

In my project, I set out to explore real-time image processing and face detection, focusing on thresholding across multiple color channels (RGB, YCbCr, and CMYK). My first step involved capturing video from a webcam or using snapshots, then splitting each frame into its individual channels—Red, Green, and Blue. By applying threshold values to each channel, I could isolate specific features, such as brightly colored objects in the red channel or green backgrounds in the green channel. Extending this approach to YCbCr and CMYK opened up new possibilities for skin detection and background separation, offering more precise control over the final image output.

One of the major issues I encountered was dealing with variable lighting conditions. In brightly lit environments, the thresholded areas sometimes washed out; in dim or uneven lighting, the results became noisy. I addressed this by implementing dynamic sliders, allowing me to quickly adjust threshold values and observe the impact in real time. Additionally, I experimented with local histogram equalization to normalize brightness variations, which substantially improved the consistency of my thresholded images.

A central component of my work was integrating a face detection algorithm based on the Viola-Jones framework. Once a face was detected, I experimented with overlaying fun masks—specifically a Joker mask and a Batman cowl. Getting the masks to align properly with each detected face proved challenging, especially since different people have varied facial dimensions and positions in the frame. I solved this by calculating bounding boxes from the detection results, then scaling and positioning the masks based on those coordinates. Although still imperfect, iterative adjustments significantly improved the overlay alignment.

Overall, I met most of my initial goals, demonstrating successful real-time thresholding, color-space conversions, and face detection within my intended timeline. If I had more time, I would refine the face detection pipeline further—perhaps by incorporating more sophisticated landmark detection for improved mask alignment—and explore adaptive thresholding methods that automatically adjust to sudden lighting changes.

My extension involved creating an interactive “face filter” feature that switches between Joker and Batman masks in real time based on keyboard input. I chose Batman and the Joker specifically because of my deep appreciation for the DC Universe. Their longstanding rivalry provides a compelling narrative framework, with Batman serving as my favored hero and the Joker as my most admired villain. This playful addition, though lighthearted, highlights how color-based thresholding, face detection, and user interaction can be combined to create engaging, real-time visual effects. I believe this unique twist not only showcases my technical skills but also underlines the broader creative potential of real-time image processing.

