



Welcome to our May 2024 BNMA newsletter. It's been a busy start to the year following on from our great conference in Brisbane in December. The first BNMA webinar for the year, Using BNs in the design of clinical trials, given by **Prof Tom Snelling is now up on our YouTube Channel** at <https://youtu.be/E5jPor0AXk8>. We're also thrilled to announce the establishment of a new '**Engagement**' committee who are buzzing with enthusiasm to revitalise our organisational focus and outreach endeavours for 2024.

This year, our sights are set on enriching engagement both within our community and beyond. Building on the momentum of our rebranding, we're committed to fostering inclusivity and celebrating the global nature of our community. With a dedicated focus on networking, global outreach, and collaboration, the Engagement Committee is gearing up for an action-packed year. We are developing a fabulous plan with webinars, informal engagement opportunities and a BN Symposium later this year as part of the Ecological Society of Australia Conference to be held in Melbourne, which you can read more about at <https://esa2024.org.au/symposia/>.

Through cross-collaborations and a range of engaging networking events, we aim to expand the reach and impact of BNMA within the broader scientific and research communities. This year, **we're on a mission to expand our horizons and make BNMA the go-to hub for anyone interested in Bayesian Networks.**

We're also changing things up and substituting an annual conference for a series of smaller events aimed at engaging with and recruiting more members, especially those outside of Australia. If you've got an idea for an event you'd like to see, such as seminar on your favourite topic, a hybrid workshop on a topic you'd like to know more about, or a conference symposium that's all about BNs, reach out to [contact@bnma.co](mailto:contact@bnma.co) or any of our friendly board members (<https://bnma.co/contact>) who can help make it happen.

Don't forget to keep an eye out on the new website. [www.bnma.co](http://www.bnma.co) There are some improvements happening behind the scenes, so you might notice a few changes while we update the new branding. Once it's done it will be a fantastic space to engage with and collaborate about all things BNMA!

## Member spotlight: Rasoul Amirzadeh

Undertaking my PhD in fintech, I aimed to analyse the price movements of cryptocurrencies. During my review, I encountered a DAG, where I realised it perfectly met my needs to understand the key factors driving price movements. Following my supervisor's advice, I explored the beautiful world of Bayesian Networks, leading to a series of research projects. Initially, I used BNs to uncover cryptocurrency price determinants and their connections to financial markets and Twitter. Subsequently, I employed Dynamic Bayesian Networks to predict daily prices. Finally, I integrated BN and DBN outcomes with a reinforcement learning agent's inputs to empower trading capabilities. This hybrid model is called CausalReinforcementNet.



As a very enriching experience for my PhD, I had the privilege of presenting at the 15th BNMA2023 at the University of Queensland. The conference brought together a vibrant community of academics and professionals with profound knowledge of BNs across various domains, from ecology to health. The atmosphere was intellectually stimulating, and the experts' passion, support, and welcoming attitude to newcomers captured my attention. Engaging in discussions and presentations, I realised that many challenges I encountered in my research were common issues. Moreover, the conference provided a platform for networking and future collaborations. Reflecting on my experience, designing BNs is an art that blends creativity with technical expertise beyond just mathematics or computer science. If personified, BNs would be wise elders, merging experience with intelligence to transform data into knowledge."

## Member project spotlight - DTSG

Bayesian Network Modelling in Defence Science and Technology Group  
Dr. Minh-Tuan and Dr. Andrew Coutts



Defence Science and Technology Group (DSTG) uses Bayesian networks (BNs) to analyse Defence capabilities and concepts to support strategic planning, evaluation, and force structure and design. In collaboration with the University of Melbourne, DSTG developed the Bayesian Elicitation Support Tool (BEST).<sup>1</sup> BEST is designed to create model structures and capture the required data to generate the model parameters such as conditional probability tables (CPTs). BEST automates data collection and facilitates data generation, organises the data, and facilitates distribution to multiple participants via email to provide timely responses.

As BEST allows for distributed, asynchronous survey completion, it is very critical for eliciting data from different skilled Australian Defence Force (ADF) experts in large, complex and multi-domain defence problems. BEST also provides the flexibility to allocate subsections of the model to match participants' expertise. Further, BEST employs various elicitation techniques to reduce CPT size and reduces bias by aggregating the opinions of multiple participants. Various built-in analyses (what-if, sensitivity, optimisation design/strategy, cause-effect tracing, etc.) are available in our single web-based tool.

We recently have been supporting ADF to construct causal (BN) models of mission engineering products. The challenge here is to identify and capture key causal relationships within a largely process focused engineering framework. This work will provide a means to ensure consistency across mission engineering products developed by Defence and support high level what-if analysis on broad capability options.

GeNIE<sup>2</sup> is used to build our model structure while BEST helps us to collect all model parameters and carry out required queries and analyses. Our proposed BN model provides modelling and data collection structures that assist in making explicit the force structure, scenario parameters, and the subject matter experts' preferences. Our decision support tool helps us to significantly reduce the time-consuming elicitation process, and to deliver the evaluation results on time. In addition, BEST can also automate, document and verify some of our evaluation processes. It allows a quick what-if analysis of, for example, the impact of a particular investment or capability performance change across multiple missions and contexts.

1. <https://www.abnms.org/conferences/abnms2022/ABNMS2022%20Conference%20Program.pdf>. BEST (public version) can be accessed at <https://best-staging.dst.eresearch.unimelb.edu.au>

2. <https://support.bayesfusion.com/docs/GeNIE/>

**BNMA May Webinar: Hellixia & Generative AI**  
Creating Semantic and Causal Bayesian  
Networks for Decision Support  
Dr. Lionel Jouffe

Thursday, 9th May 2024, 8.30  
AM Paris/ 4.30 PM Melbourne.

Register for free at:

<https://shorturl.at/qswzH>



## Recent member publications

We have an exciting selection of publications to share from our members, covering a wide range of topics ranging from Vaccines, to polar bear to kidney transplants. If you'd like to share your recent works here, just drop us a line

**Using causal directed acyclic graphs (DAGs) to select patient-important outcomes in transplantation trials—Interventions to treat polyomavirus infection as an example.** Wu Y, Dymock M, Gately R, Marsh JA, Hawley C, Wong G, & Snelling TL (2023). *Kidney International, Editorial*, 104(4), 628-633. <https://doi.org/10.1016/j.kint.2023.07.013>

**Predicting the causative pathogen among children with pneumonia using a causal Bayesian network.** Wu Y, Mascaro S, Bhuiyan M, Fathima P, Mace AO, Nicol MP, Richmond P, Kirkham L, Dymock M, Foley DA, McLeod C, Borland ML, Martin A, Williams PCM, Marsh JA, Snelling T, Blyth CC (2023). *PLOS Computational Biology*, 19(3): e1010967. <https://doi.org/10.1371/journal.pcbi.1010967>

**A decision support tool for risk-benefit analysis of Japanese encephalitis vaccine in travellers** Lau CL, Mills DJ, Mayfield HJ, Gyawali N, Johnson BJ, Lu H, Allel K, Britton PB, Ling W, Moghaddam T and Furuya-Kanamori L. (2023). *Journal of Travel Medicine* 30(7) <https://doi.org/10.1093/jtm/taad113>

**A novel approach to assessing natural resource injury with Bayesian networks.** Rowland, F. E., C. J. Kotalik, B. G. Marcot, J. E. Hinck, and D. M. Walters. 2024. *Integrated Environmental Assessment and Management* 20(2):562-573. <https://doi.org/10.1002/ieam.4836>.

**Incremental evolution of modeling a prognosis for polar bears in a rapidly changing Arctic.** Marcot, B. G., T. C. Atwood, D. C. Douglas, J. F. Bromaghin, A. M. Pagano, and S. C. Amstrup. 2023. *Ecological Indicators* 156:111130. <https://doi.org/10.1016/j.ecolind.2023.111130>.

**Foundations of modeling resilience to sea-level rise of tidal saline wetlands along the U.S. Coast.** Marcot, B. G., K. M. Thorne, J. A. Carr, and G. G. Guntenspergen. 2023. *Landscape Ecology* 38:3061-3080. <https://doi.org/10.1007/s10980-023-01762-3>.