PC Tutorial 2: Bayesian Estimation of Linear Regression Models

1. Consider the house price example discussed in the textbook and in the lecture. Try to replicate the results. To this end, proceed in the following steps.

   (a) Write a Matlab function `normgam_posterior.m` that computes the normal-gamma posterior of a multiple regression model with normal-gamma prior. Specifically, the user should supply data y and X as well as prior parameters $\underline{\beta}$, $\underline{V}$, $\underline{s}^2$, and $\underline{\nu}$. Then the function should compute and hand back posterior parameters, posterior means of β and h, and posterior variances of β and h.

   (b) Write a Matlab script that opens the data file hprice.txt, sets informative prior parameters $\underline{\beta}$, $\underline{V}$, $\underline{s}^2$, and $\underline{\nu}$ (e.g., those discussed in the lecture), calls the function `normgam_posterior.m`, and displays the results.

   (c) Add to the Matlab script a part that sets noninformative priors, calls the function `normgam_posterior.m`, and displays the results. Note: make sure that the function can handle zeros for $\underline{V}$ and $\underline{\nu}$.

   (d) Write a Matlab function `t_interval.m` that computes symmetric $100 * (1 - \alpha)\%$ intervals for each of the k random variables of a k-dimensional t distribution with parameters μ, Σ, and ν.

   (e) Add to the Matlab script a part that calls the function `t_interval.m` and displays 95% and 99% HPDI intervals for β_1 to β_5.

   (f) Add to the Matlab script a part that computes $p(\beta_i > 0|y)$, $i = 1, \ldots, 5$, both based on the informative and noninformative priors.

   (g) (*) Add to the Matlab script a part that computes posterior odds ratios for models $M_i : \beta_i = 0$ compared to the unrestricted model.