New Bayesian approach to simultaneous estimation of multiple quantiles with applications to some business problems

Abstract

Modeling quantiles of a dependent variable's probability distribution as a function of a given set of independent variables is an interesting alternative to the more commonly known Least Squares Regression approach. Quantile Regression is a powerful technique because knowing all quantiles is in principle equivalent to knowing the entire conditional distribution of the dependent variable. In this thesis, a new Bayesian approach is proposed for simultaneously modeling multiple quantiles of a dependent variable as a function of independent variables. The idea is motivated by a method suggested by Yu and Moyeed (2001) for the single quantile case. Chapter 1 in the thesis provides the background to this problem. A significant gap in the statistical literature is addressed in chapter 2 by providing an asymptotic justification for the method used by Yu and Moyeed (2001). This theoretical development lays the foundation for the main method proposed in this thesis for handling the multiple quantile case. This method which is discussed in chapter 3, is computationally simple and flexible in accomodating various types of model forms and prior specifications. Further, it is amenable to some interesting and useful extensions. Two important extensions are presented in chapter 4, viz (i) hierarchical modeling of latent variables and (ii) joint modeling of multiple variables. The findings in this work are supported by adequate simulations an demonstrated with real life examples motivated from business problems. The methods developed pave way for numerous potential applications and theoretical developments that can be pursued for future research. These are discussed in the concluding chapter.