

# Structured Additive Regression Models: An R Interface to BayesX

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Structured additive regression (STAR) models provide a flexible framework for modeling possible nonlinear effects of covariates: They contain the well established frameworks of generalized linear models (GLM) and generalized additive models (GAM) as special cases but also allow a wider class of effects, e.g., for geographical or spatio-temporal data. This allows for the specification of complex and realistic models that can typically be conveniently estimated using Bayesian inference based on modern Markov chain Monte Carlo (MCMC) simulation techniques or a mixed model representation.

Although there is already a quite extensive existing toolset in R supporting GLMs and GAMs, many of the more complex models from the STAR class, especially those utilizing Bayesian inference, are currently not easily available. They are, however, provided in the standalone software package BayesX: a very comprehensive Bayesian semiparametric regression toolbox based on open-source C++ code. BayesX not only covers models for responses from univariate exponential families, but also models from non-standard regression situations such as models for categorical responses with either ordered or unordered categories, continuous time survival data, or continuous time multi-state models.

Since there has been increasing interest in an R interface to BayesX, the already existing CRAN package **BayesX**, which previously provided only functions for exploring estimation results, is now extended to a full interactive interface. With the new version of the package, STAR models can be conveniently specified using R's formula language (with some extended terms), fitted using the BayesX binary, represented in R with objects of suitable classes, and finally printed/summarized/plotted.

The talk outlines the usage of the R interface to BayesX and its application in complex regression problems, emphasizing its strength in estimating and visualizing models with geographical effects.

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