

- **Command Line Help:**

Run the below command to view the help/usage message displayed by the solution:

```
python pixel_ops.py -h
```

or

```
python pixel_ops.py --help
```

Help Message:

Below Help message should be displayed in the console:

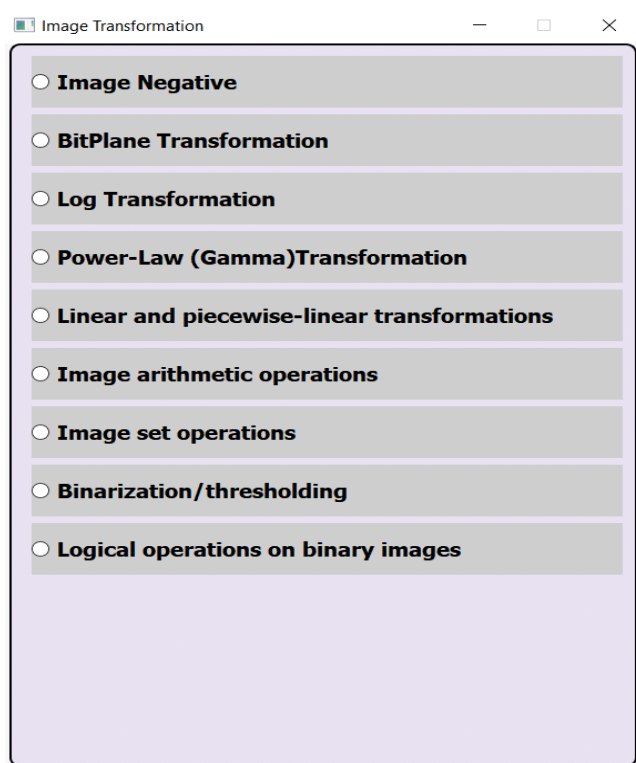
Please read the user instructions document "ReadMe.pdf" for more details

- **Startup and HomePage:**

Run the below command to view the homepage of the application as shown in the below screenshot:

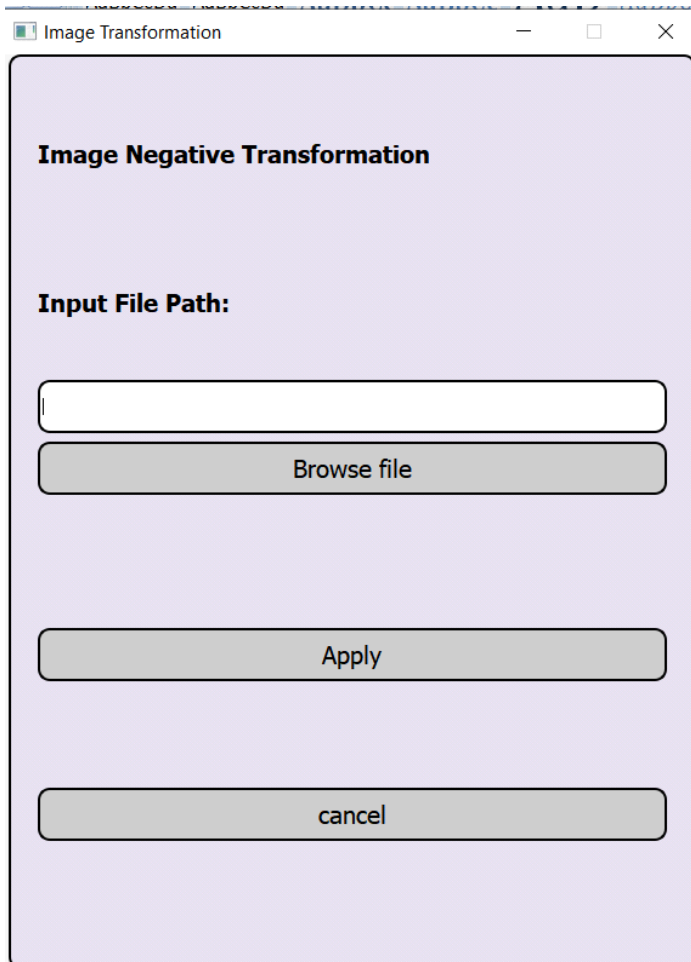
Command:

```
python pixel_ops.py
```



- **Image Negative Transformation:**

1. Click on "Image Negative" radio button in the homepage. "Image Negative Transformation" Page should be displayed as shown in the below screenshot.
2. Click on Browse file button in the "Image Negative Transformation" Page.
3. Using the dialog box, Browse to an Image file and click Open button
4. Click on Apply button.
5. The Original Image and the Transformed Image using Image Negative transformation should be displayed properly.

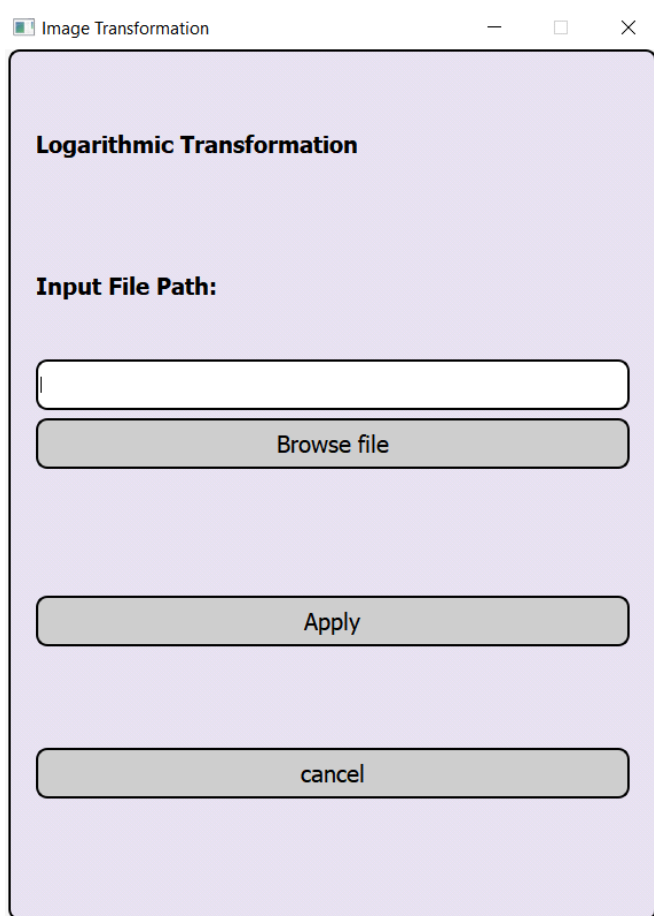


The screenshot shows a window titled "Image Transformation" with standard Windows window controls (minimize, maximize, close). The main content area has a light purple background and contains the following elements:

- Image Negative Transformation**: A section header in bold black text.
- Input File Path:**: A label in bold black text above a text input field.
- Browse file**: A grey button with rounded corners, located below the input field.
- Apply**: A grey button with rounded corners, located below the "Browse file" button.
- cancel**: A grey button with rounded corners, located at the bottom of the form.

- **Logarithmic Transformation:**

1. Click on "Log Transformation " radio button in the homepage. " Logarithmic Transformation" Page should be displayed as shown in the below screenshot.
2. Click on Browse file button in the " Logarithmic Transformation" Page.
3. Using the dialog box, Browse to an Image file and click Open button
4. Click on Apply button.
5. The Original Image and the Transformed Image using Logarithmic Transformation transformation should be displayed properly.



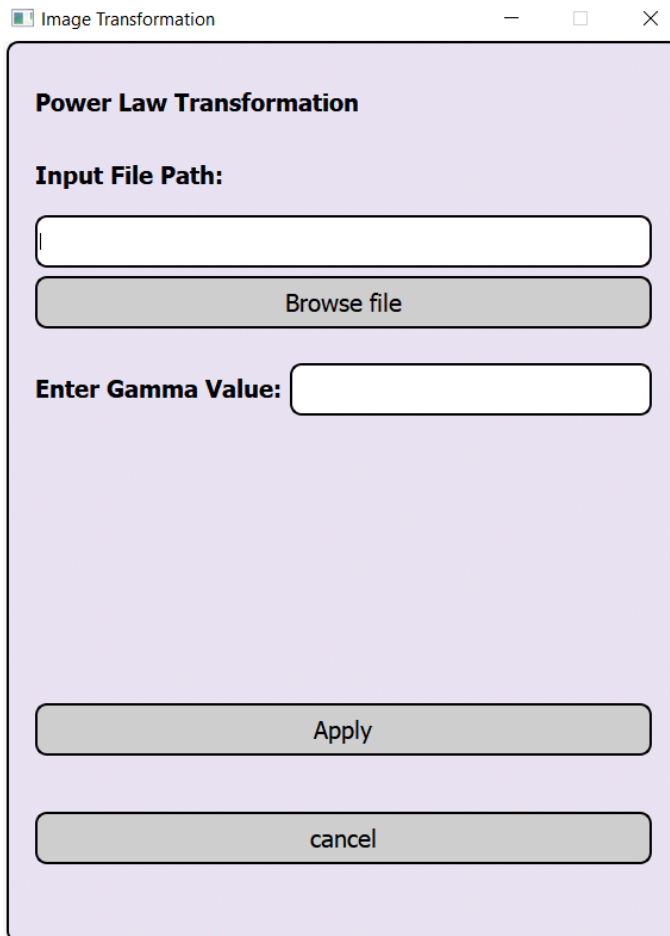
The screenshot shows a window titled "Image Transformation" with a standard Windows-style title bar (minimize, maximize, close buttons). The main content area has a light purple background and is titled "Logarithmic Transformation". Below the title, there is a label "Input File Path:" followed by a text input field. Underneath the input field is a "Browse file" button. Further down, there are two more buttons: "Apply" and "cancel".

- **Power-Law (Gamma) Transformation:**

- Click on " Power-Law (Gamma) Transformation " radio button in the homepage.

"Power-Law (Gamma) Transformation" Page should be displayed as shown in the below screenshot.

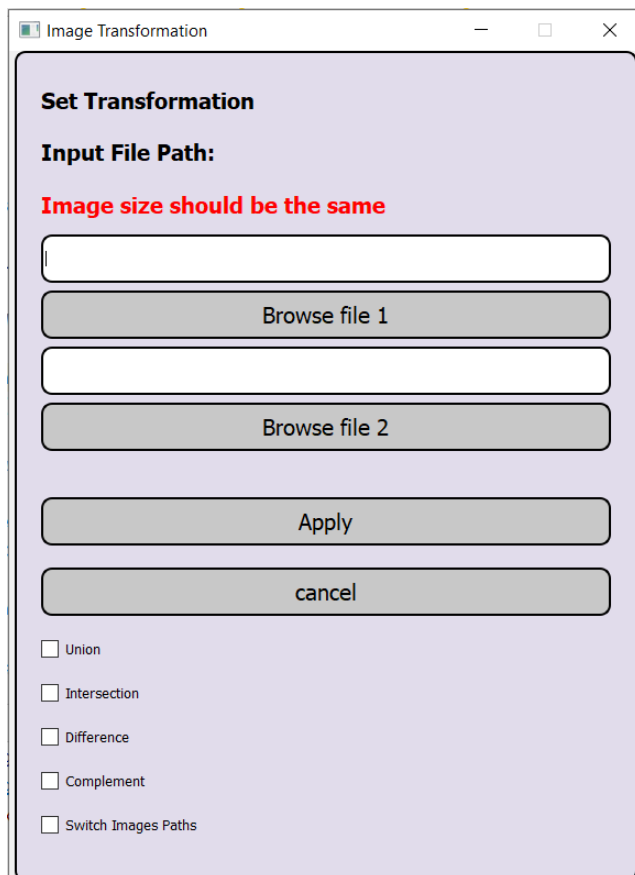
2. Click on Browse file button in the " Power-Law (Gamma) Transformation" Page.
3. Using the dialog box, Browse to an Image file and click Open button
4. Enter the required gamma value (float/decimal value). Click on Apply button.
5. The Original Image and the Transformed Image using Power-Law (Gamma) Transformation transformation should be displayed properly.



The screenshot shows a window titled "Image Transformation" with a standard macOS-style title bar (minimize, maximize, close buttons). Inside the window is a light purple panel titled "Power Law Transformation". Below the title, there is a label "Input File Path:" followed by a text input field. Below the input field is a "Browse file" button. Further down is a label "Enter Gamma Value:" followed by another text input field. At the bottom of the panel are two buttons: "Apply" and "cancel".

- **Image Set Transformation:**

1. Click on "Image Set operations" radio button in the homepage. "Set Transformation" Page should be displayed as shown in the below screenshot.
2. Click on Browse file 1 and Browse file 2 button in the "Set Transformation" Page (Images chosen should be of the same size).
3. Using the dialog box, Browse file 1 and file 2 to an Image file and click Open button
4. Click on Apply button.
5. The Original Image and the Transformed Image using different set operations (Union, Intersection, Difference, Complement) transformation should be displayed properly.
6. Using Switch Images Path check box, input path images should be switched.



The screenshot shows a window titled "Image Transformation" with a light purple background. The main heading is "Set Transformation". Below it, the text "Input File Path:" is followed by a red warning message: "Image size should be the same". There are two input fields for file paths, each with a corresponding "Browse file 1" and "Browse file 2" button. Below these are "Apply" and "cancel" buttons. At the bottom, there are five checkboxes: "Union", "Intersection", "Difference", "Complement", and "Switch Images Paths".

Set Transformation

Input File Path:

Image size should be the same

Browse file 1

Browse file 2

Apply

cancel

☐ Union

☐ Intersection

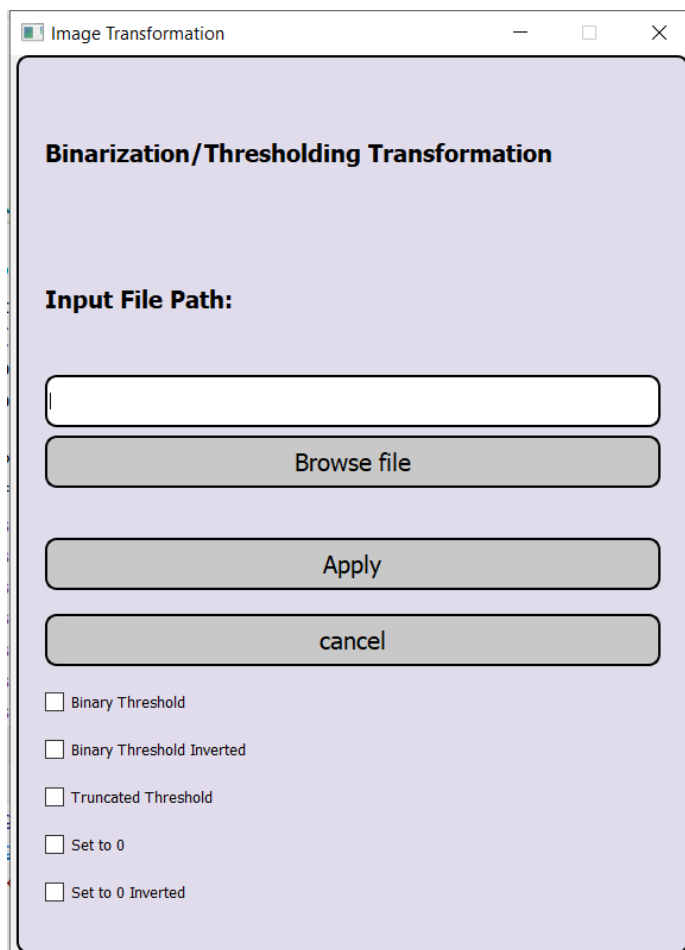
☐ Difference

☐ Complement

☐ Switch Images Paths

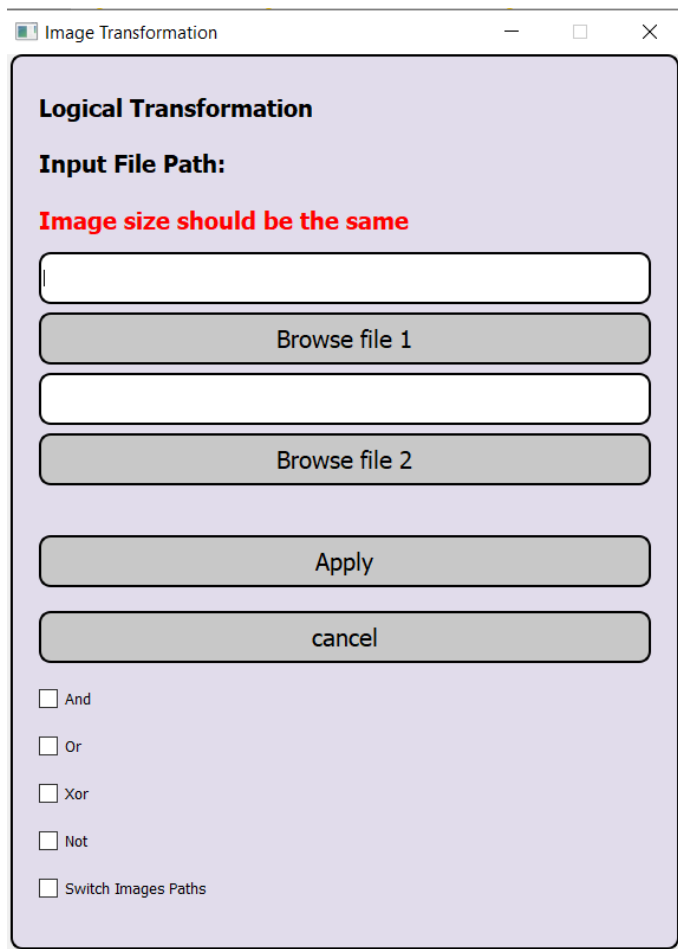
- **Binarization/thresholding Transformation:**

1. Click on "Binarization/Thresholding Transformation " radio button in the homepage. " Binarization/Thresholding Transformation" Page should be displayed as shown in the below screenshot.
2. Click on Browse file button in the " Binarization/Thresholding Transformation" Page.
3. Using the dialog box, Browse to an Image file and click Open button
4. Click on Apply button.
5. Selecting the check box for different thresholds, the Transformed Image for the selected thresholds should be displayed properly.



- **Logical Transformation:**

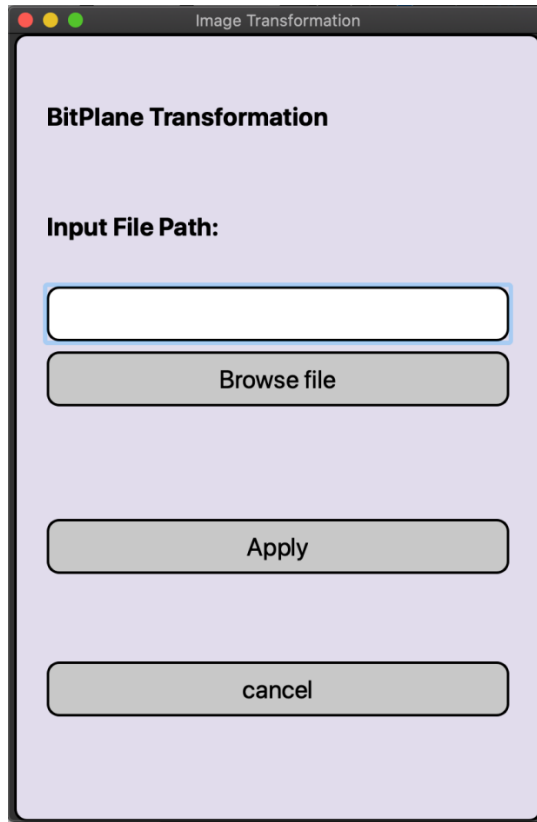
1. Click on "Logical operations" radio button in the homepage. "Logical Transformation" Page should be displayed as shown in the below screenshot.
2. Click on Browse file 1 and Browse file 2 button in the "Logical Transformation" Page (Images chosen should be of the same size).
3. Using the dialog box, Browse file 1 and file 2 to an Image file and click Open button
4. Click on Apply button.
5. The Original Image and the Transformed Image using different logical operations (And, Or, Xor, Not) transformation should be displayed properly.
6. Using Switch Images Path check box, input file path images should be switched.



The screenshot shows a window titled "Image Transformation" with a light purple background. The main heading is "Logical Transformation". Below it is the label "Input File Path:". A red text warning "Image size should be the same" is displayed. There are two empty text input fields for file paths. Below the first input field is a "Browse file 1" button, and below the second is a "Browse file 2" button. Further down are "Apply" and "cancel" buttons. At the bottom, there are five checkboxes: "And", "Or", "Xor", "Not", and "Switch Images Paths".

- **Bit-Plane Transformation:**

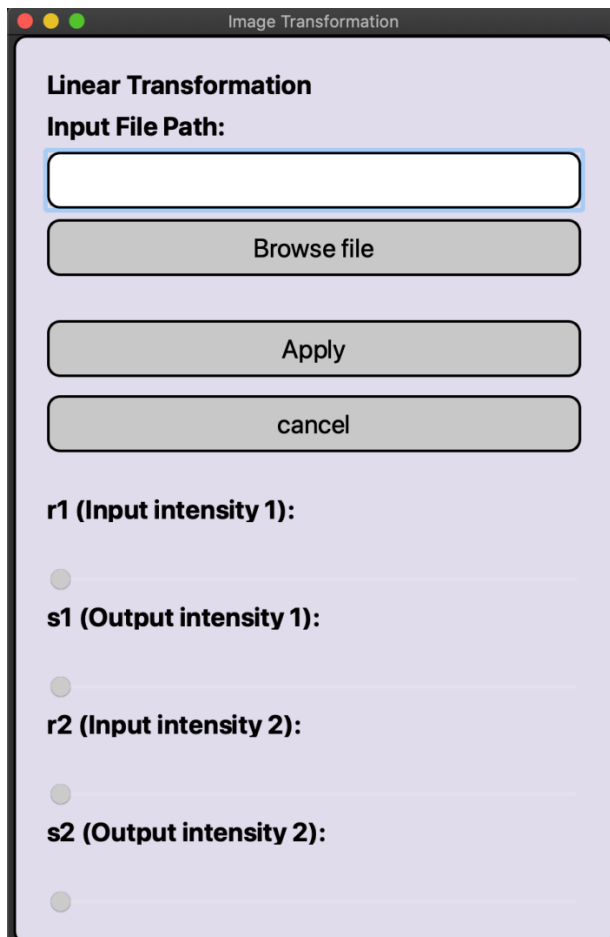
1. Click on “Bit-Plane Transformation” radio button in the homepage. “Bit-Plane Transformation” Page should be displayed as shown in the below screenshot.
2. Click on Browse file button in the “Bit-Plane Transformation” page.
3. Using the dialog box, Browse to an Image file and click Open button, Then click the Apply button.
4. The Original Image and the Transformed image using Bit-Plane Transformation will be displayed with each bit labeled.



The screenshot shows a window titled "Image Transformation" with a light purple background. Inside the window, the title "BitPlane Transformation" is displayed at the top. Below the title, the label "Input File Path:" is followed by a white text input field. Underneath the input field is a grey button labeled "Browse file". Further down is another grey button labeled "Apply", and at the bottom is a grey button labeled "cancel".

- Linear and piecewise-linear transformation:

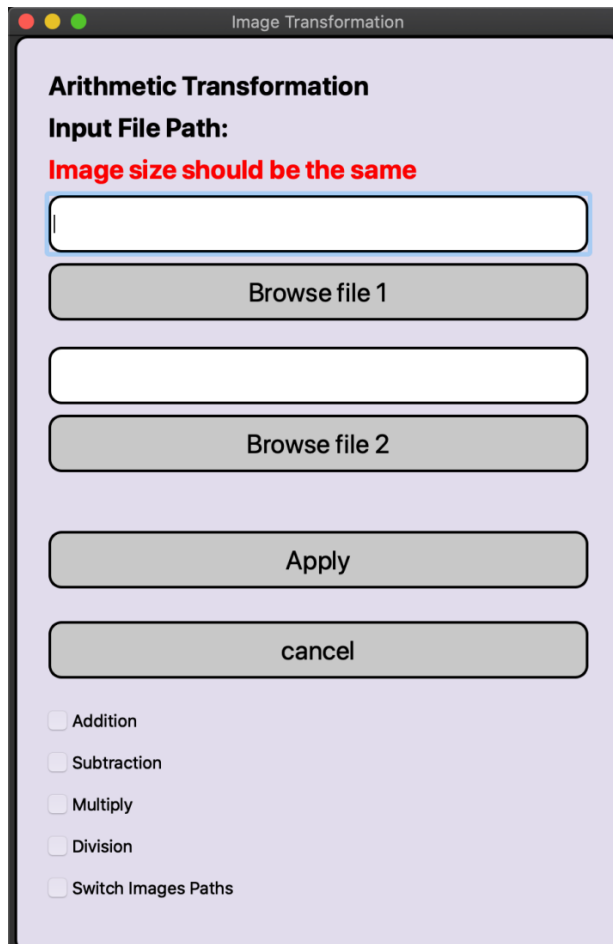
1. Click on “Linear and piecewise-linear transformation” radio button in the homepage. “Linear and piecewise-linear transformation” Page should be displayed as shown in the below screenshot.
2. Click on Browse file button in the “Linear and piecewise-linear transformation” page.
3. Using the dialog box, Browse to an Image file and click Open button.
4. Then select the Values you want for Input intensity 1, output intensity 1, Input intensity 2, output intensity 2, then click apply. (if you want to change the values again on the same image you need to click apply after changing the input values).
5. The Original Image and the Transformed image using Linear and piecewise-linear transformation will be displayed in grayscale.



The screenshot shows a window titled "Image Transformation" with a light purple background. The main heading is "Linear Transformation". Below it is the label "Input File Path:" followed by a text input field. Under the input field is a "Browse file" button. Below that is an "Apply" button, and at the bottom of this section is a "cancel" button. Further down, there are four sets of sliders for intensity mapping. The first set is labeled "r1 (Input intensity 1):" and "s1 (Output intensity 1):". The second set is labeled "r2 (Input intensity 2):" and "s2 (Output intensity 2):". Each set consists of a horizontal slider bar with a small circular handle.

- **Image arithmetic operation:**

1. Click on “Image arithmetic operation” radio button in the homepage. “Image arithmetic operation” Page should be displayed as shown in the below screenshot.
2. Click on Browse file 1 button in the “Image arithmetic operation” page for the path to the first image.
3. Using the dialog box, Browse to an Image file and click Open button.
4. Click on Browse file 2 button in the “Image arithmetic operation” page for the path to the second image.
5. Using the dialog box, Browse to an Image file and click Open button.
6. Then select the operation you want to perform on the pictures which are Addition, Subtraction, Multiply, Division, and to switch the paths of the input files.
7. You can select multiple operation you want to perform and a window will open for each operation and Click Apply to run the operation.
8. The Original Image and each operation will display in its own window.



The screenshot shows a window titled "Image Transformation" with a light purple background. The main section is titled "Arithmetic Transformation" and contains the following elements:

- Input File Path:** A label followed by a red warning text "Image size should be the same".
- File Path Inputs:** Two empty text input fields for file paths.
- Browse Buttons:** Two buttons labeled "Browse file 1" and "Browse file 2" corresponding to the input fields.
- Action Buttons:** Two buttons labeled "Apply" and "cancel" at the bottom of the main section.
- Operation Selection:** A list of five operations with checkboxes: "Addition", "Subtraction", "Multiply", "Division", and "Switch Images Paths".