**Image Processing for Aerial Photography**

GOAL:

My goal in this project is to create an automated image processing system that can detect colors, shapes, and potentially letters within an image and a GUI to display output in a text box and choose general parameters as well as outputting results to a text file.

By the end of the semester, I plan to have the shape and text recognition, color detection, GUI, and display text completed. Once these are complete, I will then attempt to automate the process from settings placed in the GUI.

**OVERVIEW**:

Image processing is a very important field for automating unmanned vehicles. Once a machine can recognize an object within its field of view, it gains the ability to sort through image data and determine visual characteristics of its environment without human input. While machine vision is growing, the size of some of the machines that require this capability is shrinking. The military is starting to turn to Unmanned Aerial Vehicles to do a lot of reconnaissance in warzones to reduce the risks that these missions introduce to humans.

In this context, the Association for Unmanned Vehicle Systems International has been hosting a competition for student teams to create a UAS and complete a reconnaissance mission at a Naval Air Base. This reconnaissance mission includes the navigation of a search area in order to observe an unknown number of colored alphanumeric targets. One of the bonus tasks available to the teams is the autonomous accurate detection of targets.

This project is significant because there are not many teams that compete in the competition that are capable of accurately locating and characterizing these targets autonomously. Therefore, I would like to create the backbone of this automated target recognition system and see if I can create an improved version of those that are currently in use by other teams.

**INVOLVEMENT:**

I will be doing this project by myself under Dr. Blankenship.

**METHODOLOGY:**

I will be conducting this project in MatLab using the Image Processing Toolbox to achieve the major computational goals of the project and GUIDE to develop the GUI. Much of the development will be based on MatLab’s online documentation and testing using multiple colored images taken in various lighting conditions. In this manner, I hope to develop a highly robust recognition program that can be used either indoors or outdoors to recognize a minimum of 8 colors and 8 shapes.

**SCHEDULE:**

## Phase 1: Shape Recognition

1. FEB 1-7
   1. Begin work on shape recognition
      1. Define shapes to do testing on
      2. Start writing code
2. FEB 8-14
   1. Continue work with shape recognition
      1. Continue writing code
3. FEB 15-21
   1. Continue work with shape recognition
      1. Continue writing code
4. FEB 22-28
   1. Finalize shape recognition program
      1. Test with shapes on high-contrast and low-contrast backgrounds
      2. Test with shapes with sharp corners as well as circles and half-circles

## Phase 2: Color Detection

1. MAR 1-7
   1. Create modified histogram formula that ignores background color (green)
2. MAR 8-14
   1. Begin writing mid-semester report
   2. Finish histogram formula
   3. Use histogram data to differentiate between shape color and letter color
3. MAR 15-21
   1. Complete mid-semester report
   2. Finalize color differentiation
4. MAR 22-28
   1. Polish output data format

## Phase 3: Text Output

1. MAR 29-APR 4
   1. Determine desired output and sketch initial format ideas
   2. Draft code for template output
2. APR 5-11
   1. Create layout for text box with automatic sizing of output areas and option to output to .txt file
3. APR 12-18
   1. Implement outputs from previous sections into textbox and format .txt file output for readability

## Phase 4: Automation

1. APR 19-25
   1. Create draft layout of GUI for completing each of the four prior processes individually and concurrently
   2. Create initial version of GUI with dead buttons to finalize layout
2. APR 26-MAY 2
   1. Implement functions to corresponding buttons
3. MAY 3-9
   1. Draft Final Paper
   2. Draft method for completing processes live
4. MAY 10-15
   1. Complete final paper
   2. Complete live processing method

**LEARNING OUTCOMES:**

I plan to become very familiar with image processing techniques, specifically those used in MatLab’s Image Processing Toolbox. I should also be able to develop a functional GUI with multiple inputs that can allow for multiple different types of outputs.

**LAB REQUIREMENT:**

I will not be taking this course to count for the Advanced Laboratory Requirement.

**REFERENCES:**

"2014 Student UAS Competition Awards Banquet." 2014 Student UAS Competition (2014): n. pag. AUVSI - Seafarer Student UAS Competition. AUVSI, 21 June 2014. Web. 3 Feb. 2015.