

CPSC 535

Assignment 5b: Counting Coins

The goal of this assignment is to develop a pattern-recognition system that can count the number of different objects in an image. In this case, the objects are a standard mix of coins. Section 9.2 of Sonka, Hlavac and Boyle covers material on statistical pattern recognition. This assignment is actually quite difficult for several reasons related to the nature of coins. I recommend taking classifier-tree approach to solve this assignment where you use multiple classifiers that distinguish on different characteristics. For example, one classifier may split the coins by size groups, while follow-up classifiers may differentiate coins of the same size. It will be difficult to get 100% accuracy on this assignment and the grading will be scaled accordingly (that is, you can get a very good mark without 100% detector accuracy).

1 The Data

For this assignment you get two sets of images.

The first set is the training data. It contains images with only one type of coin. The coin types are:

1. 1 eurocent
2. 5 eurocent
3. 10 eurocent
4. 50 eurocent
5. €1 (1 euro)
6. ¥10 (10 yen)
7. ¥100 (100 yen)
8. penny (1¢)
9. dime (10¢)
10. twonies (\$2 piece)

Use these training images to *teach* your algorithm to recognize coins.

The second set of data contains three images for testing your algorithm. These images show a mix of the coins that need to be counted. Your marker has two additional images (similar properties) not given to you to test your algorithm.

2 Your Program

Your program should work as follows (working from within octave is okay):

myprog *image-file-name*

If you have a different usage, make sure it is simple and you document how to use it. The output of your program should be a table indicating the counts of each grain type, e. g.,

```
1 eurocent: 5
10 eurocent: 2
50 eurocent: 10
1 euro: 1
10 yen: 5
100 yen: 3
pennies: 15
dimes: 7
twonies: 3
total: 51
```

Include a copy of your output on the test images in your writeup for easy reference. No ground truth is provided, but you can determine this by doing a manual count. To test your algorithm, I have to additional images like those in the test set for use in evaluating your program. I will not give you these images beforehand.

3 Hints

- Threshold your image to determine what is coin and what is background
- Use the `bwlabel` and `find` commands to isolate individual coins. `bwlabel` is available in the `image` package (`pkg load image`) in Octave 3.0 or downloadable from the prof's website for earlier versions.
- Your coins are RGB/Color images. You can convert them to intensity values (greyscale) for particular processing.

4 Questions

1. Describe in detail the features and procedure that you used to detect the coins. Point out particular challenges or successes.
2. Discuss the implications of the features you use to match the coins. For example, what happens if you have dirty coins or coins of a different style? What are some other functions or features you could think of?
3. Discuss particular properties of coins that make this assignment easy / hard.
4. Reflect on the following questions (shorter answers). Would your algorithm still work if... What approach would you take to address...
 - (a) if the resolution/scale of the coins were not guaranteed.
 - (b) if the perspective of the coins were not guaranteed such that you have a skew / 3D perspective of the coins on the flat surface.
 - (c) if the coins were on a bumpy (not flat) surface such that the coins have different heights and perspectives.
 - (d) if the lighting was dynamic and not guaranteed.
 - (e) if coins were not isolated and overlapped.

Hand In

Hard copy and electronic copy (email to TA):

1. Cover sheet with your name, course number, and assignment number only.
2. Name and student ID number inside the cover sheet.
3. Writeup
4. All plots, images, and source code. Make sure you label the plots to indicate what they are.

Collaboration

The assignment must be done individually so everything that you hand in must be your original work, except for the code copied from a cited source or that supplied by your instructor. When someone else's code is used like this, you must acknowledge the source explicitly. Copying work that is not your own without acknowledgement is academic misconduct. Contact your instructor if you have problems or questions regarding this.



Figure 1: Example of sample coins and collection.