UNIVERSITY OF LINCOLN

Lincoln School of Computer Science

Assessment Component Briefing Document

Title: CMP3641M Computer Vision and Robotics, Assessment Item One – Digital Image Processing	**Indicative Weighting: 30%**

Learning Outcomes:

On successful completion of this component a student will have demonstrated competence in the following areas:

- [LO2] apply computer vision techniques to solve practical problems.

Requirements

This assessment comprises two assessed Tasks, as detailed in the following page.

1. Digital image analysis for static potatoes. Weighting: 60% of this component.
2. Potato segmentation with a changing background. Weighting: 40% of this component.

Your submission should include a zip file with all newly created functions and data files and a concise report (maximum 6 pages, not including the cover sheet) that describes your work on the above tasks.

Useful Information

This assessment is an individually assessed component. Your work must be presented according to the Lincoln School of Computer Science guidelines for the presentation of assessed written work. Please make sure you have a clear understanding of the grading principles for this component as detailed in the accompanying Criterion Reference Grid.
If you are unsure about any aspect of this assessment component, please seek the advice of a member of the delivery team.

Submission Instructions

The deadline for submission of this work is included in the School Submission dates on Blackboard.

You must make an electronic submission of your work in pdf format together with a zip file containing all developed code files by using the assessment link on Blackboard for this component. Each student is then required to demonstrate their solution to the module instructors, as per the schedule indicated on Blackboard. You must attend the lectures for further details, guidance and clarifications regarding these instructions.

DO NOT include this briefing document with your submission.

Task 1: Digital image analysis for static potatoes

Download and unzip the file '`Spud dataset 1.zip`' from Blackboard. You should obtain a set of 10 images, each comprising a group of potatoes on a (mainly) black background.

Write a program in MATLAB that detects potatoes in the provided images. The results should be displayed by showing the original image with a blue outline drawn around the outer margin of each potato; also display the following summary statistics in the Command Window:

- Number of potatoes detected;
- Per potato, in a table (one row per potato):
    - (x,y) location of the centroid;
    - size (number of pixels) of the potato;
    - the length of the major and minor axes of the potato;
    - the "circularity", i.e. P2A statistic, of the potato;
    - mean and standard deviation of the R, G and B colour values in the potato.

The submission should include an m-file, named `findspuds.m`, which produces the desired results, together with any subsidiary m-files. Note: please add appropriate comments to your code to explain all of the main steps in your reasoning. The `findspuds` m-function should take a single argument, the name of the image file to be processed, and display the image with the outlines and the summary statistics when run as (for example) below:

```
>> findspuds('1.png');
```

Task 2: Potato segmentation with a changing background

Download and unzip the file '`Spud dataset 2.zip`' from Blackboard. You should obtain a set of still images extracted from a video sequence (see the movie '`beltpotatoes_small.avi`' on Blackboard). In this task, the segmentation problem is harder than in the previous task, because the image "background" (i.e. non-potatoes) consists of a motorised roller table, which changes between successive images.

Write a MATLAB program that segments the potatoes from the background. You are provided with 4 images without potatoes ('`beltempty_*.jpg`'), which should be used to create a model of the background (roller table), and 11 images with potatoes ('`beltpotatoes_*.jpg`'). Your program should "learn" a suitable model of the background using the former 4 images, and then use this model to analyse the latter 11 images.

Given one of the input images containing potatoes, your segmentation function should carry out the following steps:

- For each pixel in the source image, compare the pixel colour values with the learned background model.
- If the pixel is classified as "potato", then the corresponding pixel in the output image should be set to the same colour as the input pixel, otherwise set the output pixel to "black".
- Return the output image.