Imagine being able to automatically extract objects from images with utmost accuracy and efficiency. This is where image segmentation comes in, a crucial step in the field of image processing.

In this presentation, we will explore a groundbreaking research paper titled ‘A New Criterion for Automatic Multilevel Thresholding’ that proposes a novel approach to multilevel thresholding.

This paper introduces a unique cost function that considers both the discrepancy between the thresholder and original images, as well as the number of bits required to represent the thresholder image. By minimizing this cost function, we can determine the optimal number of gray-level classifications and threshold values, all automatically.

The best part? This approach boasts a significantly lower computational complexity than other methods, making it an attractive solution or real-world applications.

Join us as we dive into the details of this innovative approach and discover how it could revolutionize the field of image segmentation.

Thanks, chamod. As chamod explained earlier that’s the conventional approaches for bilevel image segmentation using the concept of entropy. But we know now, there are soo much draw back when it comes to computation complexity. Therefore, in this research paper, they’ve proposed a new approach, that is maximum correlation criterion.

Okay, this is the basic idea. How we can choose the optimal threshold value when it comes to bilevel thresholding. The idea behind is, we have to select the threshold value such that the total correlation of object or foreground and the background of the image maximized like maximum entropy. But here we’ve used correlation instead of using entropy. It’s because this concept can reduce lots of mathematical operations performed like logarithmic functions in the calculation of entropy.

That’s why in this new approach they propose this method. So that’s the basic idea behind the maximum correlation criterion. But this is not the end. They’ve proposed this new criterion in bilevel thresholding into multilevel thresholding. Here is that.

Multilevel thresholding.

Okay. What is multilevel thresholding. Basic idea here is , we are going to extract not only one object from the image, we are going to separate multiple objects from the image. That's why it is called multilevel thresholding. So, then we can have multiple classes and classifications and threshold values.

This is the deep background of multilevel thresholding.

When there is multiple threshold values or classification number rather than having single threshold value, the discrepancy between original image and the thresholder image is going to decrease while required bits to represent the image is increased.

One is as advantage. Another one is disadvantage. Therefore, there must be a compromise between these two factors. But in conventional MEC approach, that will not be addressed and that will cause to increase the time required to find the threshold values. Specially, in this case classification number (How many threshold values must be found) is given by a supervision.

In this novel approach, they introduce a cost function which takes into account these two factors.

This cost function will give us the quantify value to represent the cost incurred by the previous two factors. So we are going to minimize this value.

If we are able to find the minimum cost function value, while go through the different classification numbers, that's the place, where is the minimum cost function value, that's the optimal classification number we have to choose in this approach. That is the basic mathematical background of this approach.

Why this is better than the previous approach. The best part is here.

Actually we don't want to go through all the classification numbers we can have in a particular situation. It's because the thresholder image becomes more similar to the original one as the classification number increases. Hence, the discrepancy should decrease when the classification number increases. As you can see in this graph, this discrepancy value is not going to increase as the classification number is increasing. This value is going to reach zero. Isn't it?

Now here, according to cost function value, that value does not perform same movement as discrepancy value.

Cost value is decreasing and decreasing and decreasing. And there is a classification number where the cost function value is going to be minimized.

After this value, the cost value is going to increase. Therefore, we don't want to go through all the possible classifications we have in a situation. The only thing, we want to do is, when we go through from the beginning, once it is going to start the up side movement of the cost function value. We can wrap up the algorithm and get the threshold values and classification number automatically. That's why this new approach is drastically reduced the computational complexity and time wastage unlike conventional approaches. Sudaraka?