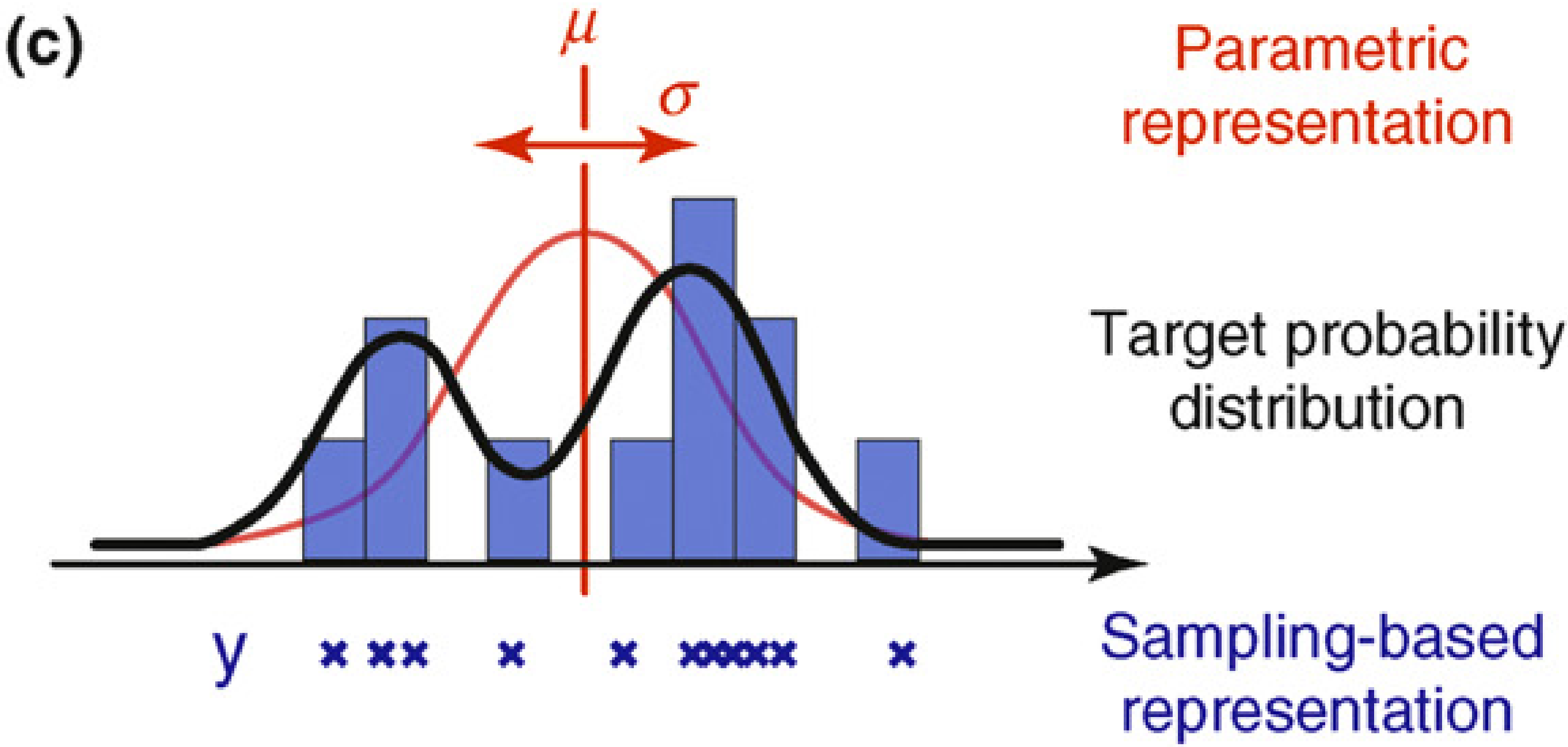
Sampling representation of probability distributions

Sampling based representation

Sampling based representation

http://www.labri.fr/perso/guenneba/Sqrt3PointCloudRefinement_eg05.php

Neurons represent variables, not parameters



Fiser et al. 2010

Whats so great about a sampling based representation?

- Flexible (can represent arbitrary distributions)
- No of neurons required scales linearly with dimensionality of feature space.
- Certain computations are straight-forward (e.g. marginalisation)

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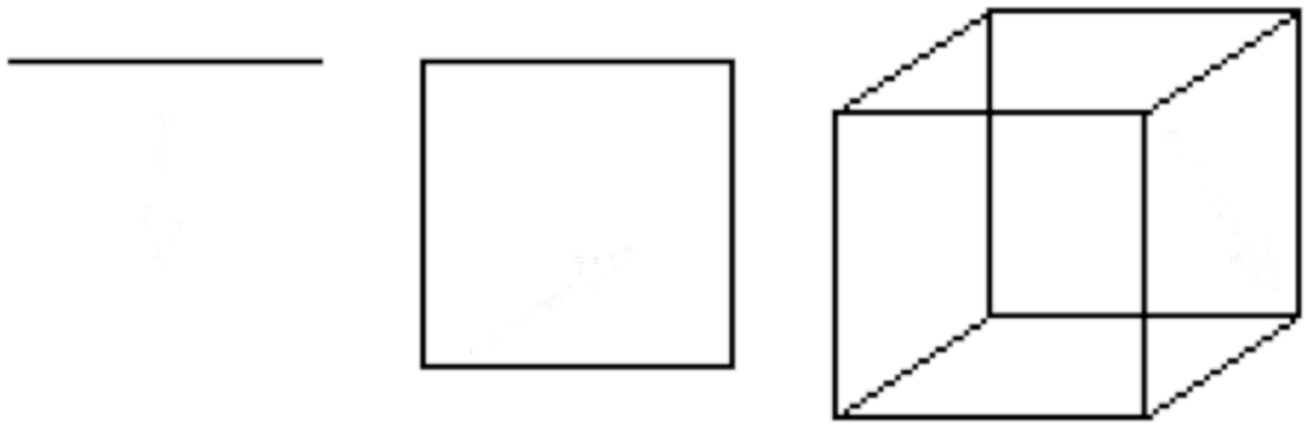
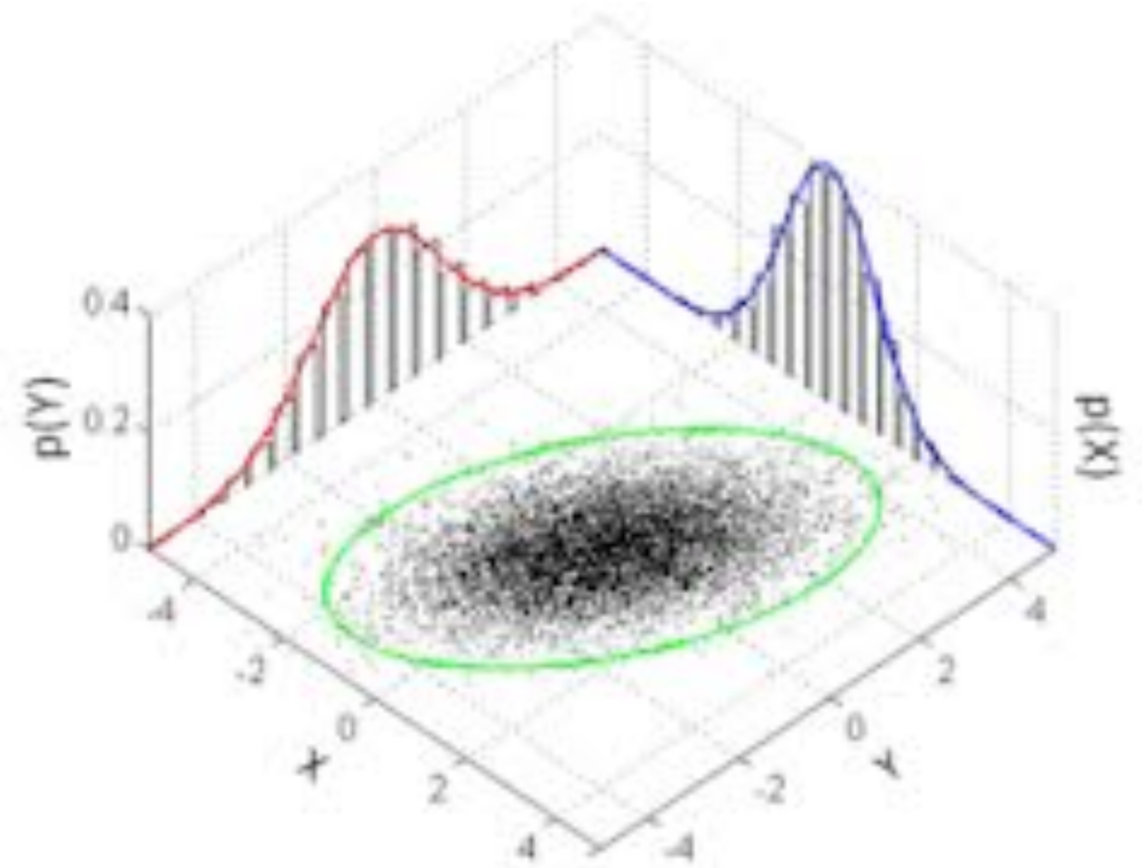


N = 1 N = 2 N = 3

For sampling rep: no of neurons required scales linearly with N

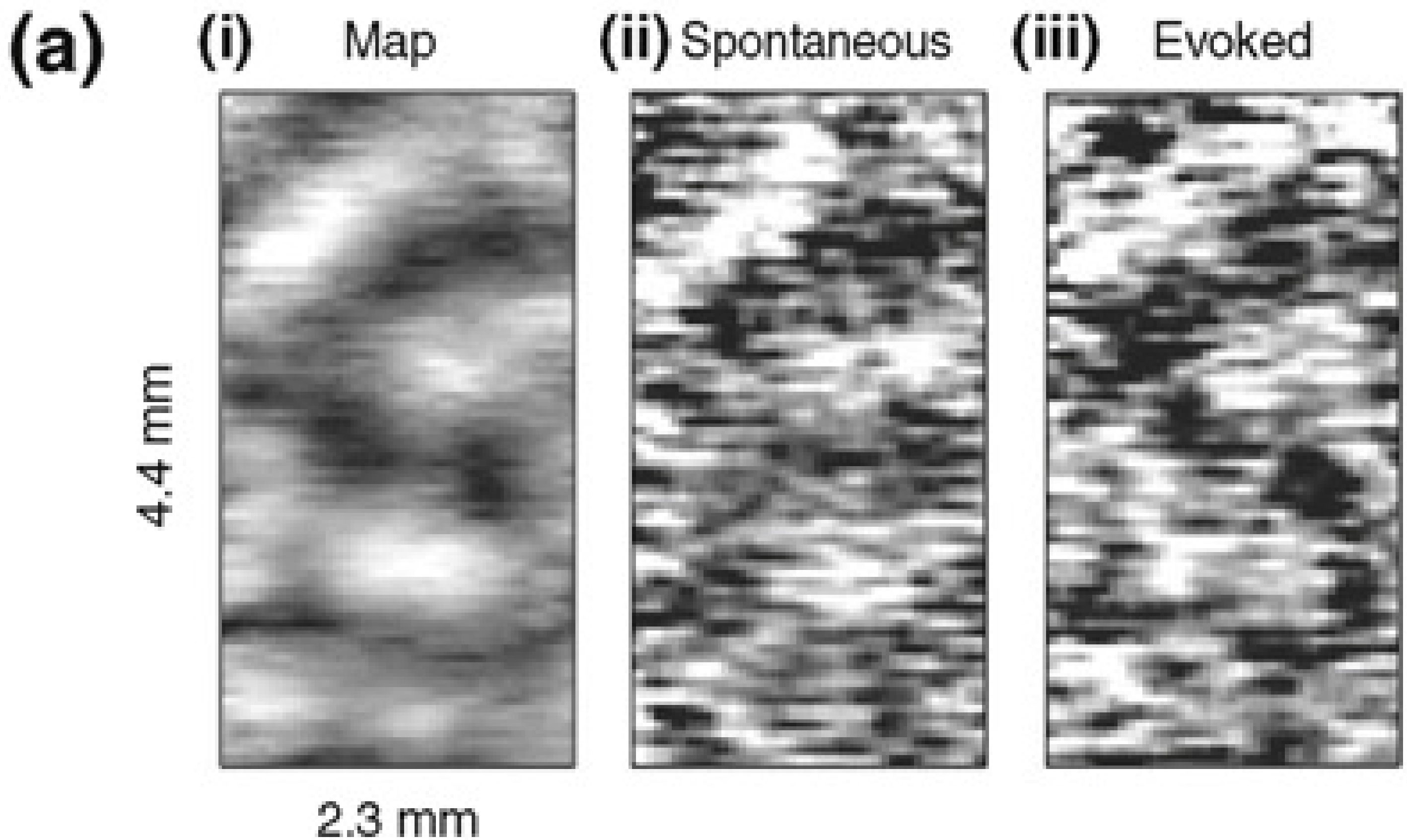
For a parametric rep (e.g. normal) scales exponentially(?) with N (e.g. with N^2)

Certain computations are straight-forward (e.g. marginalisation)



But consider the time taken to obtain this marginalisation . . .

Spontaneous and evoked activity



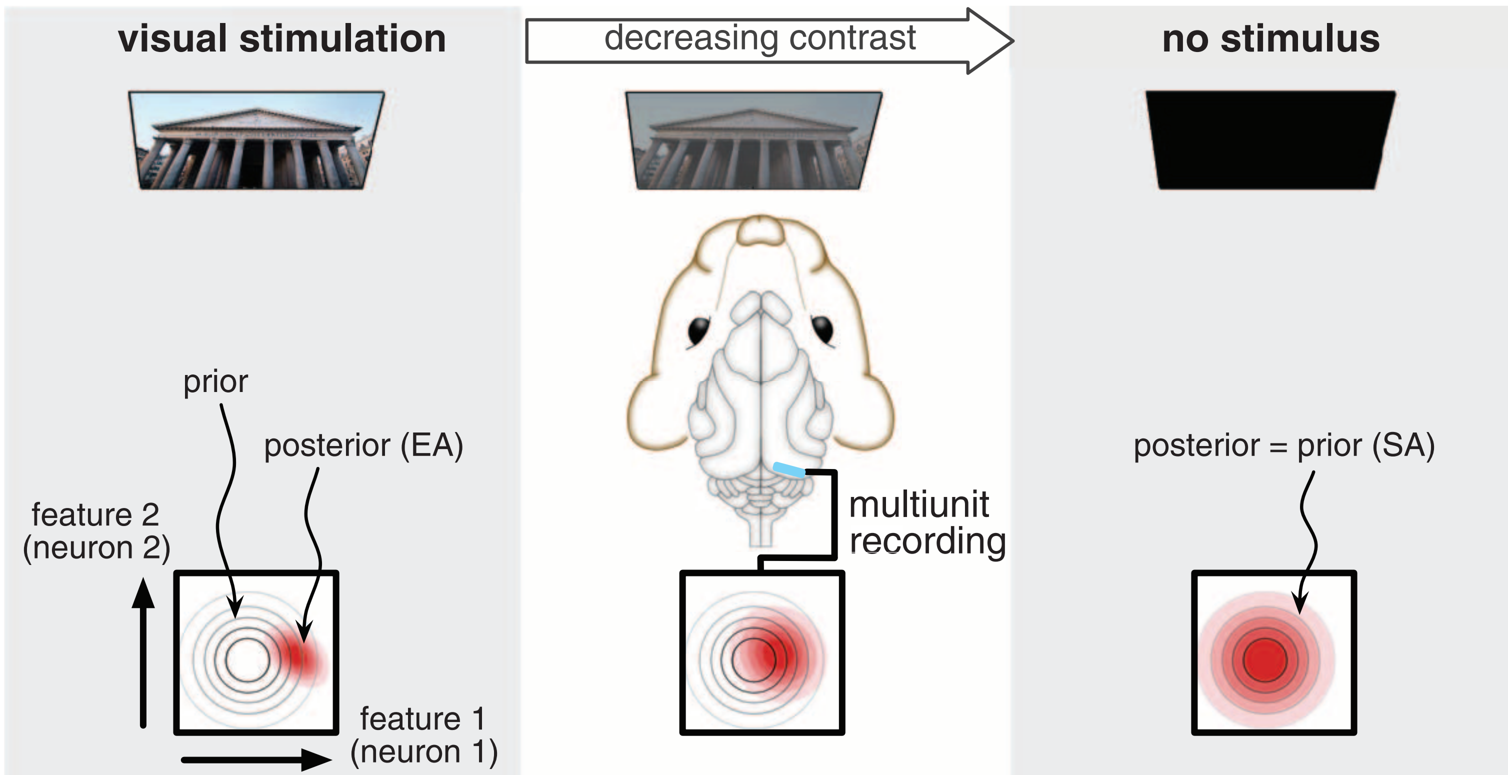
Kenet et al. 2003

Spontaneous and evoked activity

$$\text{Posterior} \ \alpha \ \text{Prior} \ \times \ \text{Likelihood}$$

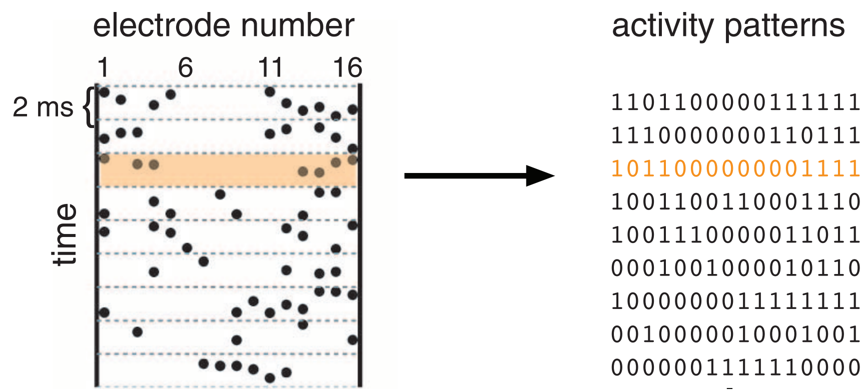
$$P(\theta \mid \text{Data}) = \frac{P(\theta) \ P(\text{Data} \mid \theta)}{P(\text{Data})}$$

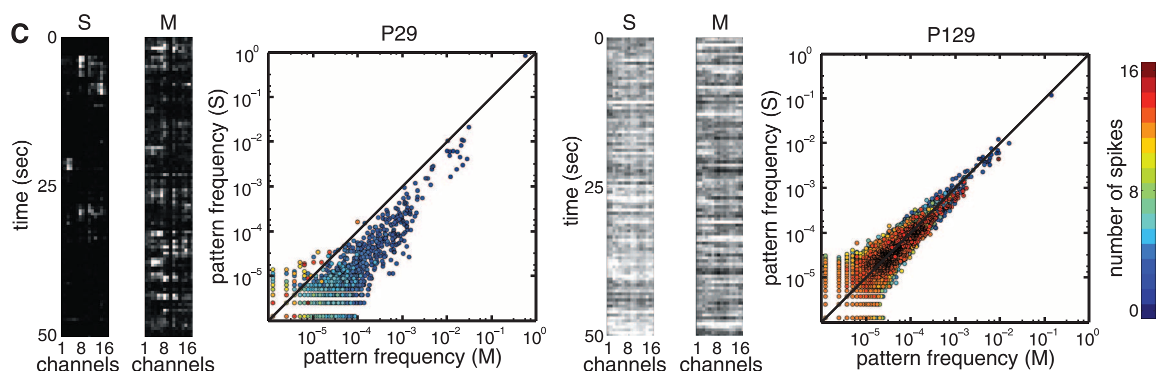
Spontaneous and evoked activity



Berkes et al. 2011

Spontaneous and evoked activity





Berkes et al. 2011

Conclusions

- Sampling based representations seem to have some conspicuous advantages (and disadvantages, time?) w.r.t. PPC.

- Some empirical evidence that spontaneous activity is sampling the prior.