Dissertation meeting

April 20, 2023

Talking points

- Joe's idea
- Discuss Ryan reaching out again to work

Problem areas to explore

- Create an information criteria that is better than QIC by accounting for the within-cluster correlation in the goodness-of-fit term.
- Data drive method to determine the variance estimator to use for inference of $\hat{\boldsymbol{\beta}}$ for GEEs.

Ryan's involvement

- Ryan reached out to me about a model selection problem that he believe would be a good disssertation topic. Below is his email.

> *I have an interesting project and it requires to use model (or variable) selection for binary and survival outcome. In the project, longitudinal covariates are included and thus, both longitudinal and model selection procedures will be considered in the analysis of binary outcome and survival outcome. In my opinion, it would be a good topic for doctoral dissertation. Would you like to hear more about the project?*

- After discussing this email with Joe, we decided that I would meet with Ryan to discuss this problem. Mention to Ryan that you will only take on this problem area if it concides with my current research.

Vague description of Joe's idea to adjust QIC

Suppose

$$\mathbf{y} \sim N(\mathbf{X}\boldsymbol{\beta}, \mathbf{V}), \mathbf{V}^{-1} = \mathbf{V}^{-1/2}\mathbf{V}^{-1/2}.$$

Then, using the *generalized least squares* approach to transforming $\mathbf{y}$, we have the following

$$\begin{aligned}\mathbf{V}^{-1/2}\mathbf{y} &\sim N(\mathbf{V}^{-1/2}\mathbf{X}\boldsymbol{\beta}, \mathbf{I}) \\ \mathbf{y}^* &\sim N(\mathbf{X}^*\boldsymbol{\beta}, \mathbf{I}),\end{aligned}$$

which transforms the data back to the independence structure. Thus, the goodness-of-fit term in QIC is valid.

- The issue with this approach is that generally information criterions cannot be used to compare models where the response has been transformed. This leads to the following question: *How do we incorportate the transformed response?*
- Also, what about the link function for non-normal responses? The above result assumes an identity link.

Action items

- Continue literature review
- Setup meeting with Ryan if he would still like to.
- Setup P: drive