Real Time Target Identification Proposal

Shane Grant
Department of Computer Science
University of California San Diego
La Jolla, CA 92093
wgrant@ucsd.edu

Lewis Anderson
Department of Computer Science
University of California San Diego
La Jolla, CA 92093
lkanders@ucsd.edu

Abstract

This project aims to develop a vision system for target identification in Unmanned Aerial Vehicle environments. Specifically, it aims to recognize targets which consist of alphanumeric characters on an arbitrarily shaped background.

1 Statement of Qualifications

Shane Grant is a senior undergraduate student studying computer engineering at the University of California, San Diego. He has taken courses in image processing and artificial intelligence, as well as a prior project in CSE 190a. He has worked on imagery systems for the UCSD Unmanned Aerial Systems team for three years.

Lewis Anderson is a first year undergraduate student at the University of California, San Diego. His primary experience in computer vision is through work on the UCSD UAS team where he currently assists in developing GPU based imaging techniques. He has past programming knowledge through developing applications for the Apple iPhone.

2 Project Outline

The goal of our project is to correctly identify the alphanumeric, shape, orientation, and color of specifically designed targets. Though the environment that we apply these algorithms to is constrained, we will think in a more generic fashion to allow usability outside of our purposes. We assume here that targets have been reasonably segmented from their background prior to performing any analysis.

We intend to draw upon research done in the areas of shape recognition [4, 5, 6, 7, 8], especially when applied to the task of identifying characters [1, 2, 3].

2.1 Assemble a Data Set

Essential to the project is obtaining a suitable training/testing set of images related to our objective. We will exploit domain specific knowledge to reduce the complexity of our images - alphanumeric will always be filled capital letters against a solid background that is of a different color. We will construct sample targets and obtain aerial photographs/video from the UCSD Falco airframe to make our data sets in addition to using prior acquired imagery from past years.

Deadline: End of week 2

2.2 Review Relevant Papers and Approaches to Shape/Character Recognition

Since shape and character recognition are relatively new to both Shane and Lewis, we will spend time becoming acclimated with appropriate algorithms and approaches to performing shape and character recognition. We will spend the first three weeks reviewing references and developing a plan for our algorithm/implementation. This will happen in parallel to constructing the data sets.

Deadline: End of week 3

2.3 Implementation

Implement the algorithm or series of algorithms necessary to perform the target identification. We will be implementing as much as possible on an NVIDIA GPU using the CUDA programming paradigm. When necessary, we will fall back to OpenCV.

Deadline: End of week 7

2.4 Test and Modify

Run algorithm on test data set and observe the results. Modify the algorithm as necessary to improve detection or better fit expectations. Test in the UAS operating environment and determine if detection and identification is fast enough for real time usage.

Deadline: End of week 10

3 Division of Labor

Since computer vision is a new topic for Lewis, Shane will handle a larger proportion of issues relating to theory and algorithm development. From an implementation perspective, both Shane and Lewis are at around the same level of expertise with GPU programming and the labor should be equally distributed in this regard.

4 Experimental Questions

Do the algorithms we utilize lend themselves to efficient GPU implementations?

Is our algorithm capable of working outside of our constrained environment?

Is the implementation viable for real-time analysis?

Is the error rate low enough to not need human supervision during useage?

References

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