



Department of Mathematics and Statistics

COLLOQUIUM

Tuesday, February 23rd, 2016

4:00 – 5:00 pm, Adel Mathematics Bldg., Room 164
(refreshments at 3:45)

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NAU

The Use of Dynamic Time Warping to Reduce Inter-trial Variability in Gait Data

Abstract: The timing of salient features in gait parameter varies among gait trials. When gait data are averaged, some of the standard error associated with this inter-trial variability can obscure important gait features unless normalization is carried out beforehand. A functional data analysis technique referred to as dynamic time warping registers or aligns prominent curve features for each curve, $x_i(t)$, by appropriate monotone transformation functions, $h_i(t)$, so that the analyses are carried out on the registered curves $x_i(h_i(t))$. The objective of this study was to determine how dynamic time warping can reduce inter-trial variability in human gait data, while maintaining the characteristics of the original curves. The BionX BiOM is a powered ankle-foot prosthesis that uses a motor to assist the user through the gait cycle. Gait data were collected from the BiOM's internal torque and ankle angle sensors. Thirty gait cycles were collected from one person with an amputation (PWA) during level walking. Dynamic time warping was applied to ankle angle, net ankle torque, and current. After registration of these curves, the standard error decreased. Prominent curve features were also maintained when the registered curves were averaged, while they were obscured when the unregistered curves were averaged. Dynamic time warping is thus a suitable technique to apply to gait data from animals and humans to achieve more accurate representation. Supported by NSF, IIP1237878, and IIP-1521231.

Algebra Combinatorics Geometry and Topology (ACGT) Seminar meets every Tuesday, 12:45 – 1:45 pm, AMB 164.

Applied Math Seminar (AMS) meets every Thursday, 12:45 – 1:45 pm, AMB 164.

Friday Afternoon Undergraduate Mathematics Seminar (FAMUS) meets Fridays, 3pm, AMB 164.