Computer vision

Assignment 1

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D-stream

The aim of our project is to develop a program which will locate and recognise the traffic lights from the images taken from the vehicle driving along the road. The state that is green, amber, red or red amber should be located and recognised. The traffic lights directly facing the vehicle are considered.

Detection of traffic lights using templating matching method was done successfully in some cases but faced problems in detecting the actual colour of the traffic lights.

Template matching is the method that is used in image processing for finding small parts of an image which matches a template image, for which I required two components:

1) Template image
2) Source image

The source image is compared to the template image by sliding to identify the matching parts that is patch is moved one pixel at a time from left to right and top to bottom and a matrix was calculated at each location which showed if its good or bad. More good it was more similar the images and if it is bad then images were not similar. Highest matches are shown by brightest patches.

The following methods were used to implement template matching:

1) Method=CV_TM_SQDIFF

$$R(x,y) = \sum_{x',y'} (T(x',y') - I(x+x',y+y'))^2$$

2) Method=CV_SQDIFF_NORMED

$$R(x,y) = \frac{\sum_{x',y'} (T(x',y') - I(x+x',y+y'))^2}{\sqrt{\sum_{x',y'} T(x',y')^2 \cdot \sum_{x',y'} I(x+x',y+y')^2}}$$

3) Method=CV_TMCCORR

$$R(x,y) = \sum_{x',y'} (T(x',y') \cdot I(x+x',y+y'))$$

4) Method=CV_TM_CCORR_NORMED

$$R(x,y) = \frac{\sum_{x',y'} (T(x',y') \cdot I(x+x',y+y'))}{\sqrt{\sum_{x',y'} T(x',y')^2 \cdot \sum_{x',y'} I(x+x',y+y')^2}}$$

5) Method=CV_TM_CCOEFF

$$R(x,y) = \sum_{x',y'} (T'(x',y') \cdot I(x+x',y+y'))$$

6) Method=CV_TM_CCOEFF_NORMED

$$R(x,y) = \frac{\sum_{x',y'} (T'(x',y') \cdot I'(x+x',y+y'))}{\sqrt{\sum_{x',y'} T'(x',y')^2 \cdot \sum_{x',y'} I'(x+x',y+y')^2}}$$

Where,

$$T'(x',y') = T(x',y') - 1/(w \cdot h) \cdot \sum_{x'',y''} T(x'',y'')$$
$$I'(x+x',y+y') = I(x+x',y+y') - 1/(w \cdot h) \cdot \sum_{x'',y''} I(x+x'',y+y'')$$

A template image and a source image are loaded, and template matching is performed by the help of match template function in OpenCV. Any of the methods described above can be used depending upon the conditions. In any condition one method may give better results than other method.

The successful outputs were-

The detected traffic lights are enclosed in a rectangular box.


Mill Road


KAILASH