How do Bayesian Networks support impact-based forecasting for informed decision-making?

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Introduction

- Impact-based forecasting (IBF) aims to support risk-oriented decisions in disaster risk management by promoting anticipatory actions that minimize damage and loss of life from natural hazards.
- IBF essentially uses risk matrices, which are products of the probability of impact and the extent of impact, represented as unconditional probabilities or impact numbers for events, like a flood event.
- It fails to consider conditional factors, potential interventions, and critical questions, such as the likelihood of significant consequences under different actions [1].
- Bayesian Network (BN) is a directed graphical model representing a set of variables and their conditional probabilistic dependencies.

Methods

Method used for generating BN model, which can be extended with inputs and output applications for decision making.

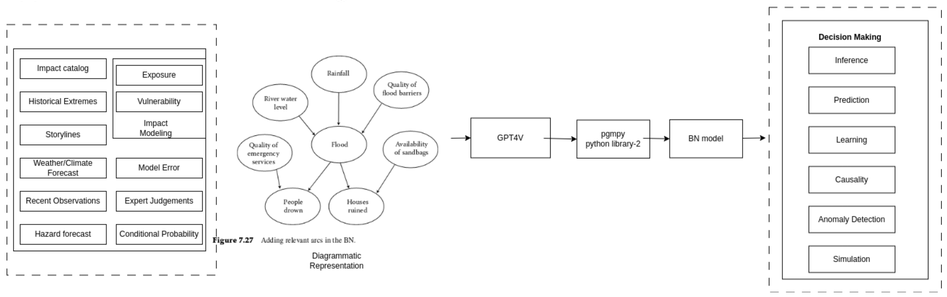

Figure 1: BN generation steps, using GPT-4V[2] and Python library pgmpy[3], test image given is from Fenton and Neil [1]

Results

- The Jupyter Notebook in Github shows the some of preliminary results related to the usage of simple Flood hazard anticipation and BN generation
- Study is ongoing to extend the application

Reference

[1] Norman Fenton and Martin Neil. *Risk assessment and decision analysis with Bayesian networks*. CRC Press, 2018.

[2] OpenAI. GPT-4 technical report, 2023. `https://arxiv.org/abs/2303.08774`.

[3] Ankur Ankan and Abinash Panda. pgmpy: Probabilistic graphical models using python. In *Proceedings of the 14th python in science conference (scipy 2015)*, volume 10. Citeseer, 2015.

[4] Nassim Nicholas Taleb. *Skin in the game: Hidden asymmetries in daily life*. Random House, 2018.

Current IBF practices have shortcomings. They often fail to address critical factors such as uncertainty, diverse perspectives, and process transparency. This oversight results in a lack of 'skin in the game'[4]. By integrating Bayesian Networks and GPT-4V, we believe there's potential to bring significant advancements to IBF.

Scan the QR Code for supporting materials
@ GitHub Repository:
icpac-igad/bn-ibf
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