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Book of Abstracts

Predicting Barth's Syndrome: An Algorithm Comparison

Sherri Verdugo (School of Computational Sciences)

The purpose of this study is to observe the two primary algorithmic methods of multivariate regression: linear and logistic. Further, this study examines the relationship between regression and statistical power in terms of type one errors. The disease of interest for this research project is a rare genetic X chromosome disorder (Barth's Syndrome) that presents with multiple symptoms in early childhood development stemming from lipid metabolism. This project involves both real data and simulations to ascertain which method of analysis is more analytically appropriate in terms of quantitative and qualitative methods. Further, the method of obtaining the data to be analyzed is extremely complex in terms of collection and in terms of finding those members of the population that have been diagnosed. In addition to using real data, we are simulating data to provide a numerical answer of significance regarding which algorithm provides a more efficient and accurate snapshot of complex data that involves both categorical and continuous data.

Modeling Optimal Capital Investment Patterns

Kevin James (School of Computational Sciences)

The hotel and electric power industries are two sectors that are characterized by large, irreversible capital investments. We construct a model for such environments and computationally find the optimal investment pattern for selected target functions.

Distribution of Family-Based Association Tests (FBAT) with small sample sizes

Louis Ehwerhemuepha (School of Computational Sciences)

FBAT is a family of conditional tests used to explore the relationship between genotypes and phenotypes. The distribution of the test statistic in large samples is a standard normal and can be ascertained through the generalization of the central limit theorem. The distribution with small samples is however unknown. We show that the distribution of the test statistics of the family based association tests attain normality even in small samples and sometimes has power for small sample sizes with large effect sizes. Furthermore, we derived an equation for estimating the probability of sampling informative families (for the trios test). The aforementioned probability gives information about how difficult it would be to sample a certain number of family trios given the penetrance functions and allele frequencies.

Analysis of Hippotherapy on Pelvic Motion

Kyle Anderson (School of Computational Sciences)

In this study we analyze the effect of hippotherapy on the gait of children with mental disabilities that adversely affect their ability to walk. The data were collected via an implementation of a wii remote control attached to each participant's pelvis that recorded observations at approximately 100hz on rotational degrees of the pelvis during a walk of 25 feet before and after a 30 minute therapy session. We focused on investigating the following important characteristics of the complex motion of walking: minimum and maximum pitch, minimum and maximum roll and gait duration. These data were analyzed via mixed effects linear models to account for the correlations induced by both the repeated measurements on the same subjects. Our results show with respect to all of the mentioned characteristics of walking, there were no significant difference in the gaits before and after hippotherapy.

Cramer-Rao Lower Bound Track Accuracy of Ballistic Targets at Long Range Using Short DurationTracking Intervals

George Escalante (School of Computational Science)

This investigation applies the Cramer-Rao Lower Bound (CRLB) method to the problem of determining the achievable track accuracy for sensors tracking ballistic targets at long range over short tracking intervals. 3D target motion and sensor measurement models are presented and corresponding approximations are developed to cast the problem into a form suitable for application of the CRLB method. CRLB track accuracy results for selected sensor-target tracking geometries are presented.

Digital Image Manipulation Detection

Chloe Martin (School of Computational Science)

An account of digital image processing experiments pertaining to manipulation detection and a reflection on the results. This project focuses primarily on using edges and contours in an image to derive information about the image's authenticity. Matlab programs implementing techniques such as Laplacian enhancement, filtering, approximate contour representation, prediction error, and normalized cross correlation were developed to aid in the experimental component of this project.

Application of a Generalized Vickrey Mechanism to a Bicycle Auction

Ryan French (School of Computational Science)

The Vickrey auction mechanism is a classic example of the disconnect between theoretical mechanism design and the application of that mechanism. The dominant bidding strategy for participants in this type of auction is to bid their value. Any deviation could result in a sub optimal allocation. It would seem that a mechanism with these characteristics would be commonly used, but this is not the case. This paper presents an algorithm that slightly modifies the Vickrey-Clark-Groves (VCG) auction mechanism, a Vickrey mechanism for auctions of multiple heterogeneous goods, and applies the mechanism to an auction of bicycles at Chapman University. The experimental results are analyzed and compared with the previous year's ascending price mechanism.