Ryan Thompson: Computer Science
Mentor: Brittany Fasy -- Computer Science
Applying Techniques from Topological Data Analysis on a Celestial Data Set: The Bigger Picture

As the field of Topological Data Analysis (TDA) continues to grow and develop, there are an increasing amount of applications that lend themselves towards this type of data analysis. This research applies the processes of TDA on a celestial data set provided by the Sloan Digital Sky Survey, with the hopes to help show and demonstrate the galactic uniformity that has past been observed. In order to achieve this, the large point cloud must first be parsed into different groups, or "windows", that focus on a select spatial region. This allows for the scope to be narrowed to these smaller, computational manageable sectors. Once these viewing areas are established, the methods of TDA can be employed on each individual region, ultimately producing a persistence diagram that then acts as a descriptor for that chosen window. In order to best sample this data set, two methods will be used: cubical decomposition and a random "cookie-cutter" approach. The number and size of the cubes and "cookies" will be varied to ensure that all aspects of the set are captured. The diagrams that will then be created for each region are able to be compared and contrasted, revealing the spatial nature that is inherently present in these celestial manifolds.