

## 1. Objectives:

- Resolve issues with the "Last Action:" label and draw rectangle function.
- Implement the new concept for the Threshold CLAHE function with improved blending and transitions.
- Transform the Threshold CLAHE function to GPU and CPU methods.
- Redesign UI components related to parameters, file names, and processing times.
- Address the issue where normal CLAHE fails to apply after threshold CLAHE has been executed.
- Begin working on the task to remove vertical lines from non-object regions.

## 2. Activities:

- **Resolved UI Issues:**
  - Corrected the "Last Action:" label to update correctly with the current action's parameters after a revert function call.
  - Fixed the rectangle drawing function to clear previous selections using `m_imageLabel->clearSelection()` before applying new effects.
- **Threshold CLAHE Function Development:**
  - **Status 1:** Applied the new concept, resulting in clear effects and a well-defined CLAHE mask. However, the under-threshold region was notably noisy.
  - **Status 2:** Implemented a spatial preservation method to maintain pixel spatial relationships, enhancing blending with a binary method to track dark pixels. CLAHE was effectively applied only to the masked region, and processed pixels were blended back into the original image.
  - **Status 3:** Added a sharpening step post-CLAHE and established a gradual transition zone of about 10% for smoother blending between processed and unprocessed areas.
  - **Status 4:** Incorporated local contrast enhancement using floating-point precision for improved masking.
  - **Status 5:** Noticed some contrast in under-threshold areas and increased the transition zone to 20% with cubic interpolation for better blending.
  - **Status 6:** Applied Gaussian blur to the mask with a CLAHE clip limit set at 75% lower than the user input, addressing very dark regions to reduce CLAHE effects.

- **Status 7:** Increased the transition zone to 35% for enhanced smoothness, implementing quintic interpolation for even smoother transitions.
- **Status 8:** Executed multi-pass Gaussian blurring on the mask, followed by a gentle final Gaussian blur.
- **Status 9:** Reduced the CLAHE clip limit to 60% of the input, diminished sharpening kernel strength, and refined contrast normalization (20%).
- **Status 10:** Integrated gradual intensity-based adaptation and smoother interpolation for dark regions.
- Final output achieved acceptable clarity and effectiveness.
- **Function Transformations:**
  - Successfully transformed the Threshold CLAHE function to operate in both GPU and CPU modes.
- **UI Redesign:**
  - Divided the “Last Action:” label into two distinct labels: “Parameters” and “Last Action.”
  - Ensured the added file name is displayed under the “File Name:” label, which replaces “Parameters” during load or save operations.
  - The labels “Parameters,” “File Name,” and “CLAHE Processing Time” will now display only when related functions are triggered.
- **Issue Investigation:**
  - Identified an issue where applying normal CLAHE after threshold CLAHE resulted in no effect. Noted that the reverse order allows normal CLAHE to apply successfully.
- **Task Assignment:**
  - Received a raw text file with instructions to implement a function for removing vertical lines in non-object regions.

### **3. Achievements:**

- Successfully resolved the label update and rectangle drawing issues, improving UI responsiveness and accuracy.
- Developed the Threshold CLAHE function with significant improvements in blending, transitions, and overall output quality.
- Completed the transformation of the Threshold function to both GPU and CPU methods.

- Enhanced the UI by redesigning the labels for better clarity and functionality.
- Identified issues related to the order of CLAHE applications, laying groundwork for further investigation.

#### 4. Problems & Solutions:

- **Problem 1:** The "Last Action:" label did not update correctly after reverting actions.
  - **Solution:** Updated the label management to reflect the most recent parameters after any action is reverted.
- **Problem 2:** After applying effects, the rectangle drawing function did not reset selections.
  - **Solution:** Implemented `m_imageLabel->clearSelection()` to clear selections before applying new effects.
- **Problem 3:** No effect observed from the threshold CLAHE when normal CLAHE was applied first.
  - **Solution:** Further investigation needed to determine interaction effects between the two methods.
- **Problem 4:** Noisy output in the under-threshold region after applying the new Threshold CLAHE.
  - **Solution:** Continued refinement of the blending and transition processes to improve output quality.