Model-Based Decisions Under Severe Uncertainty

Prof. Yakov Ben-Haim
Yitzhak Moda'i Chair in Technology and Economics
Technion — Israel Institute of Technology
Haifa, Israel
yakov@technion.ac.il
http://tx.technion.ac.il/~yakov

In this talk we discuss policy or design decisions based on highly imperfect models. Traditionally, policy optimization entails using a best model to find a most propitious strategy. The danger in this approach derives from the following theorems of info-gap decision theory:

- Robustness to model error is low if policy requirements are demanding.
- Optimal performance has zero robustness.

These theorems have the following corollaries:

- Only sub-optimal outcomes are reliable against modelling error.
- Preferences between strategies depend on the required level of reliability.

Good performance is better than poor performance, but the need for reliability must temper the aspiration for high performance. To achieve this balance we must model and manage our severely deficient information about, and understanding of, the processes we confront.

The talk has three parts:

• **Principle of indifference.** We begin with a discussion of two riddles which illustrate a pitfall of injudicious use of probability in modelling ignorance.

• **Ecological rehabilitation.** We discuss the 2nd challenge problem of the Melbourne Workshop: Setting Conservation Priorities for Land Rehabilitation.

• **Foraging behavior of animals.** Much evidence exists which contradicts patch residence times predicted by the marginal value theorem from optimal foraging theory. We derive an info-gap robust-satisficing model for foraging behavior which seems more consistent with observation than the MVT. (Joint work with Dr. Yohay Carmel.)

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