

# SCHOOL OF DATA SCIENCE

## SEMINAR SERIES

### Entropy, Extropy, and Information in The Courtroom, or a Hacker's Bedroom

Date: 6 September 2018 (Thursday)

Time: 2:30pm to 3:30pm

Venue: P7510, 7/F, Yeung Kin Man Academic Building (YEUNG),  
City University of Hong Kong

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#### *Abstract:*

I start by motivating as to how the notion of information arose, and how it evolved, via the idealistic scenarios of a courtroom, or that of a hacker trying to break a computer's password. I then introduce the notion of Shannon entropy as a natural consequence of the basic Fisher-Hartley idea of self-information, and subsequently make the claim that Shannon took a giant leap of faith when he proposed his famous, and well lubricated, formula. A consequence is that Shannon's formula overestimates the inherent uncertainty in a random variable. I also question Shannon's strategy of taking expectations, and suggest alternatives to it based on the Kolmogorov-Nagumo functions for the mean of a sequence of numbers. In the sequel, I put forward the case that the only way to justify Shannon's formula is to look at self-information as a utility in a decision theoretic context. This in turn enables an interpretation for the recently proposed notion of "extropy". I conclude my presentation with the assertion that a complete way to evaluate the efficacy of a predictive distribution (or a mathematical model) is by the tandem use of entropy and extropy.

The work described here is joint with Lai Boya whose computational support was instrumental. It was first presented to the Rotary Club of Hong Kong in 2017 (courtesy of Professor Istvan Horvath); it is conversational and should be accessible to non-specialists.