UW-S&AS faculties are among the most active in Canada.
Given: Two data sets (realizations of $X = (X_1, X_2)$).

Question: Are you surprised that the strengths of dependence between $X_1$ and $X_2$ are exactly the same in the two cases above? Prof. Marius Hofert (marius.hofert@uwaterloo.ca, M3 4207) does research on dependence modeling with applications to quantitative risk management.
Areas of Interest

Research and Scholarly Activity
Professor Drekic's research innovatively combines the use of stochastic techniques with advanced computational methods to analyze mathematical problems arising in various applications. He has co-authored over 30 research articles, and has published in key journals across several disciplines, including actuarial science, operations research, and statistics. His work has garnered particular attention in the fields of applied probability, insurance risk/ruin theory, and queueing theory. Over the past several years, Professor Drekic has been developing computationally tractable procedures for calculating the probability distributions of fundamental ruin-related quantities of interest, including the time of ruin, the surplus immediately prior to ruin, and the deficit at ruin. In addition, he has been a major proponent of the use of phase-type distributions to model claim sizes and/or interclaim times, as these distributions are one of the most general classes of distributions permitting a Markovian interpretation, and they provide a unified treatment for many classical results in both queueing and ruin theory.
Data visualization

Interactive exploration of high dimensional data spaces
Human
Bird
Dog
Cat

Statistics & Machine Learning
Chong Zhang, M3 4114
chong.zhang@uwaterloo.ca

- In causal inference, one is interested in how the treatment is causally related to the outcome variable. “Correlation does not imply causation”.
- To adjust for confounding, propensity score based approaches are used.
- Propensity Scores: the conditional probability of observing the treatment level (T) given covariates (X).
- Use Boosting (Ensemble Regression Trees) to estimate T given X.
- Regression tree is constructed on a set of binary decisions (See Fig1).
- Ensemble methods: generating multiple trees and each tree gives an estimate; the final estimate is an aggregation of each tree.
- The number of trees is an important tuning parameter in boosting.
- Create a criterion (AACC) to find the optimal number of trees based on distance correlation (See Fig2). T and X should be uncorrelated after propensity score adjustment.
- Other machine learning algorithms can be used to estimate propensity scores: Random Forests, Support Vector machines, CART, Bagging, KNN

Reference:
• Drawdown risk
• Exotic option pricing
• Optimal portfolio under ambiguity
• Path-dependent risk measures
• Stochastic models in insurance & finance
1. Risk measures
2. Catastrophe bonds
3. Dependence modeling
4. Multivariate heavy-tailed distributions
5. Extreme value theory for insurance and finance
6. Asymptotic analysis of rare events in insurance and finance