

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



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Introduction

- Impact-based forecasting (IBF) plays a crucial role in disaster risk management by facilitating anticipatory decisions that aim to mitigate damage and loss of life from natural hazards.
- Central to IBF are risk matrices, which quantify probabilities or the impact magnitudes for events like floods.
- Yet, these matrices often overlook conditional factors, potential interventions, and the implications of various actions [1]. Moreover, for IBF to be more effective as a tool for reasoning under uncertainty, it requires enhanced instruments to assist it [2].
- The Bayesian Network [3], a graphical representation of relationships among a set of variables provide a structured way to reason about uncertain phenomena using probabilities. This study explores its application in IBF.

Methods

- The figure 1 illustrate the method for creating a BN model for a given mindmap on flood hazard anticipatory action.
- The method leverages insights from GPT-4V at chatGPT web application for BN model generation by Python library pgmpy.

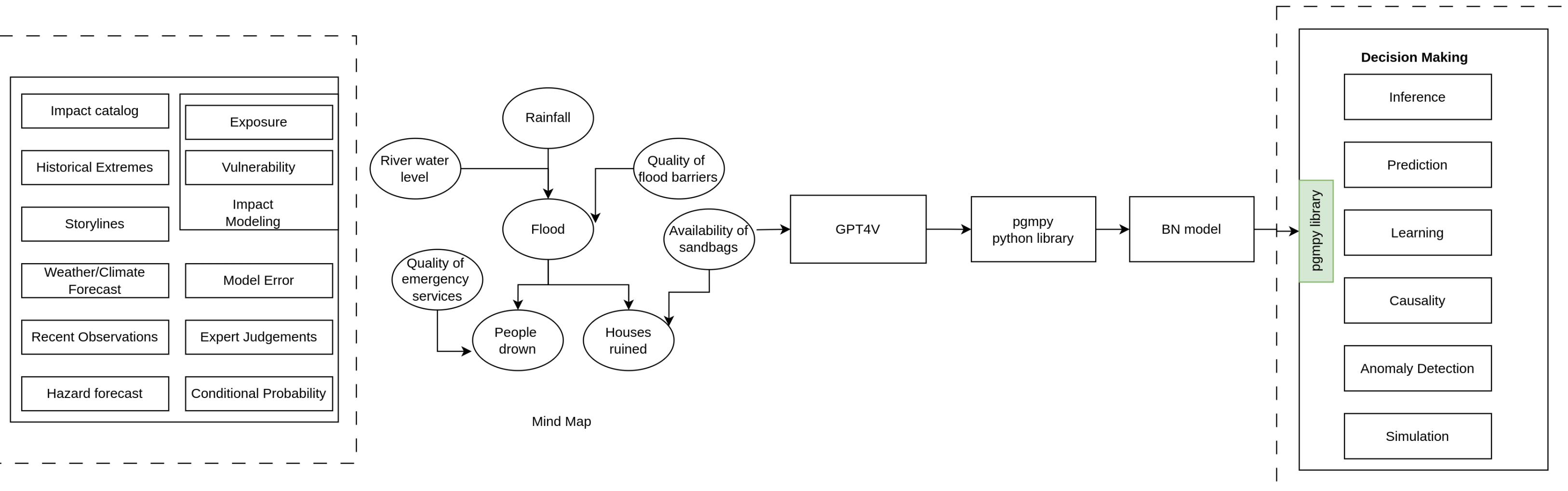


Figure 1: Steps for BN generation using GPT-4V[4] and the Python library pgmpy[5]. The test image is adapted from Fenton and Neil [1].

Results

- Preliminary findings shows the application of BN with the use of chatGPT and generated model for to carry out risk analysis for antciaptory action against flood hazards. This model can be broadened to include IBF inputs and applications crucial for decision-making.

Reference

[1] Norman Fenton and Martin Neil. *Risk assessment and decision analysis with Bayesian networks*. CRC Press, 2018.
[2] Edward Geist. Why reasoning under uncertainty is hard for both machines and people—and an approach to address the problem. *Adaptive Engagement for Undergoverned Spaces*, page 265, 2022.
[3] J Pearl and S Russel. Bayesian networks. Technical report, UCLA Cognitive Systems Laboratory, 1997.
[4] OpenAI. GPT-4 technical report, 2023. <https://arxiv.org/abs/2303.08774>.

Current IBF practices, lacking in addressing un-
certainty, diverse views, and transparency, miss
the 'skin in the game'[6]. Integrating Bayesian
Networks with GPT-4V could enhance IBF.



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