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ELEC\_ENG 332: Intro to Computer Vision

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Final Project Report

**I. Personal Views and Interests**

As I write this statement, I find myself at the end of my life’s chapter here at Northwestern University, where for the past 4.25 years I have been pursuing joint BS and MS degrees in Mechanical Engineering. As I reflect upon my time here, I am deeply grateful for the amazing education that have I received, as well as for the many professional opportunities that Northwestern has provided. In particular, I am most thankful to the school for helping me develop and nurture my passion in robotics.

I took this course because I am deeply interested in how robot systems perceive the world and react to it. Computer vision is at the heart of robotic perception and is a rapidly evolving field that has kept its pace for many decades. Through this course, I have gotten a taste of fundamental computer vision topics such as connected-component labeling, histogram equalization, image segmentation, edge detection, Hough transform, face detection, motion tracking, camera calibration, image stitching, feature extraction, and image tagging. My favorite topics have been face detection and feature extraction. As a roboticist, I am deeply interested in additional topics such as 3D object recognition and structure from motion. If I stayed another quarter at Northwestern, I would take both ELEC\_ENG 432 and ELEC\_ENG 433.

**II. Project Description**

The project my partner and I chose is the “Smart Eraser”. The goal of the project is to implement a program that erases several handwritten characters on a book page automatically and gradually in a given video, while keeping the background texture unchanged perceptively.

The handwritten characters spell “Can you erase me?” perpendicularly to the book page and act as the foreground. The background is the book page but is not detailed enough for the human eye to read the content of the book.

Where does the “smart eraser” come to play? Well, in the video someone holds a pen whose tip moves along the handwritten words. The pen tip moves once from right to left in the duration of the video.

To visualize it better, below are some of the frames of the input video and of an example output that was given in the class assignment description.

A picture containing diagram

Description automatically generated

Figure 1: Input Image Frames, (a) 100th frame, (b) 200th frame, (c) 300th frame, (d) 400th frame.

A picture containing text, case, accessory

Description automatically generated

Figure 2: Output Image Frames, (a) 100th frame, (b) 200th frame, (c) 300th frame, (d) 400th frame.

For example, Figure 1 (a) shows the 100th frame of the video, where the pen tip’s location is on top of the handwritten word “me”. In the corresponding output frame (Figure 2 (a)), the program uses the location of the pen’s tip as an indicator and erases the handwritten words between this location and the right end of the sentence. The class assignment description suggests the use of visual tracking techniques for identifying the location of the pen tip and texture impainting techniques for erasing the handwritten sentence, both previously covered in class.

**III. Our Design**

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