CS6018 IMAGE PROCESSING

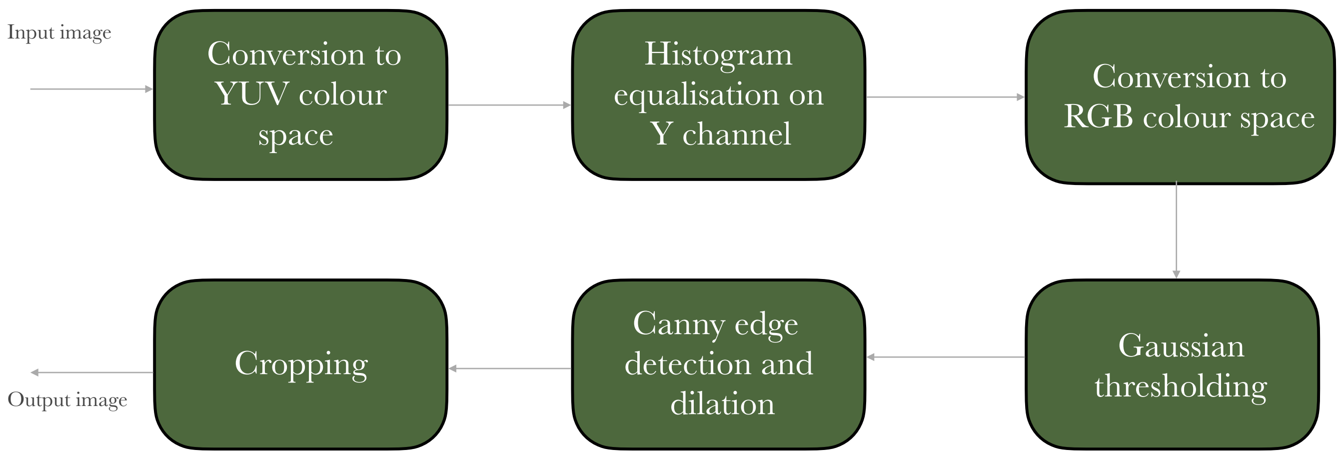
MINI PROJECT

TEXT ISOLATION AND ILLUMINATION CORRECTION

INTRODUCTION

Document scanning using mobile phones are widely used in the present age. But it is possible that the captured image might have poor contrast due to illumination. This project involves correcting the illumination by increasing the contrast as human eye is more suited to view images with good contrast. The text region is isolated and cropped.

BLOCK DIAGRAM



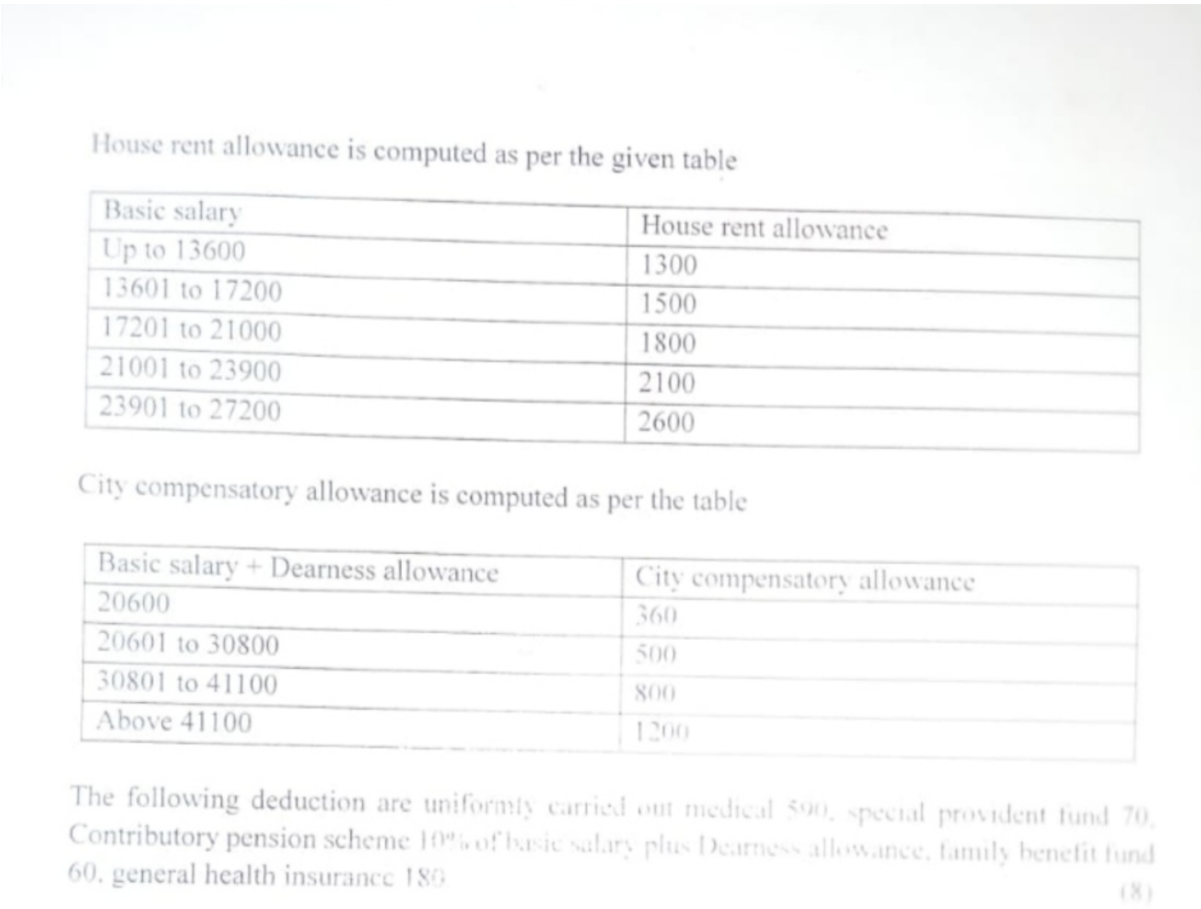
STEPS INVOLVED

- Image resizing and conversion to YUV colour space
- The Y channel is normalised using histogram equalisation
- The image is converted back to RGB colour space
- Gaussian thresholding
- Canny edge detection to detect text
- Dilation to merge edges

IMAGE ACQUISITION

An image of a document captured in a mobile phone is used as the input image. The text in the image is isolated and contrast is increased.

Original image



House rent allowance is computed as per the given table

Basic salary	House rent allowance
Up to 13600	1300
13601 to 17200	1500
17201 to 21000	1800
21001 to 23900	2100
23901 to 27200	2600

City compensatory allowance is computed as per the table

Basic salary + Dearness allowance	City compensatory allowance
20600	360
20601 to 30800	500
30801 to 41100	800
Above 41100	1200

The following deduction are uniformly carried out medical 590, special provident fund 70, Contributory pension scheme 10% of basic salary plus Dearness allowance, family benefit fund 60, general health insurance 180

(8)

CONVERSION TO YUV COLOUR SPACE

Applying histogram equalisation directly on the channels of colour images (RGB) didn't obtain good results. Therefore, the colour space of the image is converted into YUV which separates the intensity value from the colour components. The YUV model defines a colour space in terms of one luma component (Y) and two chrominance components, called U (blue projection) and V (red projection) respectively. Y stands for the luma component (the brightness) and U and V are the chrominance (colour) components; luminance is denoted by Y and luma by Y' – the prime symbols (') denote gamma correction, with "luminance" meaning physical linear-space brightness, while "luma" is (nonlinear) perceptual brightness.

$$\begin{bmatrix} Y' \\ U \\ V \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ -0.14713 & -0.28886 & 0.436 \\ 0.615 & -0.51499 & -0.10001 \end{bmatrix} \begin{bmatrix} R' \\ G' \\ B' \end{bmatrix}$$

HISTOGRAM EQUALISATION

Y channel of the image is equalised and converted back to RGB. This makes the picture have a much better contrast and doesn't disturb the colour of the image. The image is divided into small blocks 8x8 which are equalised as usual using equalizeHist. The results are tested using different values for the clipLimit variable. 2.5 is the value that work best for the image. This method usually increases the global contrast of many images, especially when the image is represented by a narrow range of intensity values. Through this adjustment, the intensities can be better distributed on the histogram utilising the full range of intensities evenly. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalisation accomplishes this by effectively spreading out the highly populated intensity values which use to degrade image contrast.

It can be used on colour images by applying equalisation separately to the Red, Green and Blue components of the RGB colour values of the image. However, applying the same method on the Red, Green, and Blue components of an RGB image may yield dramatic changes in the image's color balance since the relative distributions of the colour channels change as a result of applying the algorithm. Therefore luminance component in YUV space is equalised.

```
YUV= cv2.cvtColor(I,cv2.COLOR_BGR2YUV)
YUV[:,:,0]=cv2.equalizeHist(YUV[:,:,0])

clahe = cv2.createCLAHE(clipLimit=2.5, tileGridSize=(8,8))

output_2R = clahe.apply(R)
output_2G = clahe.apply(G)
output_2B = clahe.apply(B)

img_output = cv2.cvtColor(YUV, cv2.COLOR_YUV2BGR)
img_output = cv2.merge((output_2R,output_2G,output_2B))
eq=cv2.cvtColor(img_output,cv2.COLOR_BGR2GRAY)
```

GAUSSIAN THRESHOLDING

Adaptive thresholding is the method where the threshold value is calculated for smaller regions. This leads to different threshold values for different regions with respect to the change in lighting. With Adaptive Gaussian Thresholding method we can get a B/W document.

In simple thresholding, the threshold value is global, i.e., it is same for all the pixels in the image. Adaptive thresholding is the method where the threshold value is calculated for smaller regions and therefore, there will be different threshold values for different regions.

Contrast enhanced image

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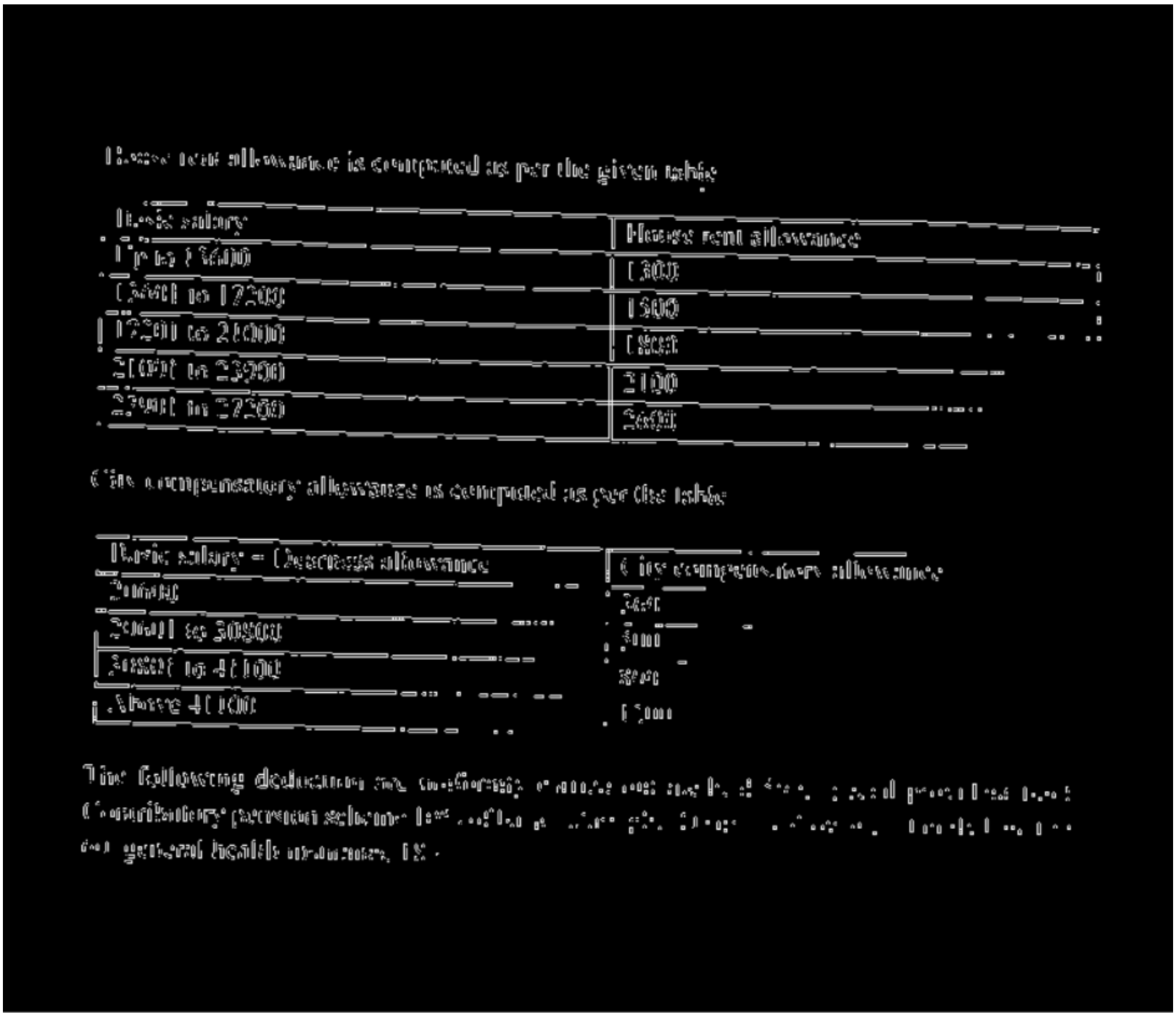
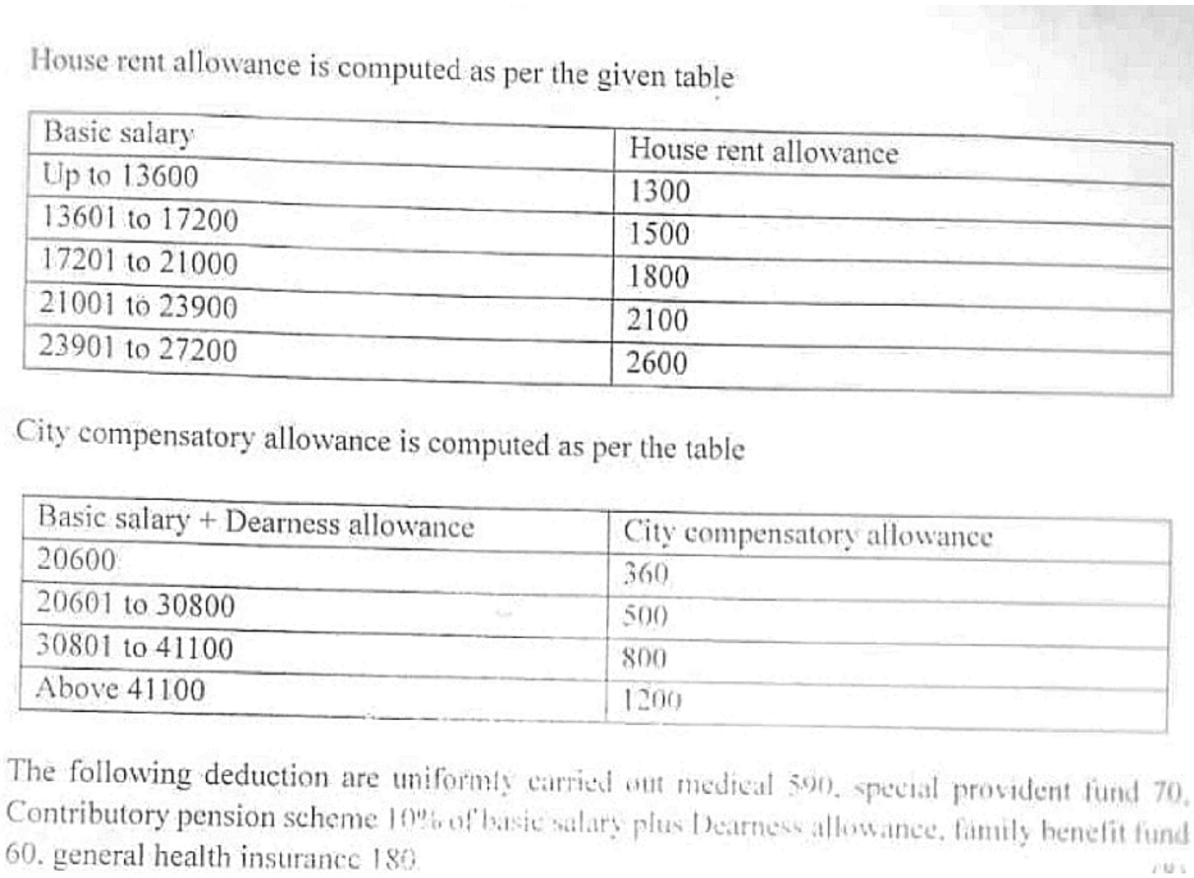
CANNY EDGE DETECTION

Edge detection technique is used to find boundaries of objects in an image by analysing varying brightness in the image. Here, it is being used for segmenting image. We have used Canny's Edge detection in our application.

After performing Edge Detection, we'll try to extract the document to be scanned from the image. Therefore, we'll find the document boundary by drawing contours around the edges detected and choose the appropriate contour. There will be irrelevant contours also.The area within the contour of the document is larger than the area enclosed by any other contours and we can use this fact to get the right boundary to extract our document.Thus we can get rid of the extraneous contours by selecting the contour of largest area.



FINAL CROPPED IMAGE



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