

Project Suggestions for APPM 5720: Computational Bayes

Here follows a list of projects you may do for the project component of this class. They are just suggestions. You can instead come up with your own project that is either original work or in the style of these projects where you take a deep dive into a paper using Bayesian methods. For all of the “paper reading projects” listed below, you are encouraged to use additional resources to aid in your understanding!

1. Read and summarize Malay Ghosh’s paper *Objective Priors: An Introduction for Frequentists*. (<https://arxiv.org/pdf/1108.2120.pdf>) Do not get too technical. Imagine you are writing a 3-4 page summary for someone to get the basic ideas across without too many equations. (You are not restricted to this page range but I am just trying to give you the idea to not write a book!) Pick one method of finding an objective prior from the paper. Write this one up in a separate paper in a little more detail and implement it for a model of your choice.
2. Read and summarize Friel and Wyse’s paper *Estimating the Model Evidence: A Review*. (<https://arxiv.org/pdf/1111.1957.pdf>) Select any two methods of estimation discussed in the paper, write them up in detail, and implement and compare them on a model of your choice. (You may even use models/examples from the paper. In this case, try to reproduce the results!)
3. Read and briefly summarize DuMouchel’s paper *Bayesian Data Mining in Large Frequency Tables, With an Application to the FDA Spontaneous Reporting System* (<http://www.stat.columbia.edu/madigan/DM08/duMouchelAmStat.pdf>) in 1-5 pages. In a separate document, give a detailed write up of Section 3.3 (Empirical Bayes) and carry out the approach of this section on a data set of your choice.
4. Read Franzén’s paper *Bayesian Inference for a Mixture Model Using the Gibbs Sampler*. (http://gauss.stat.su.se/site/pdfer/RR2006_1.pdf) Reproduce the analysis of “Example 1” in Section 5.1. Write up your results in a tutorial style stand alone paper. (i.e. Put some front matter in explaining the goal and give a lot of detail. Do not just hand in plots and code!)
5. Read An, Kang, Song, and Hall’s paper *A Bayesian hierarchical model with novel prior specifications for estimating HIV testing rates*. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4845103/pdf/nihms-778831.pdf>)

Write up Sections 2 and 3 in a tutorial style stand alone paper. Briefly state the context of the problem but then focus on the mathematics and the model. Your target audience consists of your classmates— elaborate wherever you can where the paper becomes hard to read. You are encouraged to establish your own notation, especially if it helps to make things look more “familiar”.