Final Report

This quarter, as part of the Directed Reading Program (DRP), I had the opportunity to delve into the fascinating field of robust statistics under the guidance of my mentor, Ethan Ancell. This experience provided a solid foundation in the theoretical principles of robust methods while also challenging me to apply these concepts to practical problems.

The quarter began with an introduction to the limitations of classical statistical methods, particularly their sensitivity to outliers and deviations from model assumptions. I learned about robust estimators, including the median, M-estimators, and robust regression techniques. We explored their mathematical properties, such as breakdown point, influence function, and efficiency, which quantify the robustness of these methods. Additionally, I proved several mathematical formulas, which deepen my understanding of their theoretical foundations.

For one of my projects, I implemented a robust regression analysis using simulation. The project aimed to compare the performance of robust estimators to least-squares regression in the presence of outliers. I utilized R programming to conduct the analysis, which included generating contaminated datasets, applying robust methods, and visualizing results. The outcomes highlighted the advantages of robust regression, particularly its ability to maintain accuracy and interpretability when classical methods faltered.

At the end of the quarter, I delivered a final presentation summarizing my learning journey and project findings. This presentation included an overview of robust statistical concepts. The experience enhanced my communication skills, as I had to clearly explain complex topics to my audiences.