

Edge Detection on Live Video Stream

Using Simulink Models to Detect Edges on Objects in Frame

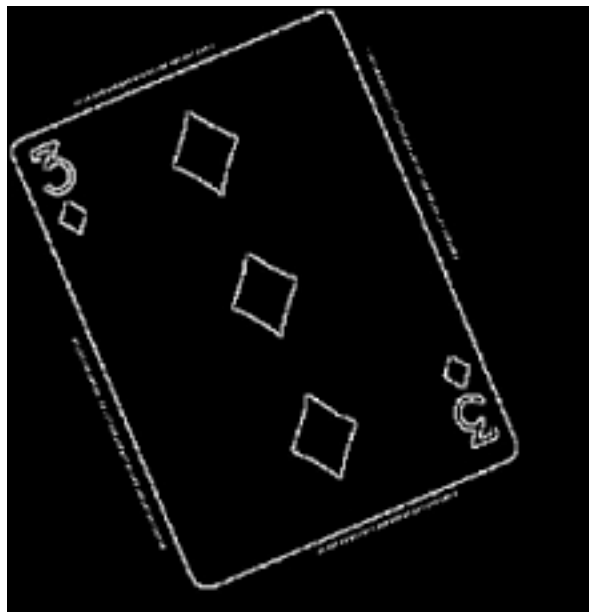


Figure 1, Card w. Edge Detectino

Keywords: Edge, Detection, Video, Image, Simulink, Live

Ian Siekkinen
ECE 480, Fall 2014
Design Team 5
11/14/2014

Abstract

There are numerous instances where detecting an edge in a video stream is needed. Many different steps and hardware can be used to acquire an edge from the given data. This application note will show how to take an acquired image stream and detect edges of objects within each frame.

Objective

This application note will explain the steps to create a program for edge detection using Simulink with accompanying Image Acquisition and Computer Vision System Toolboxes.

Introduction

Developed by MathWorks, Simulink is a graphical block diagramming and programming language that is mostly used for digital signal processing. Simulink can model, simulate and analyze many kinds of dynamic systems. Pairing Simulink with an image acquiring hardware can let the user do numerous things with the video stream. This application note will go into detail about how to use an Axis Smart Camera system and Simulink block diagrams from specified toolboxes to detect edges in images.

Technical Details

Hardware: The image-acquiring device being utilized is the Axis Q1615-E Network Camera. This smart camera has the capability of HDTV 1080p at 60 frames per second. It has shock detection, electronic image stabilization, and can work from temperatures ranging from -40° – 122° F. This camera is powered over Ethernet so a 15W Midspan is needed to connect to a power outlet. In this way the camera can receive power and data at the same time. The camera sends the acquired data from the frame to the software in Simulink via an Ethernet wire running between them.



Figure 2, Axis Security Camera

Software: After getting an approved hardware system that will comply with Simulink, the required Toolboxes must be obtained. First, the Image Acquisition Toolbox will allow you to take images from cameras and other frame grabbers and directly put this data into the Simulink software. Simulink can detect hardware automatically and configure the hardware once detected. The other toolbox needed is the Computer Vision System Toolbox. This lets you receive video as inputs or outputs, detects objects and their features, camera calibration, and generate C code for prototyping designs. It includes all types of algorithms and functions needed for the design and simulation of video processing. After having these toolboxes, the software will be able to accept the video input taken from the hardware as intensity data and put it into a given model at every step in time, meaning every frame the device obtains.

The method used for detecting edges in images by the Simulink Block is the Prewitt Method. This method takes the image and computes an estimated gradient of the image intensity function. The image gradient is the directional change in intensity or color in an image/frame. Using the gradient values acquired across the image, the software will notice large fluctuations and changes within the gradient value and determine if an edge is present in the frame. With all of these gradient values that have large changes in them, the software can then create a new image that will highlight the large values white, while it blackens the rest of the image.



Figure 3, Simulink Logo

Steps: To start setting up the block model, drag and drop the From Video Device on to the workspace. Once it acquires the needed information from the camera hardware, you can continue adding blocks. The next block that can be added is the Edge Detection box. This will be labeled with the Prewitt Edge on the block, meaning that it is utilizing the Prewitt Method in order to detect edges. This block allows the user to adjust the thresholds of the edge detection function. For example, if the threshold is raised then the amount of edges found decreases. Once this is put together, you can set up numerous types of video displays to see the newly created images. In the example shown below there is a video output to show the original image, the image created through the edge detection, and, with the edition of a compositing block, an overlay of both the original and edge detected images. With all three of these videos, it is easy to see how the software finds the edges within an image.

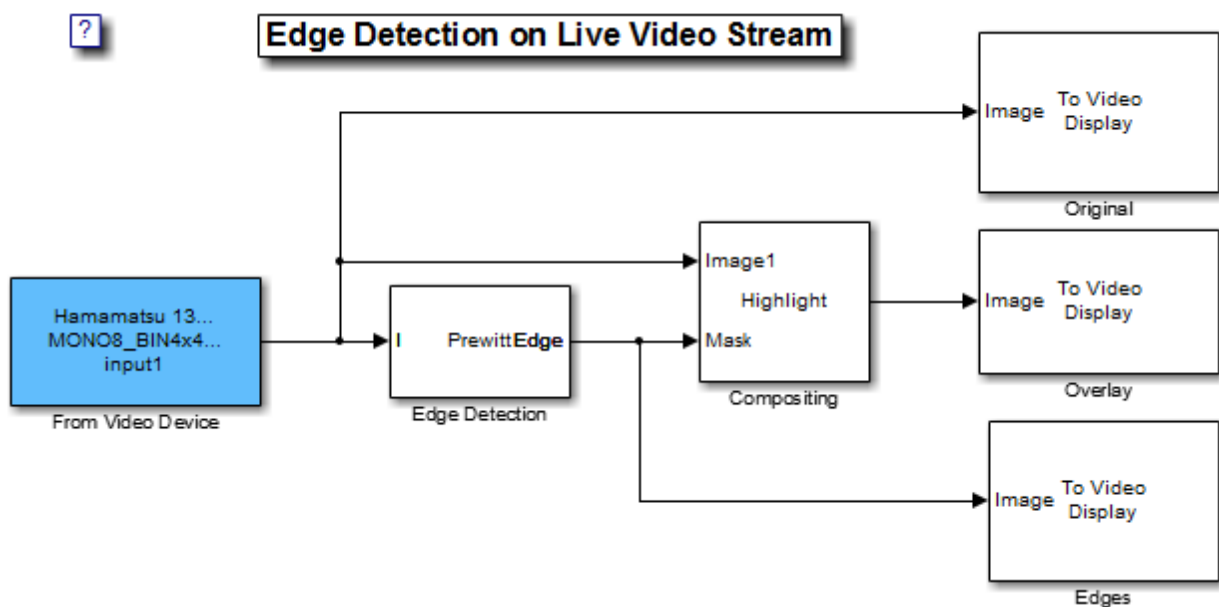


Figure 4, Block Diagram Example

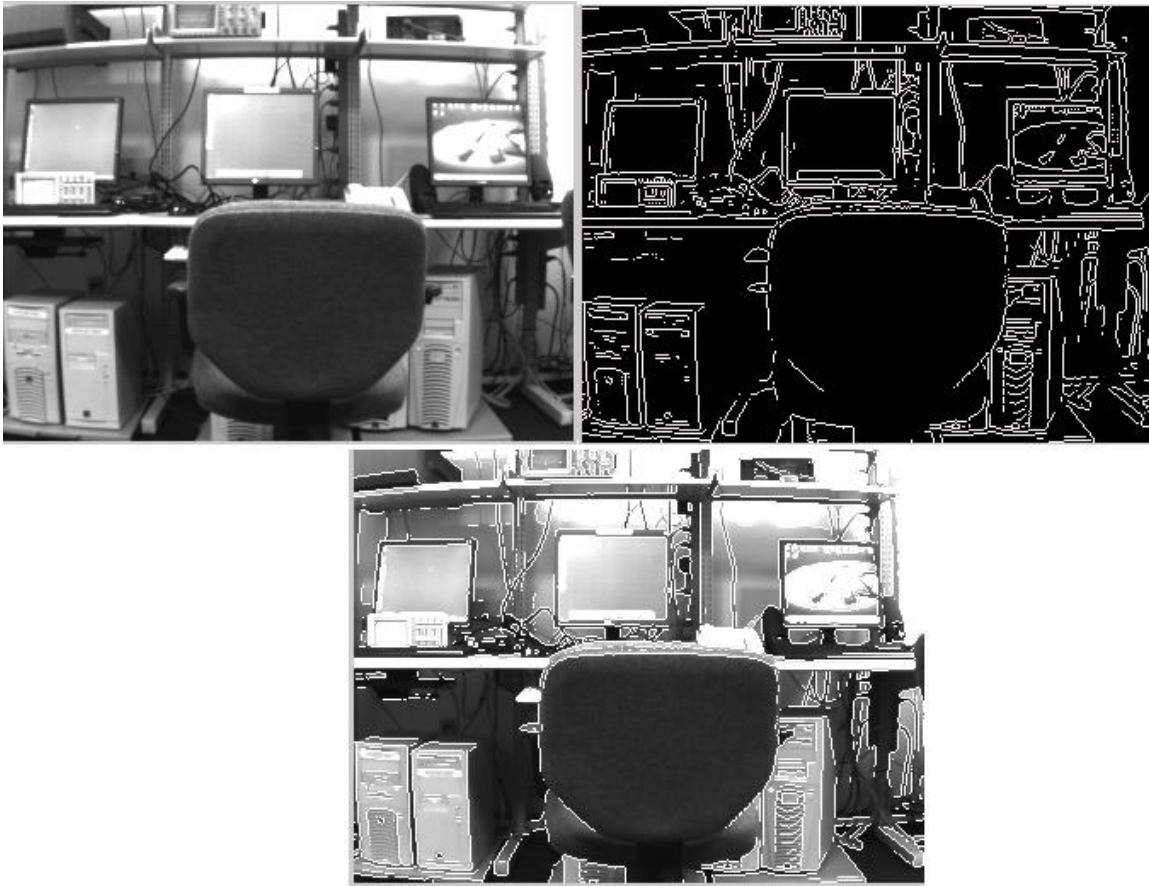


Figure 5, Top left: Original, Top right: Edges, Bottom: Overlay of both

Recommendations

Although this example was done with Axis camera system, many other types of other video sources can be used in this program with varying levels of image quality. This type of model can be used on many applications where detecting an object or edge is needed. An issue that can occur with this program is that it will detect all edges within a screen depending on the threshold. Filtering out certain parts of the image using the gradient can be done to solve this problem, but requires more steps to complete.

Conclusion

This application note explains how to set up edge detection software using a given hardware image device. It shows what type of software and toolboxes are needed to properly program edge detection within images. Simulink's block diagram system is easy to use with numerous types of hardware and can be used to detect edges on an object in a frame.

References

<http://www.mathworks.com/help/imaq/examples/edge-detection-on-live-video-stream.html>

<http://en.wikipedia.org/wiki/Simulink>

http://www.axis.com/products/cam_q1615e/index.htm

<http://www.mathworks.com/products/imaq/>

<http://www.mathworks.com/products/computer-vision/>

http://en.wikipedia.org/wiki/Prewitt_operator

http://en.wikipedia.org/wiki/Image_gradient