

Case Study 1-Group 1

Melody Jiang, Irene Ji, Keru Wu

Department of Statistical Science, Duke University

01/21/2019

Introduction

- ▶ Data: A study by Longnecker et al. (2001), comprised of 2380 observations of pregnant women.
- ▶ Goal: Assess how DDE and PCBs relate to risk of premature delivery.

Data Preprocessing

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- ▶ Standardize continuous variables.
- ▶ Missing data: Multivariate Imputations by Chained Equations (MICE package in R) for covariates. Only one missing in continuous, deleted.
- ▶ Limit of Detection (LOD): Exists in some PCBs. All LODs are negligible compared to data scale (e.g. 0.01 compared to 0.3)

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- ▶ Check Multicollinearity: Variation Inflation Factor (VIF).

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- ▶ Nonlinear Model

Model

- ▶ Generalized Additive Model (GAM)

$$g(Y_i) = \beta_0 + \sum_{j=1}^m f_j(x_{ij}) + \sum_{k=1}^l \beta_k z_{ik}$$

- ▶ Choice of g : probit or logit.
- ▶ $x_{.j}$ s include DDE, PCBs, maternal age, etc.
- ▶ $z_{.k}$ s include categorical variables and some confounding variables.

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- ▶ Bayesian Generalized Additive Model

$$g(Y_i) = \beta_0 + \sum_{j=1}^m f_j(x_{ij}) + \sum_{k=1}^l \beta_k z_{ik}$$

- ▶ Adds priors on the common regression coefficients, priors on the standard deviations of the smooth terms.

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- ▶ Approach 1: Bayesian Hierarchical Model
- ▶ Approach 2: Mixed Effect / Random Effect Model
- ▶ Generalized Additive Mixed Model (GAMM)
- ▶ Bayesian GAMM

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- ▶ Including Interactions: Bayesian Factor Analysis (Ferrari, F. and Dunson, D.B. 2019)