Project Proposal- STAT 511

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Title: Numerical methods for maximum likelihood estimation of GLM parameters

Motivation: I have been interested in numerical computational techniques for a long time. When this topic arose during class discussions, it seemed to be the obvious choice. During my undergraduate studies, I got a chance to do interesting projects like Bootstrapping in the linear regression model and application of recursive Bayesian particle filters involving a sequential MCMC procedure. I believe that these projects played a key role in honing some of my computational techniques and simulation skills which may be required for a project like this.

Abstract: In the context of Generalized Linear Models, MLE for the parameters can't be determined analytically in most cases. This is due to the fact that the system of equations is usually non-linear, when the score function is set to zero, and can't be solved for the unknown parameters in the closed form. Therefore numerical methods for computing the roots of the score function are required. Various such methods have been developed. This project, in particular, aims at illustration of two popular methods, viz. Newton-Raphson method and the Fisher scoring algorithm. Both the methods are iterative and the computational efficiency will be compared under various distributions and link functions in GLM's.

Tentative outline of the project:

1. Literature Survey
2. Simulation Study in R and relevant pseudo-codes
3. Results and Conclusions
4. Future Scope

Note: If time permits, I would also like to do a small simulation study on Bayesian Linear Models.