

STATISTICS SEMINAR

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CRITICAL POINT BASED EXPERIMENTAL DESIGN FOR GROWTH CURVE ESTIMATION

Friday, April 5, 2024

2:30 – 3:30 pm

310 MSCS

ZOOM Link for Applied M.S. Students

<https://okstate-edu.zoom.us/j/92298224591>

Abstract: Change and trends in a population can be studied by collecting data at specific time points over a time range. Sampling schedule and sample size allocation are crucial experimental design factors. This study aims to find the best combination of sampling schedule and amplitude for common nonlinear sigmoidal growth models like logistic and Gompertz curves.

The proposed design, critical-point based design is based on identifying key growth points; absolute acceleration, maximum acceleration, inflection, maximum deceleration, and asymptotic deceleration points and allocating sample sizes based on predetermined growth phase ratios, with a set minimum number of samples per occasion. Simulation studies are used in validating the methodology under various sampling schemes by assessing the bias, mean squared error, 95% confidence interval width and coverage of parameter estimates. Also, the fitted growth curves are compared using dynamic time warping (accumulated similarity scores along an optimal path.) The critical point-based design produced estimates with metric values comparable to the 1-unit, 2-unit time jump and locally d-optimal schedules. Additionally, the robustness of logistic model is demonstrated for different variance structures. Furthermore, it is shown that the derived design provides an efficient solution to the optimal design problem and is robust with respect to the misspecification of the unknown distribution and parameters. The application of the sampling design is illustrated through its potential use in explaining the growth process of pecan nuts. In conclusion, the unequal critical point-based design is a good choice in practice, considering the computational advantage relative to the locally d-optimal design and its economical use of experimental resources.

Refreshments immediately following seminar in Room 309 MSCS.