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Corresponding author: Felipe Leonardo Gómez-Cortés
fl.gomez10@uniandes.edu.co

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Weekly Activity Report
Week 3
A second algorithm using a random point catalog and the 1-Skeleton

FELIPE LEONARDO GÓMEZ-CORTÉS[1]
MASTER STUDENT
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JAIME E. FORERO-ROMERO[1]
ADVISOR

[1]*Physics Department, Universidad de Los Andes*

ABSTRACT

The new algorithm relies on a random set of points. The β-Skeleton is build over the junction set of points (observations plus random points).

Keywords: Beta Skeleton Graph, Random set of points

1. THE ALGORITHM

The main goal of this project is to identify voids in the large scale structure of the universe, using the nobel method in astrophysics: the β-Skeleton graph. In order to develop the code, a toy model catalog structure is used, then a second catalog of random points populates the same volume, the graph is calculated and then the voids are identified as the second catalog points without connections with the first catalog points.

We start with a sample of N points randomly placed inside a cubic box of lenght L. (Figure **??**. In the middle of the box there is a spherical void, i.e. an spherical region without points. This set of points is called "the observed catalog" (**OC**). This toy model will represent -in a gross aproximation- the LSS with galaxies and voids.

Then another set of N random points populates the whole box, without restrictions. This set is called "the random catalog" (**RC**). It will populate even the void region. It's only necesary to know the volume of the OC and the number of points N to create the RC.

The NGRAPH library can operate over a single set of points. This set is called "the full catalog" (**FC**). This set of points is created using the `vstack` python function. The first N elements are the RC points, the last N elements are the OC points, then the FC has 2N elements.

The 1-Skeleton graph is calculated over the FC. Runing the code over a FC of $\sim 10^4$ points in a Core i5 (2nd gen.) Linux machine, it takes 192 seconds to complete the calculus. The result is stored as the Full Catalog Beta Skeleton Graph (**fcBSk**).

The fcBSk is chopped to the half, we are interested about the RC points that are not connected with the OC points. Then a droplist is created as the subset of connections where the second point belongs to the OC, i.e., its index is greater than N.

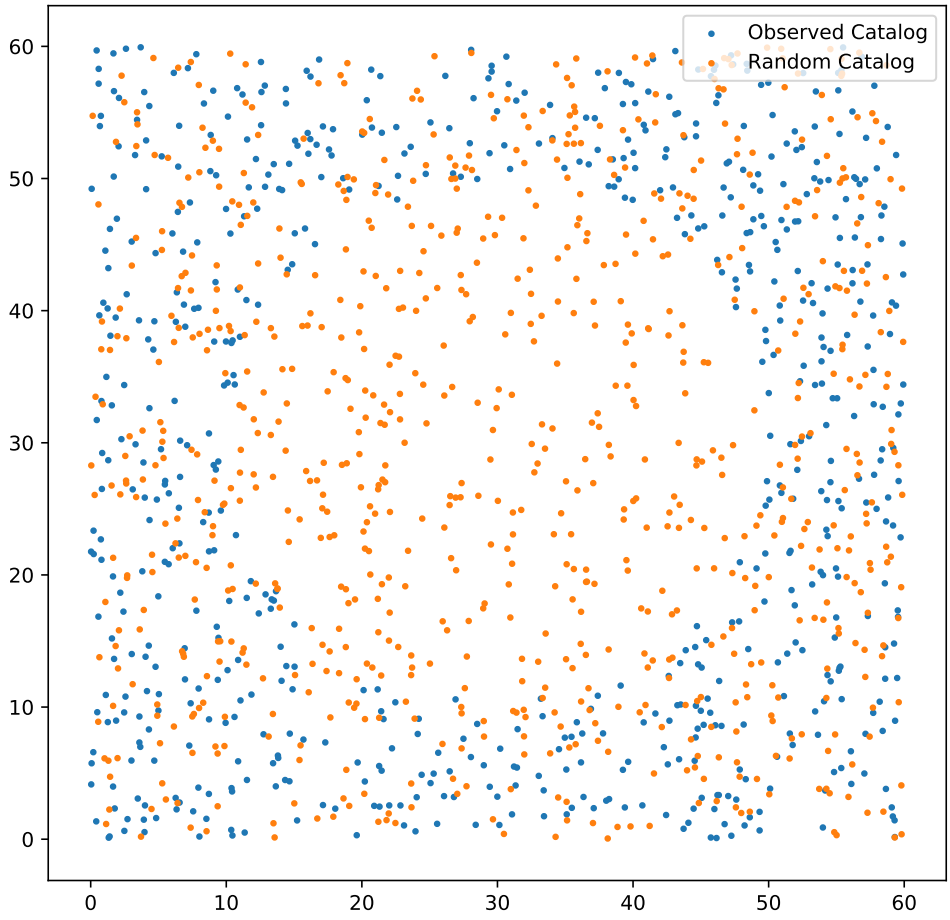

Figure 1. The Algorithm uses two sets of points: The Observed Catalog (LSS like in blue with a spherical void in the middle) and the random Catalog (orange).

Using the python `set` class, its easy to find the complement of the droplist in the fsBSk. After droping the RC points connected with the OC, it remains the points inside the void.

2. CONCLUSIONS

This new algorithm looks promising. Must be fully developed.

REFERENCES

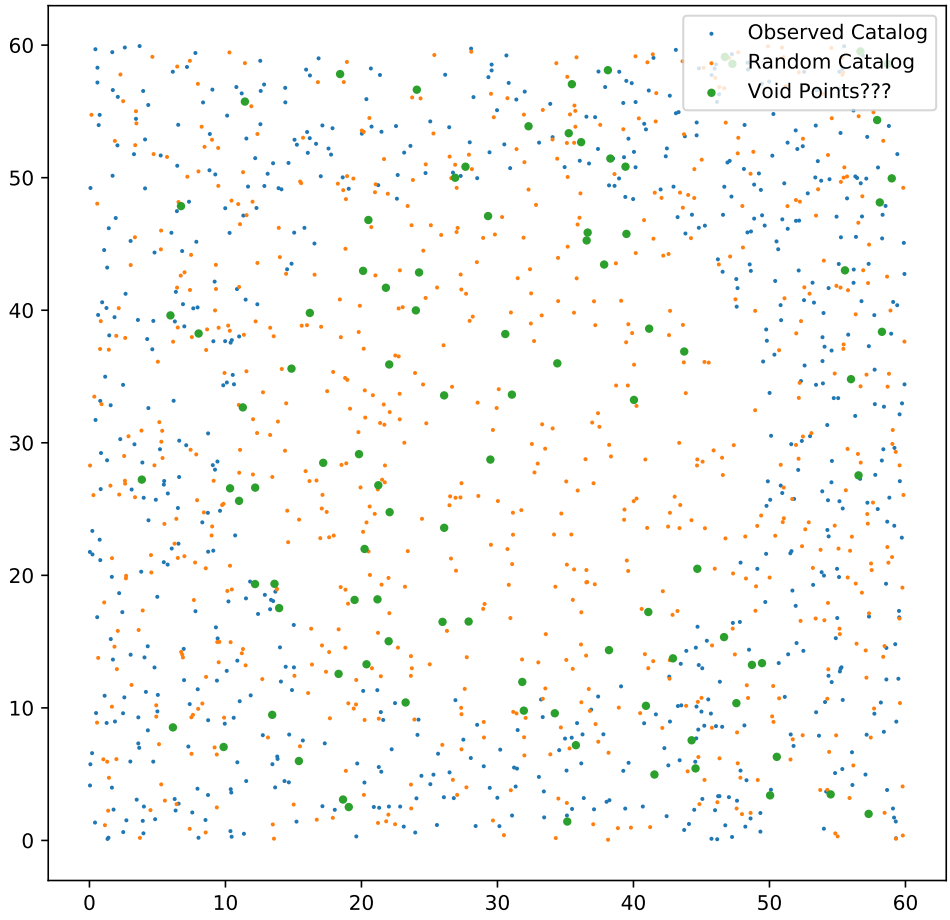

Figure 2. The Algorithm is currently under development. It fails to recognize void points (Green).