MTRN4230 Robotics Problem Solving Exercise 2 (PSE2) Description

Problem Solving Exercise 2 requires you to work individually to process several sample images and demonstrate the ability to do basic object detection. It is worth 6 of the 25 PSE course marks.

Aims

The following assessment aims are derived from course learning outcome 4:

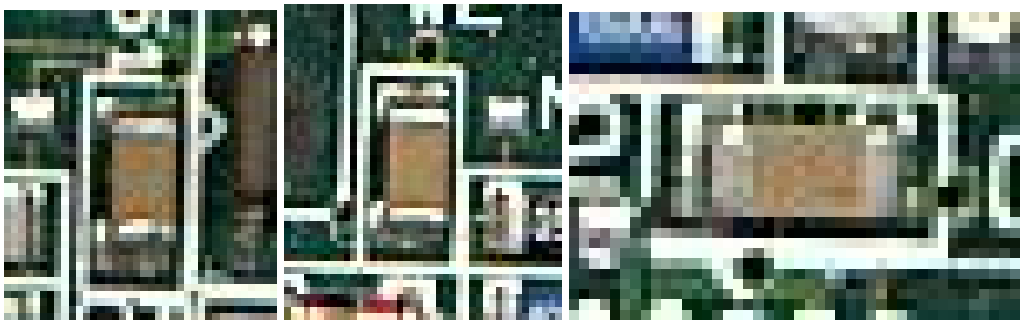
4.1. Knowledge of basic image processing techniques as applied in robotics
  4.1.1. Demonstrate ability to select appropriately from a set of basic techniques
  4.1.2. Demonstrate ability to combine basic techniques to solve an unknown problem

Assessed Tasks

Image Processing (total 12 points)

Using the four images from Matlab's default image set mentioned below, apply as many image processing operations as necessary to obtain the following results. The default images can be obtained by `imshow('board.tif')` for example but have also been provided in Moodle:

1. Using Matlab default image: "**board.tif**"
   a. (1 point) Convert the RGB image to a grayscale image, scale the intensity of the grayscale to 25%. Display the grayscale image.
   b. (2 points) Create a mask covering the beige coloured SMD capacitor segments (examples of the capacitors are shown below). In a separate figure, show the mask.



   c. (1 point) In a separate figure, show the original RGB image as a 25% intensity grayscale image with the beige components overlaid in full colour.
2. Using provided example images "**sherlock.jpg**" and "**zEXAMPLE.jpg**" complete the following tasks. On the assessment day, you will be given another image with your zID to use. The image will be similar to "zEXAMPLE.jpg"
   a. (1 point) Plot all SURF descriptors overlaid on "sherlock.jpg".
   b. (1 point) Match SURF descriptors from "sherlock.jpg" to the other image. Visualise the matched pairs.
   c. (1 point) Calculate by how many degrees the second image has been rotated from the original sherlock.jpg. Anti-clockwise rotation is to be reported as positive.
3. Using Matlab default image "**pears.png**":
   a. (3 points) Detect and overlay the boundaries of the pears with a red line. A complete solution must show less than 4 incorrect edges and the majority of the pear boundaries.
   b. Identify individual pears using blue circles. Identifying the same pear more than once will count as a false positive. False positives will incur a penalty of -1 count per false positive.
      i. (1 point) At least 7 correctly detected pears
      ii. (1 point) At least 10 correct detected pears

Hint: **imread, double, imshow, imerode, imclose, imopen, imdilate, imbinarize, detectSURFFeatures, edge, matchFeatures, imfindcircles** are useful functions to get you started and you may need to use **repmat** to convert a binary image to (m x n x 3) format.

You are recommended to generate all the separate figures in one script. The colorThresholder tool is especially useful for segmenting objects manually.

Marking Criteria

Your demonstrator will check the results visually in your tutorial and will ask questions to test your understanding of the techniques used. For each sub-task, full points for complete results. Half points for a reasonable attempt at the task. 0 points for missing or very incomplete results or inability to explain the methods used to the demonstrator.

Due date

Show your individual solutions to the above tasks to your demonstrator within your tutorial time in week 4 (due to the public holiday Monday lab groups have until their lab time on Monday week 5). There is a total of 12 points for this PSE which is scaled to 6% of your final grade in MTRN4230.

Resources

Corke's Machine Vision toolbox is installed on the lab machines and is closely associated with the textbook. Example function calls above relate to this toolbox although other image processing toolboxes exist in Matlab and can do the same thing. For more sample images in Matlab and where to find them, see http://au.mathworks.com/matlabcentral/answers/54439-list-of-builtin-demo-images

Use the course discussion forum for getting help.