

# Markov Melding

Supervisor: Murray Pollock (Warwick)\*

*\*Interested students should schedule a meeting to discuss this project prior to selection\**  
*\*Find updated project listing / availability at <https://warwick.ac.uk/mpollock/projects> \**

## Overview

Oftentimes multiple sources of data are available for the purposes of statistical inference, but for practical reasons a modular approach is taken in which each data source is modelled separately, and then the separately conducted inferences are qualitatively contrasted. Typically these data sources will look at different aspects of a common problem (for instance, each may be considering different covariates of interest). Recent work on ‘Markov Melding’ by [Goudie et al., 2019] provides a methodology for the joint modelling of multiple such sources, with particular focus on applications in epidemiological modelling. Concurrently a similar problem was studied in [Dai et al., 2019], in which a framework to ‘meld’ separate inferences *on common* parameter spaces was considered. The original motivation for this alternative approach was to exploit distributed inference frameworks which are possible in massively parallel settings, and it has the distinct advantage over Markov melding in that it is *is exact* (the resulting inference is identical to what would have been achieved had inference been conducted directly on all data sources together).

In this project we will begin by reviewing [Goudie et al., 2019], and determining the extent to which the theory and methodology in [Dai et al., 2019] can be applied. Further (more theoretical) directions for this work could study the extent to which [Dai et al., 2019] could be adapted to the setting in which the inferences do not have a common parameter space. This will be a challenging project, and students should have familiarity with Bayesian Statistics, Monte Carlo, and be comfortable with statistical programming.

## References

- [Dai et al., 2019] Dai, H., Pollock, M., and Roberts, G. O. (2019). Monte Carlo Fusion. *arXiv preprint arXiv:1901.00139*.
- [Goudie et al., 2019] Goudie, R. J. B., Presanis, A. M., Lunn, D., De Angelis, D., and Wernisch, L. (2019). Joining and Splitting Models with Markov Melding. *Bayesian Anal.*, 14(1):81–109.

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\*Email: [m.pollock@warwick.ac.uk](mailto:m.pollock@warwick.ac.uk)