Distortion Models for the Probability of Rare Events: an Application on Human Reliability

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Probabilities of rare events

The estimation of the probabilities of rare events can be problematic due to many factors:

$\hookrightarrow$ A frequentist approach is difficult due to the lack of data.

$\hookrightarrow$ The elicitation by experts leads sometimes to over- or under-estimation of the probabilities.

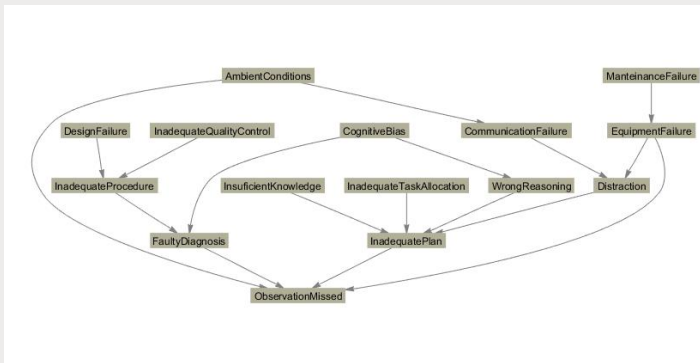To overcome these issues, we can consider:

- A graphical approach with Bayesian networks, based on conditional probabilities.

- A robust approach accounting to the lack of data.

Here use these two ideas in the context of human reliability.

Forward

An application on human reliability

We build on the work by Morais et al.:

In the graph, the (conditional) probabilities are estimated from a database of 238 major accidents.

Distortion models

- The use of the precise model P_0 leads to a vacuous conditional model when there are no observations on the conditioning event.

- Here, we consider instead a distorted model $\overline{P}$, that we condition using regular extension.

- We focus on the linear-vacuous mixture with a fixed distortion parameter ϵ:

$$\overline{P}(A) = (1 - \epsilon)P_0(A) + \epsilon \text{ for } A \neq \emptyset$$

In this manner, the conditional model is more informative, although the unconditional model is not.

- We compare the results for different values of ϵ.

We eagerly look forward to your questions in the poster

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