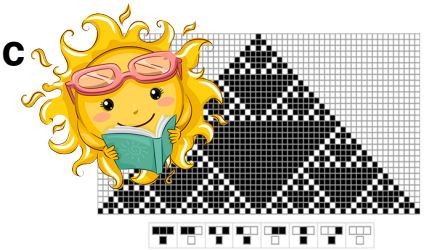
Multi-seed Image Segmentation for the Microscopic Image



Tanisha Ayach[†], Suchitra Behera[†], Sagarika Padhi[†]
Mentor: Nazma Naskar[⁕]

[†]Institute of Mathematics & Applications, Bhubaneswar, India
[⁕]Kalinga Institute of Industrial Technology, Odisha, India

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Image segmentation is one of the most important image processing techniques for biological images. Till now, various Cellular Automata(CA) rules have been used for segmentation. For updation of states of the cell, conditional rules using Von Neumann neighbourhood and Moore neighbourhood were used. In this work, instead of taking one seed point per image, multiple seed points are used for segmentation. A dataset of microscopic images has been taken and various segementation rules have been used for analysis.

A significant number of diagnostic procedures in modern clinical practise, as well as medical and biological research, now depend on the whole range of medical imaging technology. The manual procedure of screening microscopic slides requires subjectivity. Finding the boundaries of cells, cell nuclei, and histological structure in images of stained tissue with sufficient accuracy is referred to as segmentation in microscopic images. The goal of segmentation is to make an image representation simpler while also making it more significant and easier to examine. The regions must be relevant to shown objects or features of interest in order to be significant and valuable for microscopic image analysis and interpretation. The difficulty in accurately segmenting each cell, as well as the wide variability in the features of each component, make this a difficult job. Here in this proposed work, an existing dataset has been used for analysing multi-seed segmentation where the updation rule considers Von Neumann and extended Moore neighbourhood. In order for segmentation to be more prominent depending on the quality of the input images, thresholding plays a crucial role in image segmentation. Here, the updation rule using Von Neumann neighbourhood is based upon thresholding, where the same using Moore neighbourhood relies on maximum and minimum state. Results have been analysed from the images, segmented using these rules.

Segmentation simply refers to breaking up an image into various items or regions. The region of interest is labelled as the foreground in the segmentation, and the remaining portions of the image are labelled as the background. It takes a lot of time and effort to manually segment. The work is typically accomplished by marking the object of interest. However, this approach does not always produce correct results. We require an automatic image segmentation technique that produces precise results with minimal user input. Cellular automata are utilised in this automated procedure. An image is made up of pixels that can be thought of as cells, which is the basic idea behind employing cellular automata for automatic segmentation. The segmentation of an image is based on the image's characteristics, such as intensity and other properties that are derived from intensity.The classification of a pixel as foreground or background also depends on the neighbouring pixels. This is because the segmentation of the image also depends on the value of the intensities of the pixels in the pixel's neighbourhood. Edge detection and thresholding are the fundamental concerns in image segmentation. Various threshold values may result in segmented images with varying levels of clarity.

Wongthanavasu and Sadananda suggested a method based on a conditional rule for updating the state of the states. This rule can be represented as:

$$v_{c+} = \begin{cases} 0 & \text{if } \ v_c \leq v_{max} - v_{min} \\ v_{max} - v_{min}, & \text{otherwise} \end{cases}$$

In order to approach an edge detection strategy, A. Popovici and D.Popovici took into account the different state differences between the neighbouring pixels in accordance with the Von-Neumann idea and the central pixel. Here, all absolute state differences have been considered in the comparison. The central pixel's state will be 0 if the differences are more than the given threshold. Otherwise, it remains unchanged.This rule can be expressed as follows:

$$v_{c+} = \begin{cases} 0 & \text{if } \ |v_i - v_c| \leq \epsilon \\ v_c, & \text{otherwise} \end{cases}$$

The region of interest can be segmented more successfully by using cellular automata-based segmentation approaches. By using various transition rules, characteristics from various imaging modalities can be retrieved that could be useful in biological images.

Applying these above updation rules to multiple seeds,it is found that, the updation rule using Von Neumann neighbourhood often gives better result than the Moore neighbourhood e.g.,

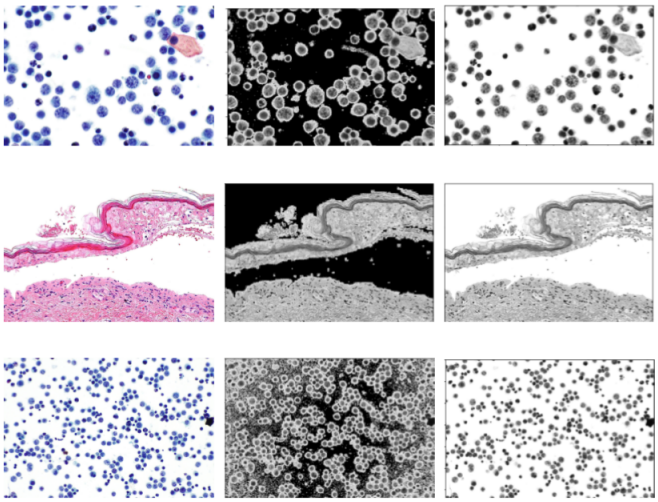

Figure 1: Original image, segmentation using Von Neumann CA & Moore neighbourhood CA