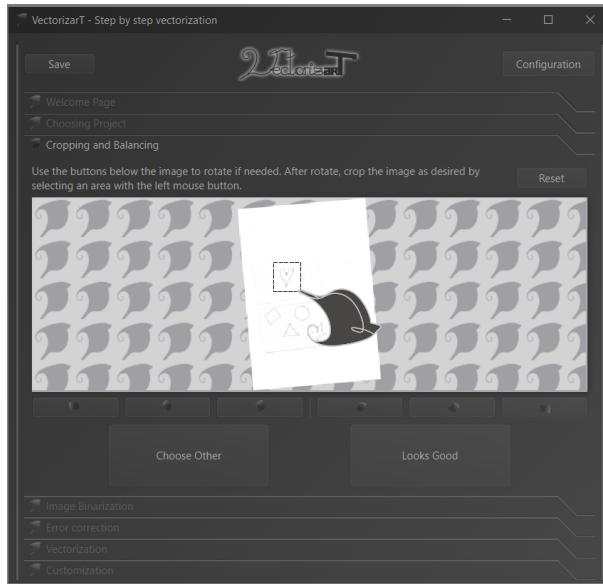


Figura 9: Step two of the application. Crop the image.

If you want to restore the image to its original state, simply use the “Reset” button to undo all changes made during the step.

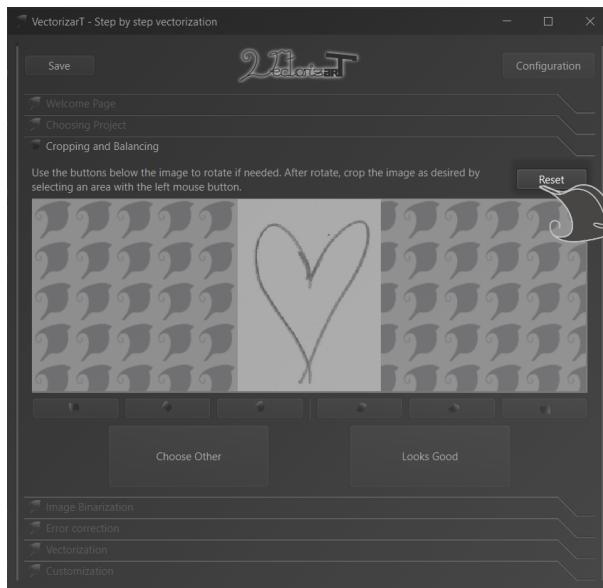


Figura 10: Changes made in the actual step of the application can be reset.

Once the user is satisfied with the image, they can proceed to the next step by clicking the “Looks good” button.

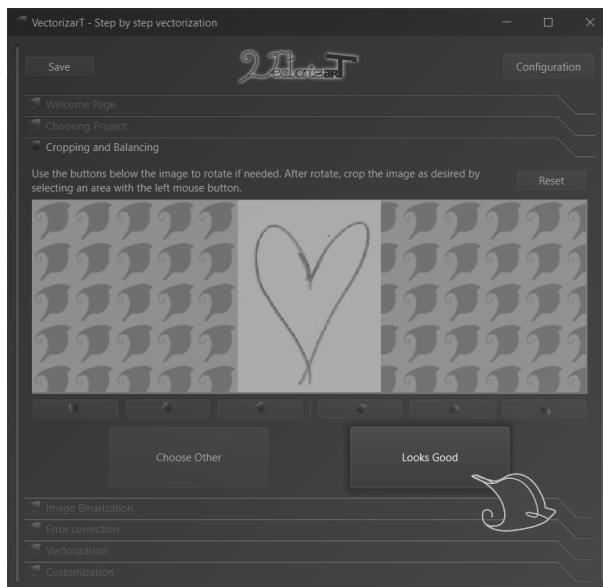


Figura 11: Step two of the application. Step transition.

5. In the third step, you will find the colour correction process.

Left-clicking on the image viewer adds the selected colour to the list of colours to be converted to “black”. Right-clicking adds the selected colour to the list of colours to be converted to “white”.

SUMMARY

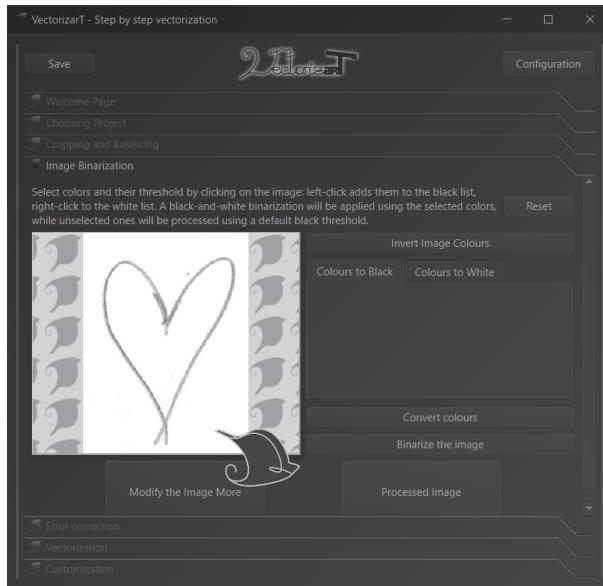


Figura 12: Step three of the application. Add colour to the corresponding list.

Each time you click on a colour, a button is added to the corresponding list that allows you to modify the colour using an auxiliary window, a number selector to adjust the threshold value (to include adjacent colours similar to the selected one), and a button that allows you to remove the colour from the list.

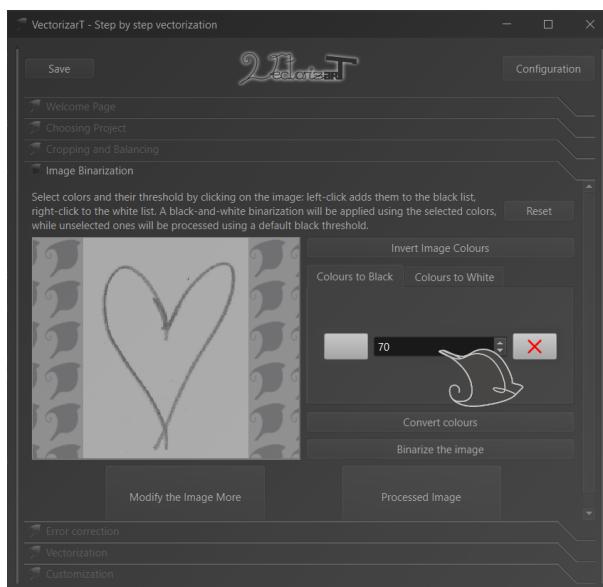


Figura 13: Step three of the application. Edit or delete selected colour.

Once the desired colours are selected, you can perform the conversion by clicking the “Convert colours” button.



Figura 14: Step three of the application. Colour conversion.

Alternatively, you can apply a default threshold-based binarization by clicking “Binarize the image”, which transforms colours close to white into white and everything else into black.

It is recommended to first use colour conversion and then apply binarization to ensure all colours are properly processed.



Figura 15: Step three of the application. Automatic binarization.

Additionally, a colour inversion feature is provided. This is useful for selecting cer-

SUMMARY

tain colours or being able to vectorize drawing made with white chalk on a black background.



Figura 16: Step three of the application. Colour inversion.

When the image is ready, click the “Processed image” button to continue to the next step.



Figura 17: Step three of the application. Step transition.

6. The fourth step corresponds to error correction.

The user can adjust the sizes for removing or filling in errors using the numeric input fields.

By clicking “Surface correction”, the program will perform erosion and opening corrections.

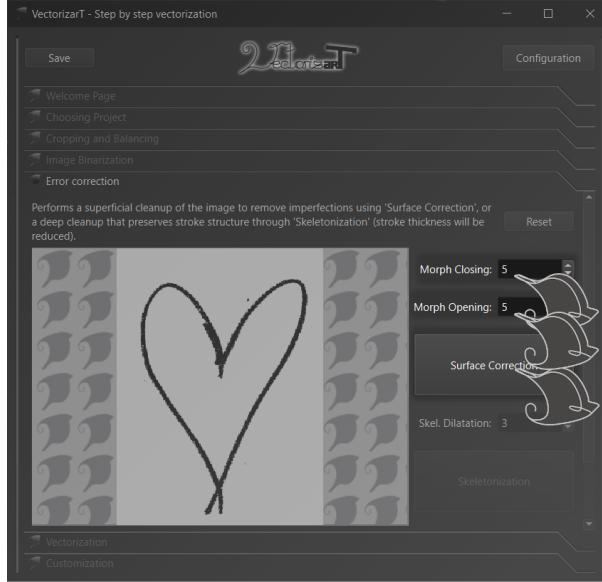


Figura 18: Fourth step of the application. Surface correction.

After the surface correction, the user can apply skeletonization and dilation, which are useful if the goal is to preserve the direction of the strokes rather than their thickness. The amount of dilation can be customized with the corresponding selector.



Figura 19: Fourth step of the application. Skeletonization and dilation.

SUMMARY

When the correction results are satisfactory, clicking the “Correction done” button will move the image to the next step.

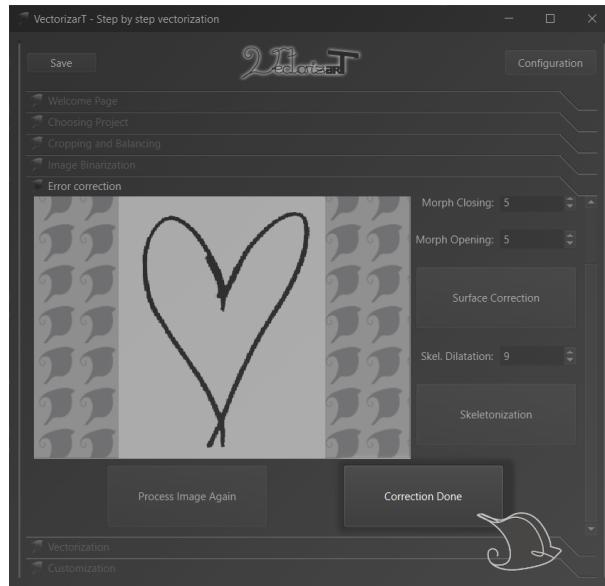


Figura 20: Fourth step of the application. Step transition.

7. The fifth step performs the vectorization. By clicking the “Vectorize” button, a dialog window will open where the user can specify the name and path of the resulting vector file.

Once the vectorization process is completed, the application will automatically move to the next step (the vectorized image will be saved in the specified location).

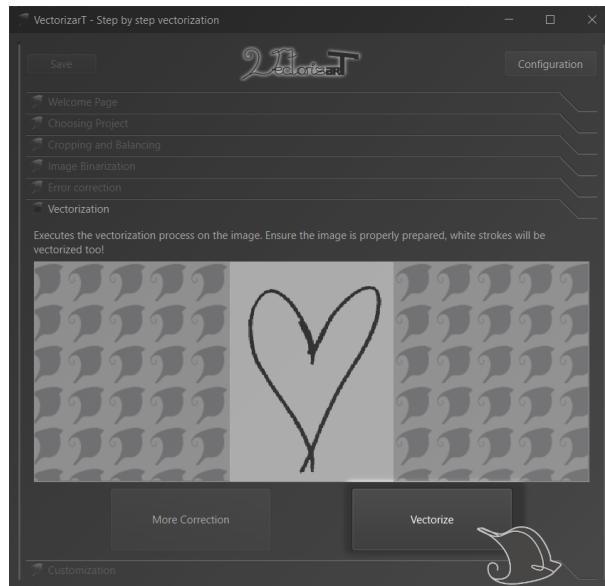


Figura 21: Fifth step of the application. Vectorization.

8. The final step allows the user to customize the vectorized file by enabling the deletion of individual paths.

Using the list of image paths, the user can choose which path to delete by clicking the delete button.

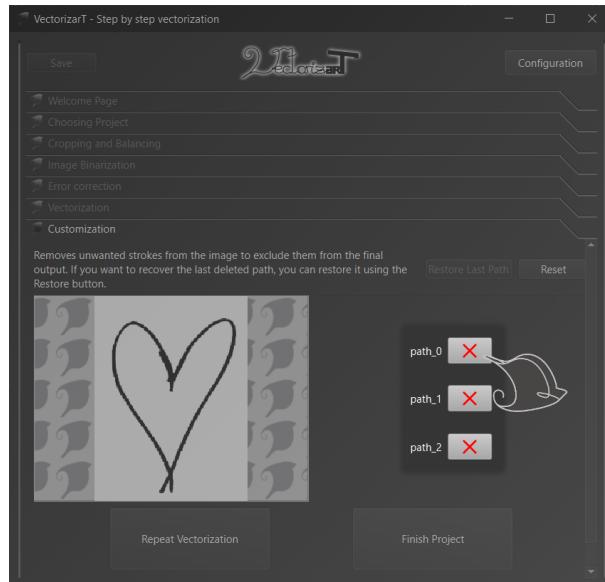


Figura 22: Sixth step of the application. Deleting paths.

If a recently deleted path needs to be restored, the previous modification can be undone by clicking the “Restore last path” button.

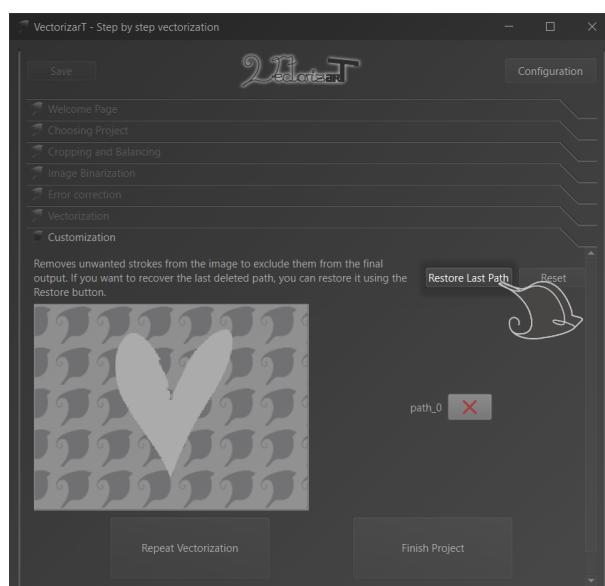


Figura 23: Sixth step of the application. Restoring a path.

SUMMARY

To finalize the project, clicking on the “Finish project” button opens a dialog window that allows the user to save the customized vectorized image.

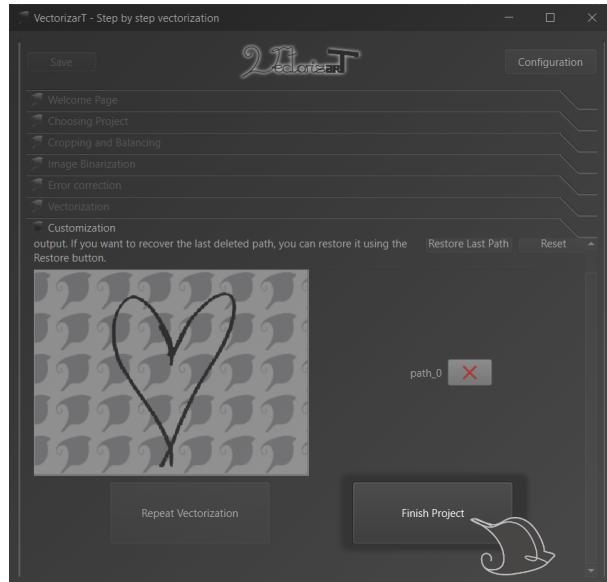


Figura 24: Sixth step of the application. Finish project.

In addition to the core project steps, the application includes customizable settings accessible at any time via the “Configuration” button.

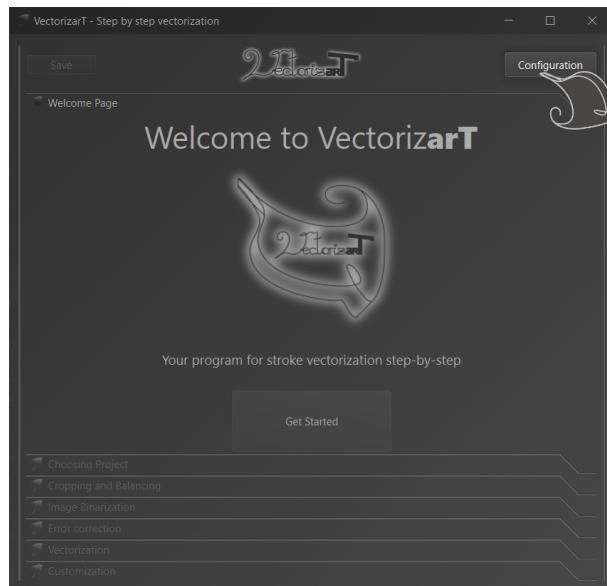


Figura 25: Application configuration.

This new window contains settings for cursor, theme, log history, and settings.

1. The first tab corresponds to cursor settings, where users can choose a special cursor for the application.

These cursors come in various colors, and users can also select the default system cursor.

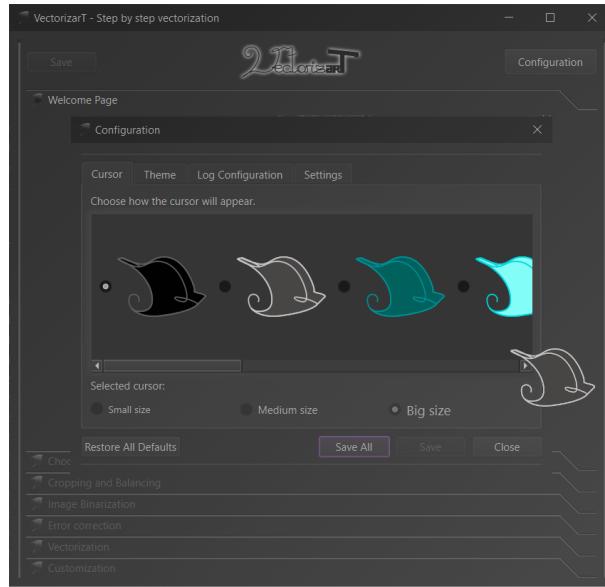


Figura 26: Application configuration. Cursor.

Users can also select the cursor size.

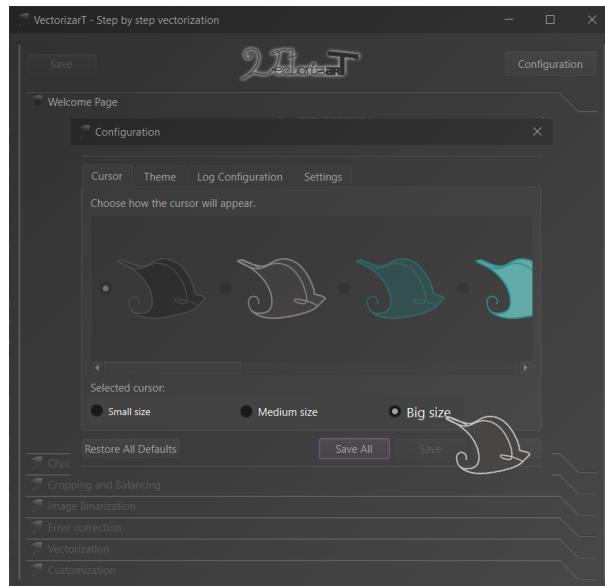


Figura 27: Application configuration. Cursor size.

SUMMARY

2. In the theme tab, users can choose between two available themes: dark theme or light theme.

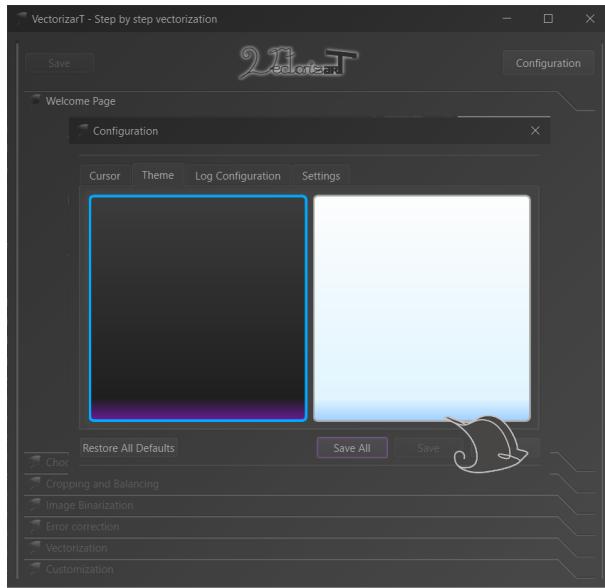


Figura 28: Application configuration. Colour theme.

3. In the third tab, you can find the log configuration settings.

The first option refers to whether the use of the log is enabled or not.

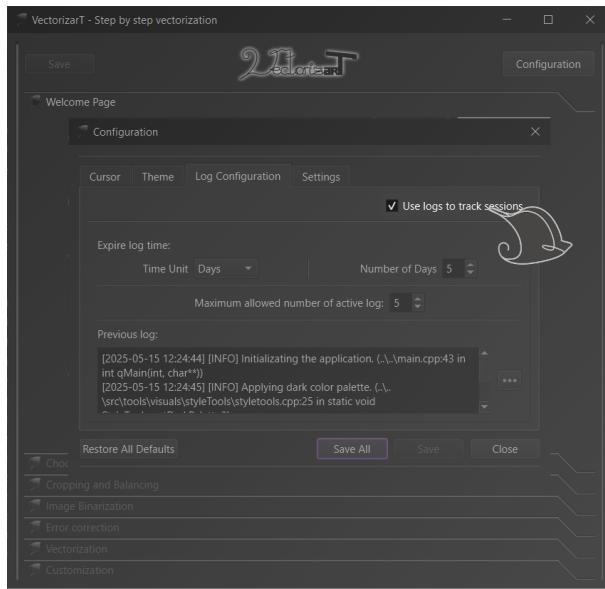


Figura 29: Application configuration. Log use.

The next configuration refer to the expiration time for log entries and the maximum number of logs allowed.

The expiration time can be configured using different time units.

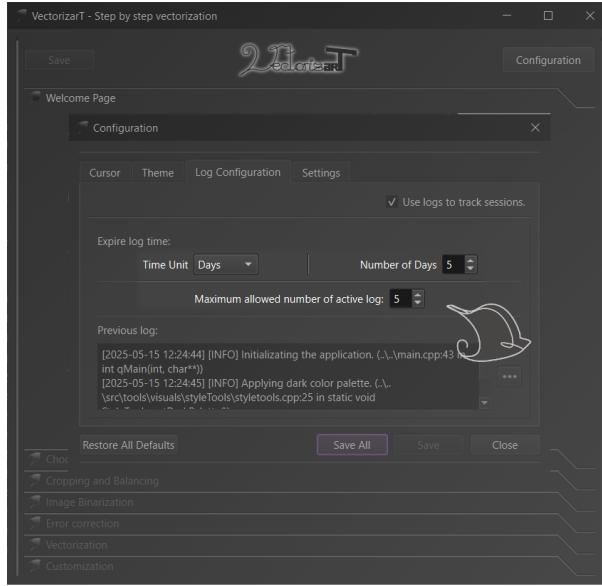


Figura 30: Application configuration. Log expiration.

Additionally, the previous generated log is shown, along with a button that allows the user to change the folder where the logs will be stored.

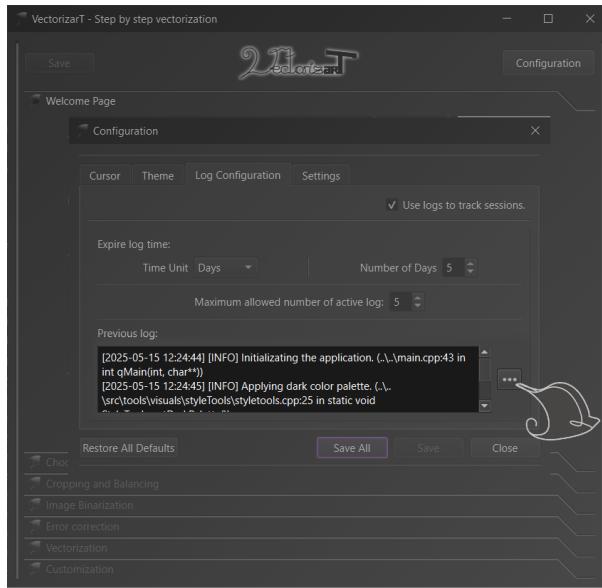


Figura 31: Application configuration. Log path.

4. Finally, the settings tab. In this tab, users can export and import settings from other users (or from another device).

SUMMARY

In both cases, an auxiliary window will open allowing users to choose where to save the file or which file to import, respectively.

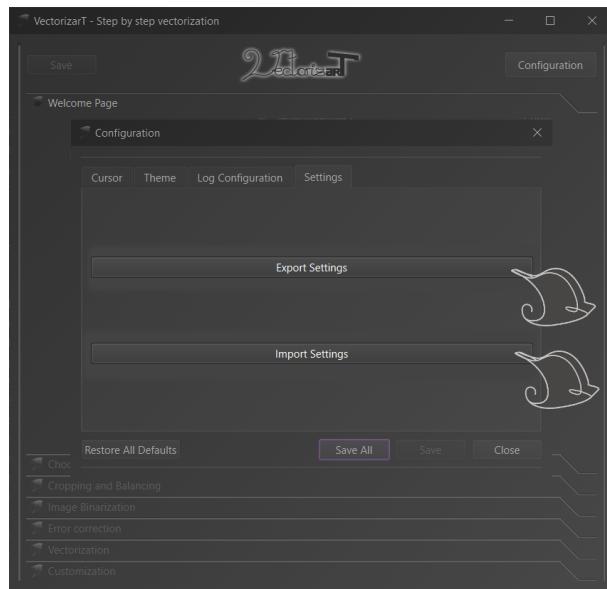


Figura 32: Application configuration. Settings.

To make changes, use the buttons located at the bottom of the window.

The “Restore all defaults” button will close the window and reset all data to their default values.

The “Save all” button will sequentially save all configuration tabs and close the window.

The “Save” button will save the current tab. It will only be active when there is a change to save.

The “Cancel” button will close the window, cancelling all unsaved changes.

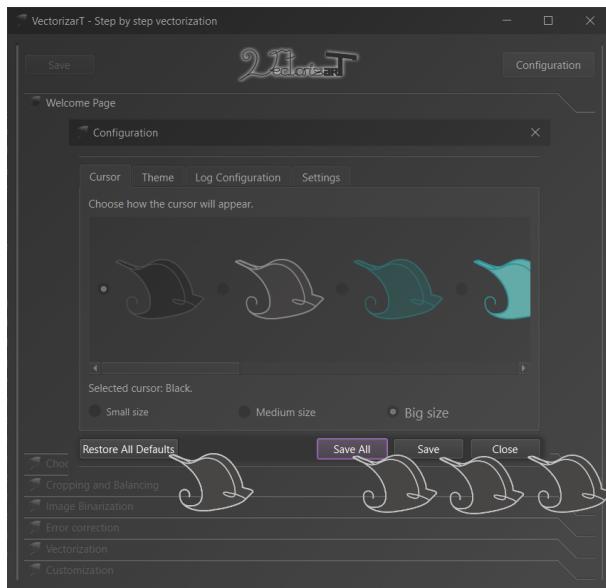


Figura 33: Application configuration. Window buttons.