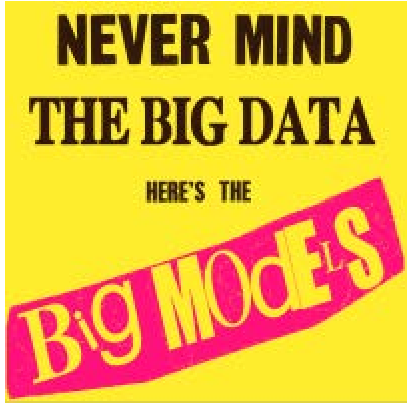
Efficient (Bayesian) inference for complex models (using Monte Carlo)

Samuel Livingstone (Mathematics)

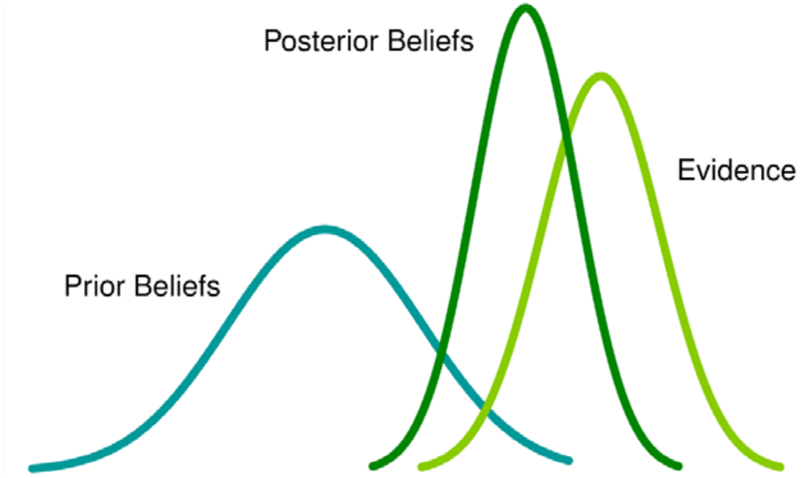


Large datasets are often highly structured and heterogeneous.

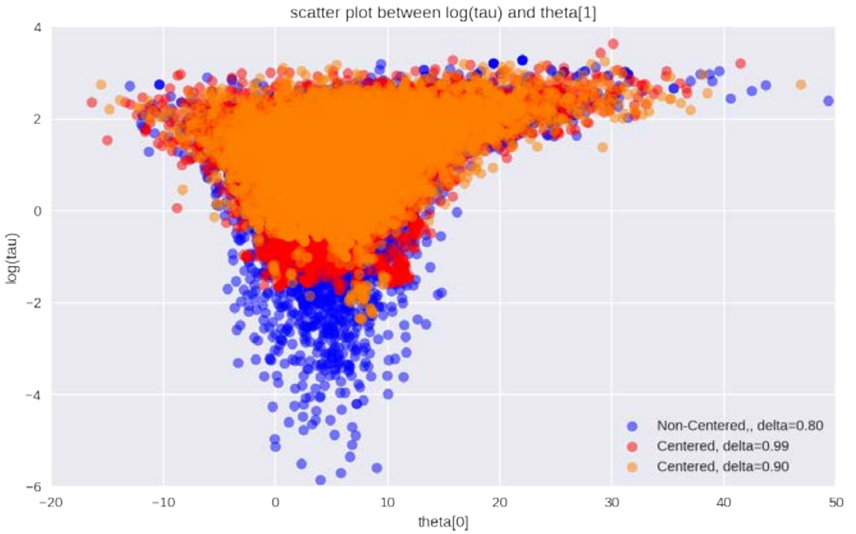
Modern research questions often ask for more than a simple t-test/linear regression can give.

Bayesian methods:

- Inference typically more robust in larger models (avoids non-identifiability)
- Can incorporate expert knowledge into modelling process (prior information)
- Comparing scientific theories (non-nested hypotheses)
- Often gives more interpretable answers



Fitting complex models is a challenge. We try to establish general conditions under which a given fitting method will 'work well'.



Theorem 5.4. *For any $L \geq 1$ (12) holds if the following conditions are met*

(SC1.1) $\liminf_{\|x_0\| \to \infty} \|\nabla U(x_0)\| > 0$

(SC1.2) $\liminf_{\|x_0\| \to \infty} \frac{\langle \nabla U(x_0), x_0 \rangle}{\|\nabla U(x_0)\| \|x_0\|} > 0$

(SC1.3) $\lim_{\|x_0\| \to \infty} \frac{\|\nabla U(x_0)\|}{\|x_0\|} = 0.$

In addition, if (SC1.3) is replaced by

(SC1.3b) $\limsup_{\|x_0\| \to \infty} \frac{\|\nabla U(x_0)\|}{\|x_0\|} = S_l,$

for some $S_l < \infty$, then there is an $\varepsilon_0 \in (0, \infty)$ such that the same result holds provided $\varepsilon \in (0, \varepsilon_0)$.