DSAA Project

Automation of slide matching

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Methods used :

Normalised Cross-correlation :

Cross correlation measures the degree of similarity between two images pixel by pixel. It calculates if the there is a correlation between the two images. We have calculated cross correlation pixel by pixel, then to calculate the correlation of the whole matrix, we have taken the mean of all the values. Then to normalise it, we have divided by the product of the standard deviations of the two matrices.

Adaptive Thresholding :

Simple thresholding follows the norm that if the pixel value is smaller than the threshold, it is set to 0, otherwise it is set to a maximum value. Now the simple thresholding uses a single constant threshold. But this might not be good in all cases, e.g. if an image has different lighting conditions in different areas. In that case, adaptive thresholding thresholding can help. Here, the algorithm determines the threshold for a pixel based on a small region around it. So we get different thresholds for different regions of the same image which gives better results for images with varying illumination. Additionally to the parameters described above, the method cv.adaptiveThreshold three input parameters:

The **adaptive Method** decides how the threshold value is calculated:

- cv.ADAPTIVE_THRESH_MEAN_C: The threshold value is the mean of the neighbourhood area minus the constant **C**.
- cv.ADAPTIVE_THRESH_GAUSSIAN_C: The threshold value is a gaussian-weighted sum of the neighbourhood values minus the constant **C**.

What we have used here is the second method . It betters the accuracy over the given test dataset.

Algorithm :

Our algorithm goes as :

-> Accepting the input slides set (of size N) and the input ppt set (of size M).

-> Now we run a nested loop of N*M where we check for each image in slides set the best fitting ppt match. The images are read using imread in grayscale . Now for each image in slide we go through N ppts to check the best check function.

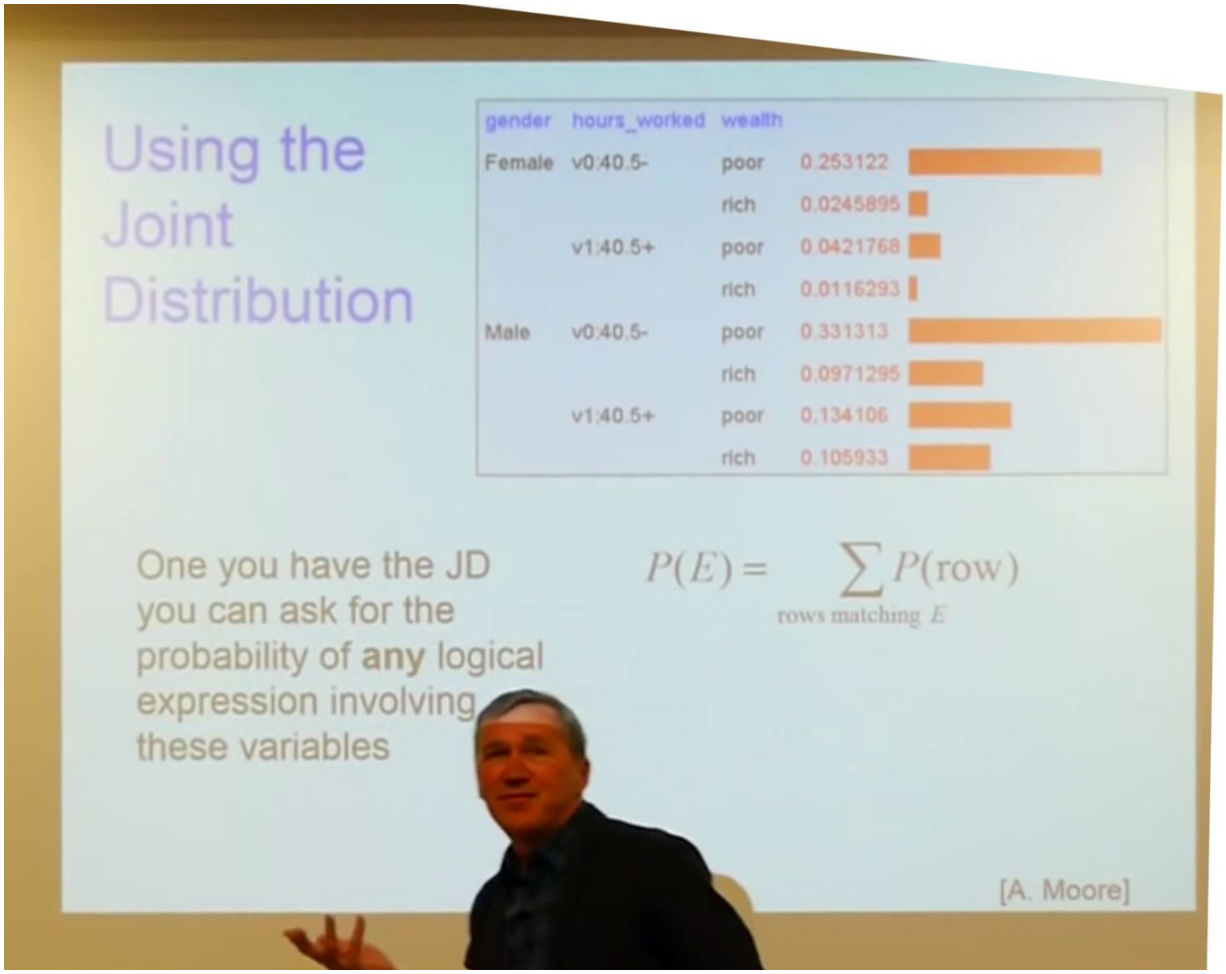
-> Now the check function works as first applying adaptive thresholding on both the images and then running the normalised cross correlation (we have written our normalised cross correlation, not used the default one, so it helps get better in efficiency, i.e, it gives match for one image really fast, what we observed each image took the worst case of running in 20 seconds.)

(-> Now for the highest matching cross correlation result we tried checking ones producing result close to this value using PSNR, MSE, SSIM but they rather caused disturbance to the accuracy . Hence we rejected all of them and went with just application of adaptive thresholding and then normalised cross correlation check .)

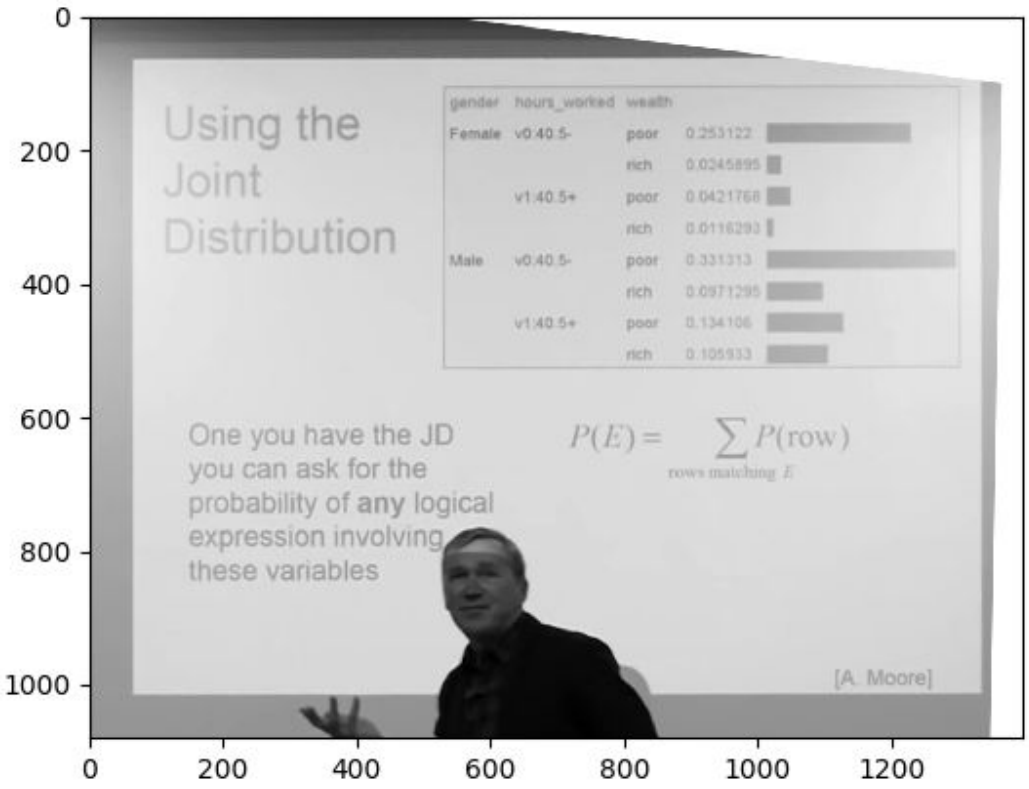
-> Final list of mapping is displayed out .

Application on an image slide :

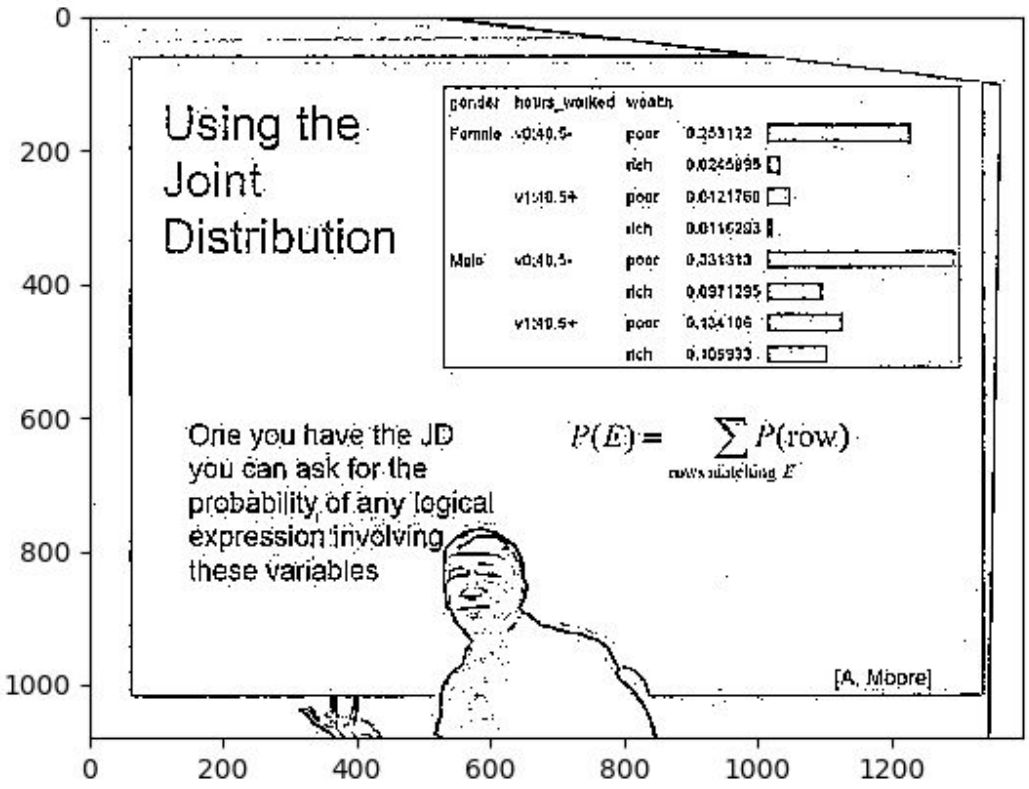
Initial slide image taken as an input :



Grayscale image scanning :



Application adaptive thresholding :



The best cross-correlation matching result found without the application of adaptive thresholding goes as 0.3568351984728727 while after the application it gives a better result enhancing the edges found : 0.5921690659016281.

Hence the image mapped to :