Agenda 2/19/2016

1. Oral exam slides/ ENAR presentation
2. New PERCH Quantitative Method - Bayesian regression with shrinkage prior

**Challenge: 230 ~ 1 billion 🡪 quadratic exponential?**

1. Shrinkage priors:

Rescaled spike/slab prior (Ishwaran and Rao, Ann. Statist. 2005)

Horseshoe prior (Carvalho, et al., Biometrika 2010)

Dirichlet-Laplace prior (Bhattacharya, et al., JASA 2015)

2) Parameterization:

|  |  |  |
| --- | --- | --- |
|  | Pro | Cons |
| Bahadur (μ, ρ) | - Marginal regression.  - Closed form and Fast Evaluation of the joint density. | - Less reasonable to assume higher order correlation ρ being independent of covariates. |
| Log-linear (Θ1,Θ2) | - Closed form and Fast Evaluation of the joint density.  - Conditional odds ratio Θ2 is reasonable to be independent of covariates. | - Conditional regression. |
| Log-linear (μ,Θ2) | - Marginal regression  - Conditional odds ratio Θ2 is reasonable to be independent of covariates. | - Requires solving a system of non-linear equations to evaluate each joint density. |

1. Current projects towards graduation in time
2. The (μ, π) PQ method:

**Etiology Estimation**: Bayesian hierarchical model with

a) MC integration to approximate marginal likelihood with (μ, π).

b) Partially informative prior to incorporate prior information on π.

c) MCMC algorithm with “mirror” proposal.

*Accomplished:* algorithm implementation, 3-dimensional simulation study, draft manuscript

*To-do:* higher dimension simulation, data application 🡪 publication

**Marginal Regression:**

1. Parameterize (μ, π) to (μ, γ) where Υ is π scaled by sum of μs.
2. Regression MCMC algorithm.

Programmable but very slow.

*To-do:* parallel computation, collapsed sampling

1. Iterative censoring imputation for survival prediction/inference

Algorithm: (treat α and α\* as tuning parameters)

1. Random multiply impute YΔ=0 with Y\* = YΔ=0 + exp(α)
2. Train ensemble predictor with (YΔ=1 ,Y\*, X), then predict YΔ=0, denote as Y\*\*
3. If (Y\*\* >= YΔ=0): update Y\* = Y\*\*

Else: update Y\* = YΔ=0 + exp(α\*)

1. Repeat step b) and c) until convergence

*Accomplished:* algorithm implementation, benchmark comparison, wins DREAM challenge with real clinical trial dataset, draft manuscript.

*To-do:* Show convergence, show why this algorithm works 🡪publication

1. Efficient Cox regression by combining information from population survival

Approach:

1. Derived the estimating equations (EE) using partial likelihood for cox regression.
2. Derived additional EEs using accumulative hazard estimator and population summary statistics (survival probability).
3. Transformed the above EEs into the form of independent sum by Functional Delta Method.

*To-do:*

1. To jointly solve the EEs by Generalized Method of Moments (GMM) and Bayesian GMM.
2. To show the efficiency improvement of the GMM solution to these EEs.