CompSci 373 Assignment 1

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Extension report

Modifications

The purpose of this extensions is to explore a modified version of the algorithm outlined in the document, which looked to improve the placement bounding boxes around all the bar codes in an image.

The algorithm has 3 key points of alteration the filter, threshold, and erosion/dilution. The threshold acts as a sledgehammer as any change to it will likely require changes to the erosion/dilution method. So once a suitable threshold was found the strategy was to modify the filter, erosion/dilation method. Furthermore, as the algorithm was looking to identify more than one bar code there was also the ability to modify the criteria for what regions would be identified as a bar code.

The modified algorithm varies slightly in terms of the filtering method, the suggested filter was using 3x3 gaussian 4 times. This algorithm uses a 5x5 box average method. The improvement was slight but made an improvement.

The erosion/dilution and filter took the most time to work out as a change to the order or scale of operations could fix one image but break two others. The key was to strike a balance between dilation and erosion to separate the regions. Particularly barcode 1 and 2, as barcode 1 required dilation to join the individual bars to form a region. Whilst barcode 2 required erosion to separate it from the packaging. Eventually I reached a sequence of light erosion then dilation, heavy erosion then heavy dilation to build out the regions.

Lastly the criteria for a region to be labelled a barcode involved size, density, and portions. The first step was to remove regions that were too small by only selecting the top 6 regions. So the algorithm maxes out at 6 bar codes, however that number is more so to speed runtime up than make a difference, so it could be increased. There is also a minimum size of 2400 pixels. The density looks at the portion of the bounding box filled by pixels in the region, with a minimum of 0.7. Lastly the aspect ratio was used to filter out odd cases of areas that met other requirements in weird un barcode like shapes. This is the fiddliest piece as it is dependent on how a barcode is oriented or shaped it could remove itself from contention. This is why on the provided multi barcodes the algorithm doesn’t identify the lower two smaller barcodes.

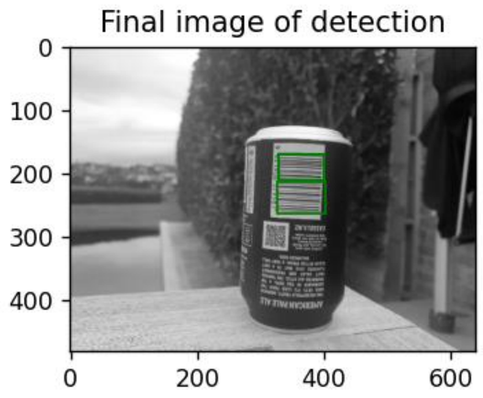
The results of these changes on the provided set are success on 1,2,3,5,6 and getting 3/5 on the multiple barcodes image (missing the thin ones at the bottom due to an aspect ratio check). 7 was a problem for the algorithm, as it suffers from needing a large amount of dilation to connect the components of the bar code. The algorithm did successfully locate 2 parts of it however if the amount of dilation was increased it would break other bounding boxes. A final comment is that due to the multiple dilation/erosion steps the algorithm is slightly slow but that appears to be the price of better accuracy.

Additional Pictures:

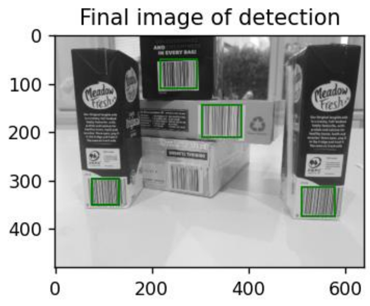
The purpose of these new pictures was to introduce difficult lighting and try trick it into making mistakes to better understand the algorithms limits I'll just go through the highlights in this report. For consistency and speed, they're all around the same size as the ones that are provided.

Background:

Purpose was to see if a non-plain background would confuse the algorithm. The algorithm identifies the bar code but splits it into two parts. The contrast on the can likely helps distinguish the bar code. With a more side on bar code the algorithm fails to pick anything up

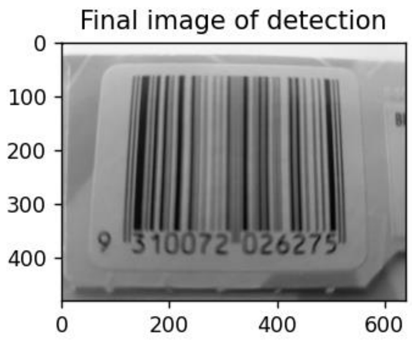


Multi:
The Multi section aims to build upon handling more than one bar code, the one provided works okay but it struggled with two as explained before. This picture uses standard proportion bar codes. The algorithm gets 4/5 which isn't bad. However I'm unsure why the lower middle bar code was skipped.



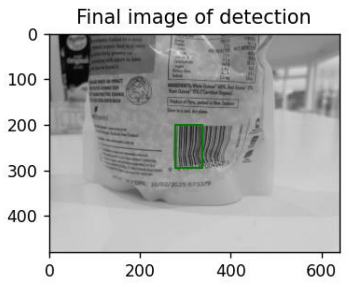
Closeup:

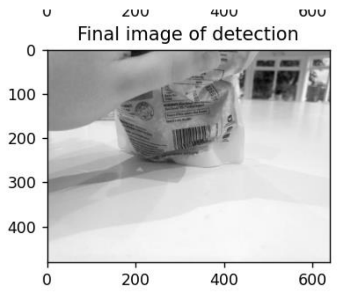
The purpose of this photo was to see if a barcode that is a major portion of the image would cause issues. The algorithm fails to identify the barcode, I assume this is to do with a lack of material to contrast the bar code from the rest of the material.



Crumpled:

The purpose of these was to assess how the algorithm handled identifying bar codes on soft body objects. The algorithm partially identified one but missed the more crumpled one entirely.





Summary

Although the algorithm performs well with the modifications on the provided samples it seems to struggle on more challenging examples. Partially because of my poor photography skills and partially because I think the algorithm is overfitted to the test samples. Not allowing it to perform as well on unseen examples.