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*Distance Correlation: A New Tool for Detecting Association and Measuring Correlation Between Data Sets.*

The difficulties of detecting association and establishing causation have fascinated mankind since time immemorial. Democritus, the Greek philosopher, noted the importance of proving causality when he wrote, “I would rather discover one cause than gain the kingdom of Persia.”

To address the difficulties of establishing causation, statisticians have developed many inferential techniques. Perhaps the most well-known method stems from Karl Pearson’s correlation coefficient, which was introduced in the late 19th century based on ideas of Francis Galton.

I will introduce in this lecture the recently-devised distance correlation coefficient and describe its advantages over Pearson’s and other measures of correlation. We will apply the distance correlation coefficient to data from large astrophysical databases, where it is desired to classify galaxies. The lecture also will analyze data arising from a study of the association between state-by-state homicide rates and the stringency of state gun laws.

The lecture will review a remarkable singular integral arising in the theory of distance correlation coefficients. We will show extensions of this integral to truncated Maclaurin expansions of the cosine function and in the theory of spherical functions on symmetric cones. (Received September 11, 2016)