Introduction

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The lmls package generalizes the standard linear model to a location-scale regression model, which contains predictor variables for both the location parameter $\boldsymbol{\beta}$ and the scale parameter $\boldsymbol{\gamma}$. There are various extensions to this framework that allow for more complex modeling approaches and might be the right choice for specific applications.

This document introduces the *Bayesian Ridge Regression* model as one such alternative. In contrast to the Frequentist approach to estimation that often requires strict assumptions to the underlying theoretical model and delivers primarily point estimates, a Bayesian model provides information about the complete Posterior distribution. In addition to point estimates such as the Posterior Mean or the Posterior Mode, further summary statistics such as quantile estimates can be easily obtained. Moreover, Markov Chain Monte Carlo sampling can be used in situations, when analytical solutions do not exist and standard numerical procedures fail to compute e.g. the Posterior Mean.

Although the flexibility of the location-scale regression model is in some way restricted by its parametric form, a penalty on the coefficient vectors helps to avoid overfitting if a large number of covariates is included in the model. The L2-Penalty that is induced by Ridge Regression corresponds to (multivariate) normal Prior distributions in the Bayesian context and is therefore often convenient from a mathematical perspective as well as for interpretation.

The following sections build upon this motivation: Chapter **??** explains the mathematical theory in more detail and provides a general overview of the hierarchical Bayesian structure. Chapter **??** introduces the `R` package `asp21bridge` that implements the statistical estimation and provides many more features in order to extract as much information as possible from the collected data. Finally, chapter **??** illustrates the effect of penalized Bayesian estimation across different scenarios and, thus, serves as first guidance in which cases the `asp21bridge` package can be a worthwhile alternative to well established estimation approaches.