Maze Solving Using Image Processing

***Abstract*—** Maze solving using Image Processing can be done using morphological operations. It is a technique for solving mazes in which the maze is represented as a binary image, with the walls of the maze represented as white pixels and the paths through the maze represented as black pixels. The technique uses morphological operations, such as erosion and dilation, to extract the structure of the maze. Erosion is used to shrink the white pixels and remove small branches, while dilation is used to expand the black pixels and fill in small gaps in the maze. These operations are applied continuously until a solution is found.

***Keywords*- Image Processing, morphological operations, erosion and dilation**

I. INTRODUCTION

Maze solving using morphological operations is a technique that utilizes image processing techniques to solve mazes represented as binary images. The goal of the technique is to find the shortest path from the start point of the maze to the end point. The technique is based on the idea that by applying morphological operations to the binary image of the maze, the structure of the maze can be extracted and manipulated in such a way that a solution path can be found.

The basic steps for solving a maze using morphological operations are as follows:

1. First, the maze image is loaded and thresholded to convert it to a binary image.
2. The maze is now converted to binary image, with the walls of the maze represented as white pixels and the paths through the maze represented as black pixels.
3. Next, a morphological operation called dilation is applied to the binary image. Dilation is an operation that increases the size of the white regions in the image by adding pixels to the boundaries of the white regions.
4. After dilation, a second morphological operation called erosion is applied to the image. Erosion is an operation that decreases the size of the white regions in the image by removing pixels from the boundaries of the white regions. The purpose of this step is to remove any isolated white pixels that were created during dilation and to ensure that the white regions are connected.
5. Now the image has only one connected region which is the solution path of the maze.
6. Path can be traced from the start to end point.
7. Finally, the solution path found is superimposed on the original binary image of the maze to show the solution.

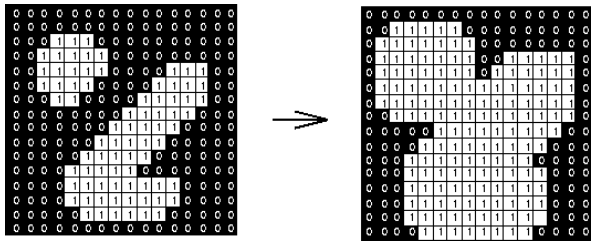
Brief Introduction of Morphological operations

Morphological operations are a set of image processing operations that process an image based on its shape. These operations are defined on the pixels of an image, where each pixel is either 0 or 1 (black or white). The basic morphological operations are dilation and erosion.

Morphological operations are often used in image processing tasks such as image segmentation, feature extraction, and object recognition. They are particularly useful in image processing tasks which involve binary images, or images which have been thresholded to create a binary image..

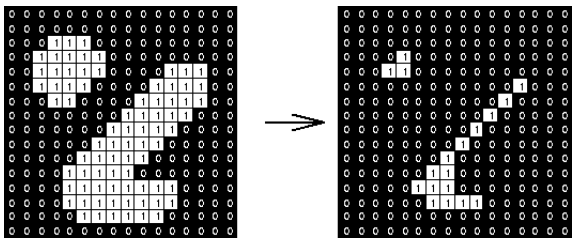
Dilation: Dilation is used to add pixels to the boundaries of an object in an image. For example, dilation can be used to connect broken parts of an object or to fill small holes in an object.

Dilation is defined by structuring element, which can be of different shape and size, Dilation is useful for image processing task such as image segmentation and object recognition, it can be applied multiple times for multi-scale dilation.

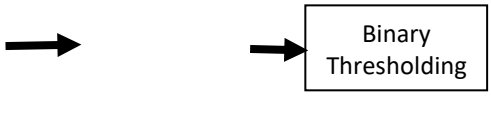


Erosion: Erosion can be used to remove pixels from the boundaries of an object in an image. For example, erosion can be used to reduce the size of an object or to remove small pixels or noise from an image.

Erosion is defined by structuring element, Erosion is useful for image processing task such as image segmentation, object recognition and noise reduction, it can be applied multiple times for multi-scale erosion.



II IMPLENMENTATION



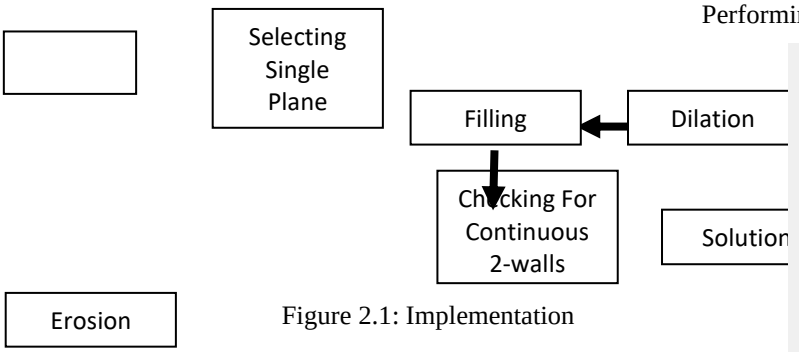
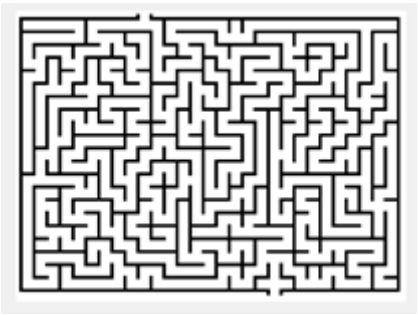


Figure 2.1: Implementation

1. Reading the Original Image:

First we will read the Original Image of the Maze.

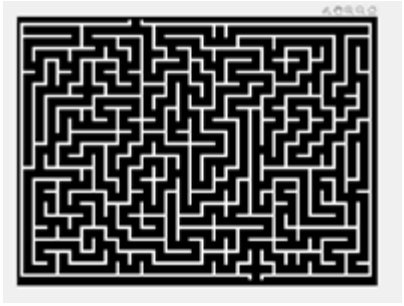


2. Selecting Single Plane:

We check whether the image is combination of RGB and Consider the Prominent Color-Plane

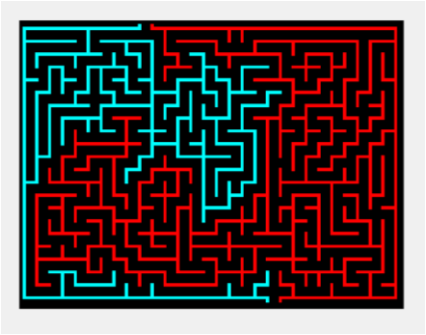
3. Performing Binary Thresholding:

The maze is now converted to binary image, with the walls of the maze represented as white pixels and the paths through the maze represented as black pixels.



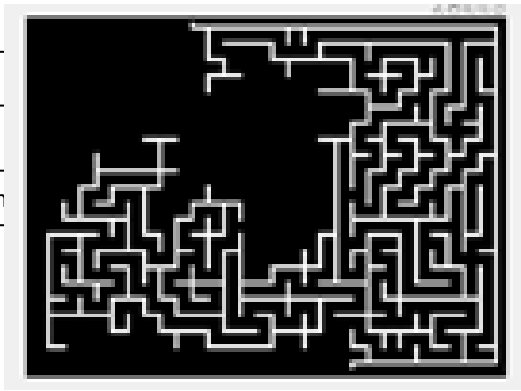
4. Checking For Continuous 2 Walls:

Now we will check whether the maze is formed with any 2 continuous walls



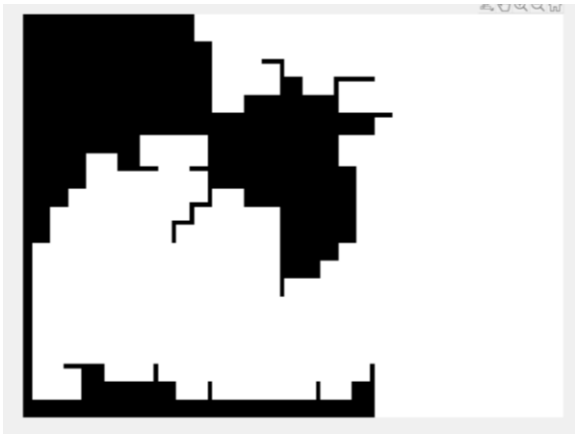
5. Dilation:

Performing Dilation on the Maze



6. Filling:

We fill the small holes of the resultant maze



7. Erosion:

We perform Erosion on the Resultant Image

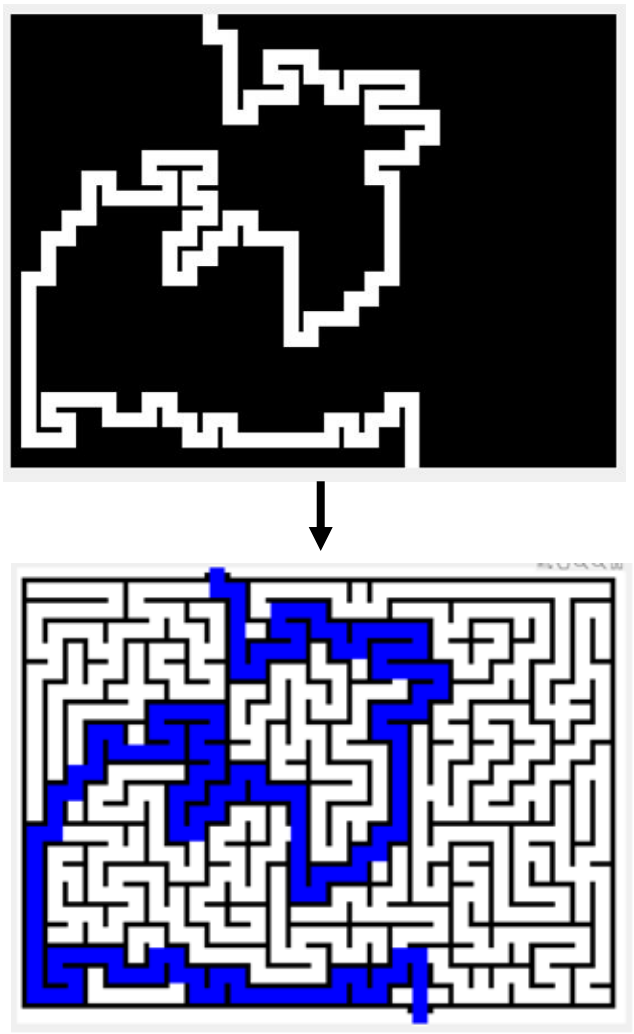
III. Implementation and Results

8. Solution:

We perform Subtraction of images here

That is we subtract eroded image from the Dilated Image to Obtain the Solution for the maze

Solution = Dilated Image – Eroded Image



Final Result: Showing the Path in the Selected Plane

IV. Conclusion

In this project we could finally able to find the path of maze using morphological operations. So we don't have to go for very complex machine learning algorithms to find path for simple mazes whose big picture is known to us in prior.

ACKNOWLEDGMENT

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V REFERENCES

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