EEL 4930 - System-on-Chip Design

Spring 202

Project 4

The homework must be solved individually. Undergraduate students are allowed to work in teams of 2 (max). Submission is done individually with the name of your teammate (if you have any) on your report.

Total: 40 points

(Deadline: 03.30.2025, 11.59pm)

Objective:

In this work, you are required to install SystemC in your system. You will be using OpenCV libraries along with SystemC library functions to implement some image processing applications.

Instructions:

Your goal in this homework is to apply the interface and channel concepts of SystemC to design an image processing system. OpenCV must be integrated into SystemC for this homework. Pictures will be read using OpenCV, processing in SystemC, and display with OpenCV.

In this work, you will be tasked to install OpenCV in your system. You will be using OpenCV library functions to implement some image processing applications.

We recommend using a 64-bit Linux system (It will be easier to link SystemC libraries with OpenCV libraries for future tasks). However, Visual Studio also works.

This site gives you a quick introduction into OpenCV

Task 1: OpenCV Installation (5 pts)

Follow the links below to download and install OpenCV Libraries on your system.

Installation instructions for Linux

Installation instructions for Windows

Implement a simple hello world program. The program should read a simple image (either from your webcam or the file enclosed and display the result. There are many tutorials (like this one) online you can use.

Task 1: Edge Detection (10 pts)

In this task, you will be writing a C++ code that will take an image file (.jpg) as input and perform edge detection. For edge detection, you will be using the OpenCV built-in libraries. (You can choose any edge detection algorithm as you please).

Submission file:

<edge_StudentLastName.cpp> : The source code of the implementation.

<outImage_StudentLastName.jpg> : The generated output image. Use the attached image of coins as input image.

Task 2: OpenCV + SystemC-Acceleration (25 pts)

You are required to develop a line detection application. It will consist of two processors and a memory unit. The first processor (playing the role of the initiator) will provide the image that will be processed. The memory will serve as a temporary buffer. The second processor (playing the role of the target) will read the content of the memory and use OpenCV functions to implement the line detection. Communication should be handled at the transaction level. The image resulting from the line detection will be stored as a file. The images below show an input image and an example of result obtained after running a line detection with OpenCV:

Fig2. Input Image

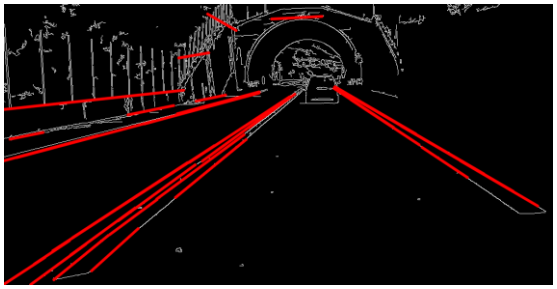

Fig3. Example of line detection

Note: You are only required to detect the lines on the streets. You do not need to identify specific lanes for this assignment. However, while drawing the detected lines on the output image try to avoid lines detected outside the road.

Deliverables:

- GitHub implementation
- Write a report that describes your work with screenshots.