STAT 605 Project Proposal

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Project Overview

In the conditional density regression problem, we have data, $(y_i, x_i), i = 1, \dots n$, and we want to estimate the conditional density of $y|x$. The general approach models the conditional density of $y|x$ as a mixture of linear regressions, with covariate-dependent weights that are included through a logistic link function.

$$f(y|x) = \sum_{h=1}^{K} \pi_h(x) N(y|\mu_h(x), \sigma^2) \tag{1}$$

where $\mu_h(x) = x'\beta_h$ and $\pi_h(x) \propto \exp(x'\gamma_h)$. In this project, we want to try to solve this problem by forming variational approximations to estimate the conditional density. Since there is limited support for Bayesian density regression in `R`, one of the long term goals is to write a public package that incorporated some of these models.

Some papers and related work I will be looking into include the following:

Regression Density Estimation Using Smooth Adaptive Gaussian Mixtures

A Comparison of Variational Approximations for Fast Inference in Mixed Logit Models