

Semiparametric Regression with R

Spring 2018 Syllabus

A. Instructor:

Jaroslaw Harezlak, Associate Professor

Contact information:

Department of Epidemiology and Biostatistics
Indiana University School of Public Health-Bloomington
1025 E 7th St., C107
Bloomington, IN 47405

Email: harezlak@iu.edu

Office hours: By appointment

B. Online course

February 19, 2018 till June 15th, 2018

C. Course Description:

Semiparametric regression methods build on parametric regression models by allowing more flexible relationships between the predictors and the response variables. Examples of semiparametric regression include generalized additive models, additive mixed models and spatial smoothing. Our goal is to provide an easy-to-follow applied course on semiparametric regression methods using R. There is a vast literature on the semiparametric regression methods. However, most of it is geared towards researchers with advanced knowledge of statistical methods. This course explains the techniques and benefits of semiparametric regression in a concise and modular fashion. Spline functions, linear mixed models and hierarchical models are shown to play an important role in semiparametric regression. There will be a strong emphasis on implementation in R with a lot of computing exercises. This course is based on the upcoming book ‘Semiparametric Regression with R’ by J. Harezlak, D. Ruppert, and M.P. Wand (Springer).

D. Prerequisites:

Linear regression course. Some familiarity with R statistical computing environment is assumed. Students who are uncertain about their level of preparation are encouraged to contact the instructor.

E. Educational objectives:

At the end of the course students:

- will know how to model in a principled way nonlinear relationships between the predictor and outcome variables
- will be able to apply appropriate methods using modern computational algorithms

F. Online Modules (each module consists of 2-3 videos covering the material, 1-2 lab videos, 1 homework assignment and a discussion)

1. Introduction to Semiparametric Regression
2. Linear Regression Methods Review
3. Introduction to Smoothing
4. Linear Mixed Models
5. Smoothing Parameter Selection
6. Linear Mixed Models and REML
7. Confidence Intervals, Confidence Bands and Hypothesis Testing
8. Simple Semiparametric Models
9. Additive Models
10. Semiparametric Mixed Models
11. Interaction Models
12. Introduction to Generalized Linear Models (GLM)
13. Generalized Additive Models
14. Bivariate and Spatial Smoothing
15. Measurement Error Models

G. Required and Recommended Text:

No required text. Most of the material will be taken from **(HRW)**

(HRW) “Semiparametric Regression with R” by J. Harezlak, D. Ruppert and M. Wand, Springer (to appear in 2018)

Some helpful books:

(RWC) “Semiparametric Regression” by D. Ruppert, M. Wand and R. Carroll, Cambridge University Press (2003)

(SW) “Generalized Additive Models: An Introduction with R” by S. Wood, Chapman and Hall/CRC, 2nd edition (2017)

H. Evaluation and Grading:

Students will be evaluated based on their performance on the homework assignments (40%), class participation (10%), final presentation (20%), and the term paper (30%).