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## README - fe\_region\_growth.m

### Electrical Subsystem

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### fe\_region\_growth ()

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**Description:**

The function is used to get the coordinates of the centroid of each star in the input image. Here, the portion that is classified as a star are the set of 4-connected pixels whose value is above a particular threshold.

**Formula & References:**

The centroid of a star is defined as:

$$(x_{centroid}, y_{centroid}) = \left( \frac{\sum_{p \in region} I_p x_p}{\sum I_p}, \frac{\sum_{p \in region} I_p y_p}{\sum I_p} \right)$$

where  $I_p$  is the intensity of the pixel and  $(x_p, y_p)$  are the coordinates of the pixel.

The algorithm searches from the top-left corner of the image and looks for a pixel whose intensity value is greater than the threshold, once it finds the first pixel, it calls the fe\_get\_data function, which gets the weighted sums of the x and y coordinates and the sum of pixel intensities required. Once it is doing getting that information for the whole image, it simply divides the numerator with the denominator in the equation shown above and gets the centroids. This algorithm is called the Region Growth Algorithm.[1]

**Input parameters:**

1. **arr\_in\_img** : (matrix) - input image, with pixel location wrt the top left corner as indices ([i, j]); and the reading at the corresponding pixel as the value stored at [i, j]

**Output:**

1. **centroids\_st**: (matrix) - the shape is (no. of stars, 2), with each row having format  $(x_{center}, y_{center})$ .

## References

- [1] Alexander O. Erlank, *Development of CubeStar : a CubeSat-compatible star tracker*, 2013.