# Algorithm Design

**EE, IITBSSP**

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# Overview

**Project Aim:**

To extract Star centroids from an image taken in outer space .

**Details:**

- Language used: Python
- Sequential algorithm used

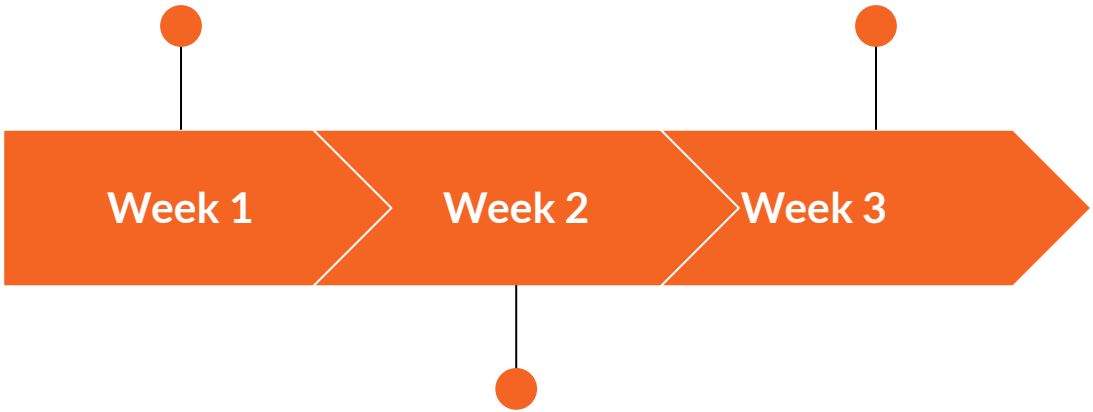
**Constraint**

Can only travel through the image once

# Weekly Progress

Read the paper provided, learnt about some technical terms

Implemented the code

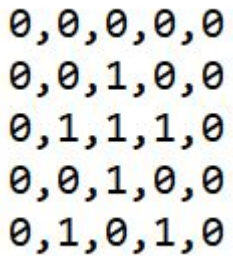



Prepared a flowchart, learnt basics of python

# Week 1

## Learnt about terms like:

- Sequential algorithms
- Images as arrays
- 4-connectedness
- Centroids



# Week 2:

Made a flowchart.

Started implementing the algorithm.

**Flowchart**

# Week 3:

Implemented the algorithm on python

Testing and debugging!!!

Code with outputs

Code

# The algorithm, explained

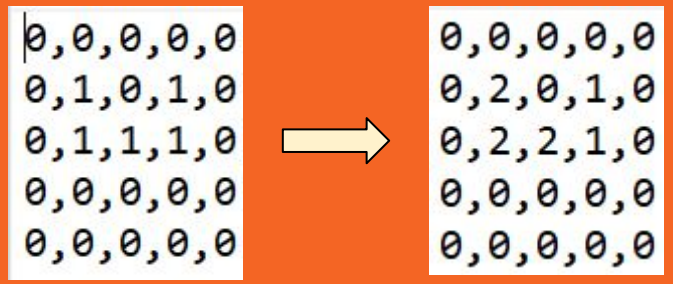
- Will add a 1-pixel wide padding to the image.
- Will travel through the image in a neighbour-to-neighbour pixel sequence, i.e without abrupt jumps.
- Sequence used: Left to right in alternative rows, next row when an extreme  reached.

# The algorithm, explained

- For each pixel with a non-zero value, check 4-connected neighbours which have been travelled through.
- Labelling the groups of pixels.
- Extract data into separate arrays.

# The algorithm, explained

- Clashing of tags/labels!
- A simple example:




- Solution: Maintain linked arrays with labels which clash and use them to make suitable changes in the extracted data.

# Expected output:

- Number of pixels of each star
- Net intensity of each star
- Sum of x-coordinates and y-coordinates of pixels, of each star

**Additional output generated:**
Plotted the original image and the centroids extracted by the code.

# Obstacles encountered

## Fault in logic !

Spotted a logical error in the clashing-elimination part of the flowchart.

Problem: Was missing certain indirect clashings.

## Solution:

Maintained another 2D array each row of which will have all clashed identities corresponding to one star

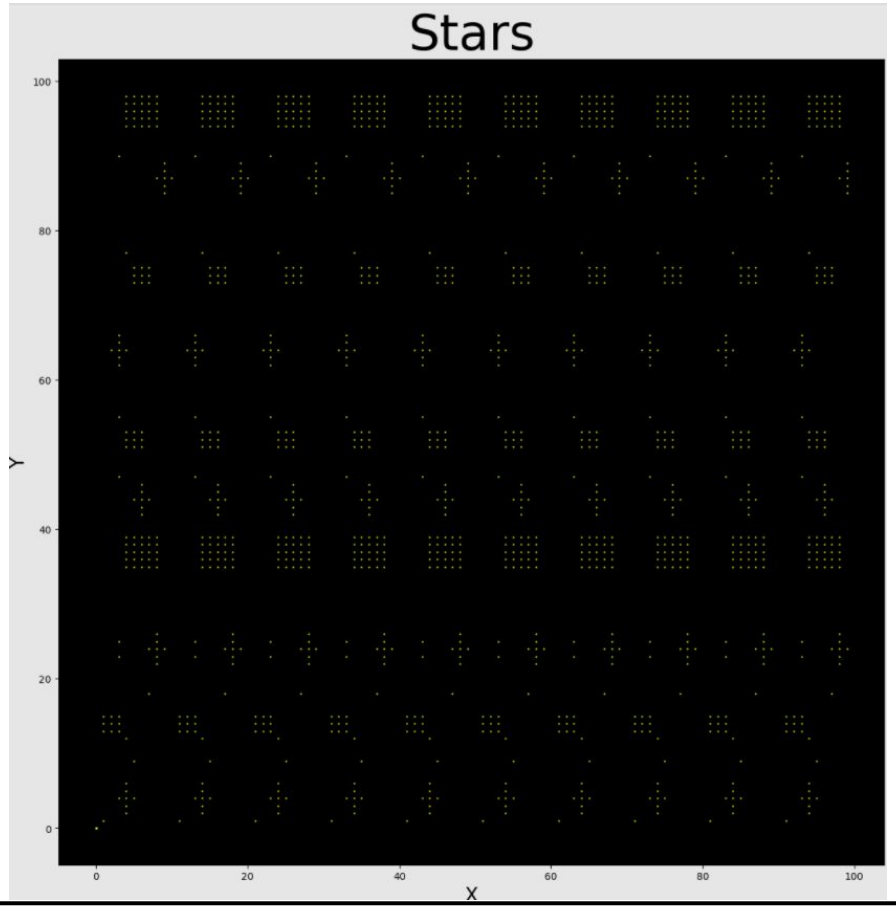
```
Array 1: [1 2 1 3 4]
Array 2: [3 5 6 7 8]
```

Example

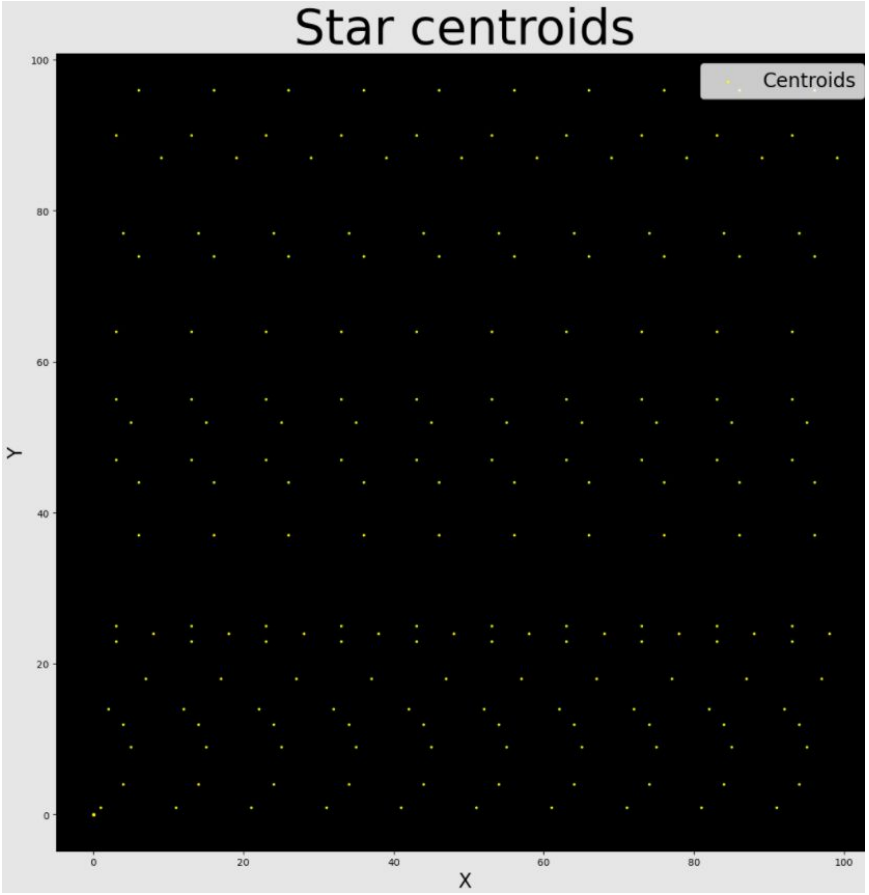
# The result

**Testcase:** Testcase

# The original image:



# Output:



# Final remarks

# The project

**1. As we have extracted the relevant data, centroids have also been determined.**

I have plotted them for a visual output.

**2. The problem statement asked for an algorithm for an input image with only binary values**

I have made it general, not just for binary values

**3. This algorithm considers 4-connectedness only.**

# Personal Gains

1. Learnt about star centroid extraction process, a few things about algorithms

2. Learnt python basics and implemented the code in an new language.

3. Had fun while coding and stress while debugging :)

# Feedback

1. The mini-project has overall been an amazing learning experience. Met new people, got to learn some things, and had fun.

2. Besides the actual project, the presentations in general meetings; and subsystem meetings also were a new thing.

3. Thanks to my mentor Aravind for clearing my doubts and going over my code and helping me throughout the mini-project. Also thanks to Millen for providing guidance while debugging.

4. Hope I get to do more of such work for SSP.

# Thank you