

Bayesian Estimation of Monotone Single Index Models

Description and Intended Functionality

This package intends to perform a Markov Chain Monte Carlo algorithm to estimate a monotone Single index models of the form:

$$y = g(x^\top \beta) + \epsilon$$

where y : response, x : p-dimensional predictors, β : p-dimensional coefficient vector, ϵ : independent $N(0, \sigma_\epsilon^2)$ random errors, g : unknown monotone link function. To construct a prior on g , we consider the basis expansion: $g(x) = \sum_{l=0}^L \xi_l \psi_l(x)$, where $\psi_l(x) = \int_{-1}^x h_l(t) dt$, h_l is a B-Spline basis function of order 2. Then, g is monotonically increasing if and only if $\xi_l \geq 0 \forall l$, thereby enforcing the monotonicity constraint in an equivalent way.

The `monotoneSIM` function rescales the covariates and β so that $|x^\top \beta| \leq 1$. Then an MCMC algorithm is performed to generate samples from the conditional posteriors of the unknown parameters, ξ , β , σ_ϵ^2 . The obtained sample of β is back-scaled to get β corresponding to the original covariates. The function also returns the estimated monotone function g for a grid of x values based on ξ obtained from the algorithm.

Installation

To install this package from Github, run the following in your R console:

```
devtools::install_github("das-snigdha/monotoneSIM")
```

To Do

The following tasks shall be performed during the remaining of the semester:

- Perform Compatibility Checks on user supplied input.
- Select equispaced `knots`, u_0, u_1, \dots, u_L between -1 and 1, if not supplied.
- Select grid of x values, `grid.x` between -1 and 1 of length `size.grid.x`, if not supplied
- Perform scaling of covariate matrix `X` and supplied `beta.init`.
- Perform back-scaling on obtained `beta`, to get coefficients corresponding to unscaled `X`.
- Create a vignette to demonstrate the usage, if time permits.