Recent example of SGR: (23/01/2009)

- Pulsar timing arrays & radiastronomy
- A SGR dataset
- ~100 pulsars & 500 residuals each
- Irregularly spaced
- ms pulsar

Study of 51ms → very stable periods
- Old, rapidly spinning neutron stars
- Maybe X-ray binary
- Companion
- Transferring angular mom.

- Stochastic gravitational wave background
- SGWB
- Incidence of inspiral compact BH binaries

\[ \langle a_\theta(t) a_\theta(t') \rangle \sim A_0 \theta^{-3} \omega^{-2.5} \delta(t-t') \]

\[ S_\theta(t) = \int \frac{d \theta(t) d \theta(t')}{2 \pi} \delta(t-t') \]

\[ S_\theta = 1.3 \text{ predicted} \]

\[ S_\theta = \text{"Helfand's ancora"} \]
\[ \mathcal{S} \times (x_i, y_i) \sim \mathcal{N}_j (x_i, y_i) \]

Gaussian process

\[ \text{size number} \times \text{number residuals} \sim 5000 \times 500 \]

\( \sim \text{one week} \) for

\( \sim \text{seconds} \)

\( \rightarrow \) neural posterior inference

Example 2: "optimal cosmological analysis"

2202.05282 Dae & Sijak

Generalizing cosmological inference beyond simple Gaussian assumption

- large scale structure - not Gaussian
- 2d maps (weak lensing, etc.,...) - too high dimension

and beyond summary statistics

Goal: learn likelihood

\( p(x | y) \)

Their example: 4 2d maps of matter overdensity, 128^2 pixels

\( 4 \times 128^2 = 65536 \)

\( \rightarrow \) too large for ordinary flow!
Imposing translation & rotation symmetries

\[ \hat{X} = (\hat{x}_i) \text{ pixelizations} \]

\[ \hat{x}_i = e^{-\frac{x_i^2}{2\sigma_i^2}} \text{ is translation invariant} \]

\[ \tilde{X}_i = \tilde{X}_{i-1} \]

\[ \beta \sum_{i=1}^{\tilde{X}_i} \]

Build f out of pixelwise nonlinearities \( \Phi(x) \)

Fourier transform convolution

\[ \mathcal{F}\{T(\tilde{x} - \tilde{y}) \times (\tilde{x})\} \]

\( \mathcal{F} \& T \) param by NNS

\[ \rightarrow "TREN " \]

Impressive results on improving sensitivity vs. \( \text{Day}_5 \) vs. conventional power-spectrum approach!