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Spherical Point Processes with application to the distribution of gamma ray bursts
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The project originated with Prof. Adrian Baddeley and his research interest in analysing spatial point patterns. He has written a package called spatstat in R and I initially familiarised myself with some of the techniques used in the analysis of spatial data.

It was noted that there are significant limitations, often due to historical reasons, as to what is possible in the analysis of spatial data. One of which relates the restriction to problems relating to two dimensional rectangular regions. It was intended that the project was to be on the analysis of astronomical data relating to the clustering of galaxies as this presents some interesting challenges, namely that of analysis of clustering of points in three dimensional space. However as the title suggests, this didn't happen. It was decided that a much better problem was that of analysing the distribution of gamma ray bursts (GRB's). Such a topic would involve the analysis of points on a sphere which is a non-trivial.

Currently very little is known of gamma ray bursts and the primary question of interest is if they have an isotropic distribution. If they are isotropic then this provides evidence for extragalactic models. In my project I used the data from the BATSE project which was conduced by NASA aboard the Compton Gamma-Ray Observatory.

My statistical analysis included the application of mixture models to classify the durations of the bursts into two classes. The use a paper by Peter Hall regarding Kernel density estimation applied to spherical data. A study of hypothesis test for uniformity for spherical data that proved to be flawed and the use of Adrian's spatstat to create point process models which involved constructing a likelihood so one can perform analysis of deviances between different alternatives. The latter proved to be of great success both in the optimal nature of the statistical test (due to the construction of a likelihood function) and the way that the true intensity of the point process can be separated from the observed intensity.

Overall I really enjoyed this project as it was something new and original. It was a rewarding experience to critically analyses journal articles in the development of my project. I would like to thank AMSI and The University of Western Australia for providing me with the opportunity to undertake this research project.

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See http://www.ice-em.org.au/students.html#scholarships2007