Dependency Elicitation Using Fuzzy Logic

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The State of the Art in the use of Expert Judgment
In Risk and Decision Analyses
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Outline I

Expert Judgement in Finance and Insurance

EIOPA Guidelines - on the Use of Internal Models

Chapter 4: Assumption setting and expert judgement

1.33. *The insurance or reinsurance undertaking should set assumptions and use expert judgment, in particular taking into account the materiality of the impact of the use of assumptions with respect to the following Guidelines on assumption setting and expert judgement.*

1.34. *The insurance or reinsurance undertaking should assess materiality taking into account both quantitative and qualitative indicators and taking into consideration extreme losses conditions. The insurance or reinsurance undertaking should overall evaluate the indicators considered. - EIOPA*

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- Insurers need a greater understanding of the risks they face and the underlying nature of these risks.
- Insurers need to know the statistical properties of some of the risks they face, but are constrained by:
  - Data
  - Lack of knowledge of a suitable representation of experts and their judgement
  - Lack of a mathematical framework to model dependencies.

What is a Risk?

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Risks are **not**:

1. Always Entirely Adverse
2. Uncertainty
3. Volatility

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All methods rely on Experts and their judgement.

Classical Model by Professor Roger Cooke

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- Experts in insurance are **Hierarchical**

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- Experts in insurance are **Hierarchical**
- Experts know of **Influential Factors** that help to formulate a risk
- Experts are aware of a **Range** of Plausible Values within a **Degree of Certainty**

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We still need to be able to aggregate experts of different expertise to formulate an understanding of one risk.

Big Ideas

1. Obtain opinions from several experts on the influential factors that form one risk
2. Then mathematically calculate a dependency structure between the two or more risks

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- The purpose of Fuzzy Logic is to provide a mathematical representation of linguistic variables when under uncertainty.
- Since its creation, Fuzzy Logic has been used extensively in risk management and computer science.
- However, recently there has been increasing interest in the usage of fuzzy logic in the actuarial setting.

Outline of Model

1. List all Influential Factors that may drive a risk
2. Call an expert to represent each influential factor
3. Expert proposes a selection of levels for that influential factor
4. Expert selects the level most appropriate for the risk under discussion

Outline of Model

5 Expert specifies a function which represents the range of plausible values for that influential factor (via Fuzzy Logic)

6 A decision-maker (typically Senior Management) assigns a weight to the function based on their expert biographies, past performance and any notions of disagreement

7 Aggregate the weights and the functions to formulate each risk

8 Examine several risks together and derive the estimate of the linear and non-linear dependence.

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Thank you.