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Info-Gap Theory: Overview and Application to Fault Diagnosis

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Abstract

Info-gap theory is a method for analysis, planning, decision and design under severe uncertainty. The future may differ from the past, so our models may err in ways we cannot know. Our data may lack evidence about surprises: catastrophes or windfalls. Our scientific and technical understanding may be incomplete. These are info-gaps: incomplete understanding of the system being managed. Info-gap theory provides decision-support tools for modelling and managing severe uncertainty. Info-gap theory has been applied to many disciplines, including engineering, economics, biological conservation, medicine, homeland security and so on. After outlining the info-gap methodology, we explore applications to fault diagnosis. We first consider a simple task in which missed-detections and false-alarms must both be controlled. We then consider the training of a neural net for fault diagnosis.

Outline

- Principle of Indifference
- Simple examples of info-gap robustness:
 - Path planning for target search.
 - Profiling with limited resources.
- Missed detections and false alarms.
- Neural nets and fault diagnosis.
- Forecasting a non-stationary process with data-revision uncertainty.

Selected Publications

- Yakov Ben-Haim, 2006, *Info-Gap Decision Theory: Decisions Under Severe Uncertainty*, 2nd edition, Academic Press, London.
- Yakov Ben-Haim, 2010, *Info-Gap Economics: An Operational Introduction*, Palgrave.
- Yakov Ben-Haim, 2005, Info-gap Decision Theory For Engineering Design. Or: Why 'Good' is Preferable to 'Best', appearing as chapter 11 in *Engineering Design Reliability Handbook*, Edited by Efstratios Nikolaidis, Dan M.Ghiocel and Surendra Singhal, CRC Press, Boca Raton.
- S.Gareth Pierce, Yakov Ben-Haim, Keith Worden, Graeme Manson, 2006, Evaluation of neural network robust reliability using information-gap theory, *IEEE Transactions on Neural Networks*, vol.17, No.6, pp.1349–1361.
- Sary Regev, Avraham Shtub and Yakov Ben-Haim, 2006, Managing project risks as knowledge gaps, *Project Management Journal*, vol. 37, issue #5, pp.17–25.
- Yakov Ben-Haim, 2009, Info-gap forecasting and the advantage of sub-optimal models, *European Journal of Operational Research*, 197: 203–213.

Additional information: <http://info-gap.com>