JuliaGPs + Turing.jl

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Get set up

Who am I?

- Currently a postdoc with Hong
- I work on AD in Julia
- I used to work on GPs (approximate inference and software)

Objectives

- Understand available GP functionality
- Understand some common package design features
- Run + write some code

Outline

- GP refresher
- A complete example using JuliaGPs + Turing.jl
- A dive into the design of JuliaGPs
- Further examples
- Everything will be interactive

JuliaGPs

- Made to assist in our own research
- Useful composable components
- Extensible

JuliaGPs

Core Packages

- KernelFunctions.jl
- AbstractGPs.jl
- ApproximateGPs.jl (less stable)

Refresher

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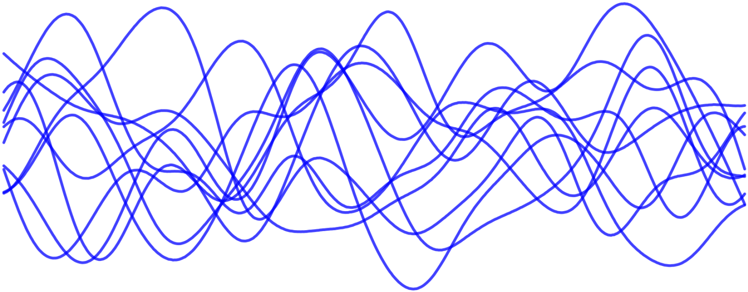
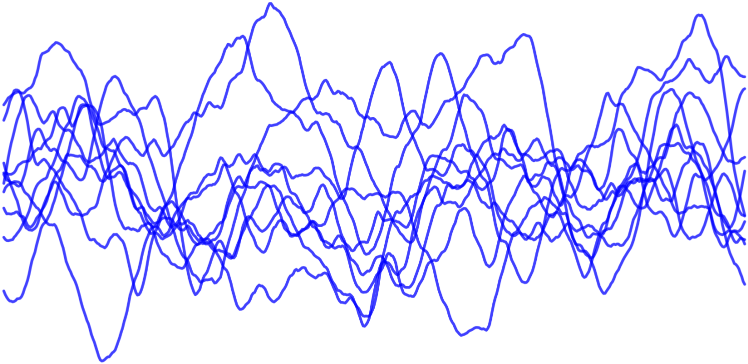
$$f \sim \mathcal{GP}(0, \kappa)$$

Refresher



Refresher



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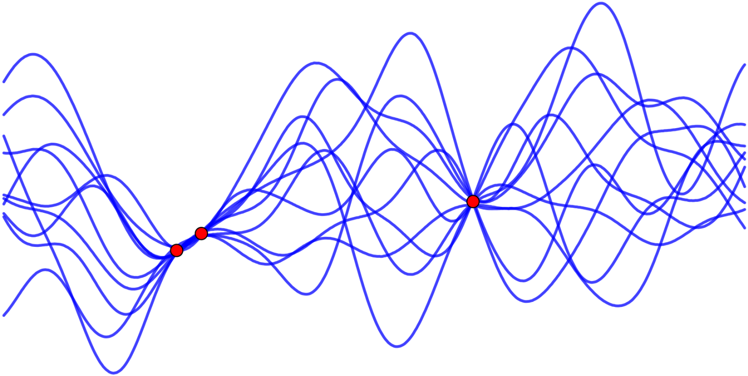
$$\mathbf{y} \mid \mathbf{f} \sim \mathcal{N}\big(\mathbf{f}, \sigma^2 \mathbf{I}\big)$$

Refresher



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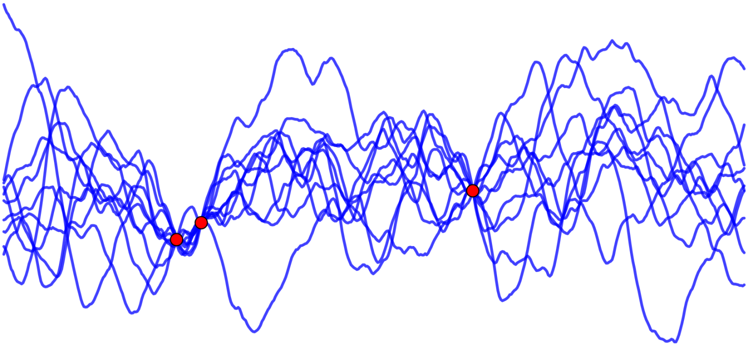

Running Toy Example

- Putting example from BDA (Gelman et al, 1995)
- *Incredibly* simple
- Non-Gaussian
- Small data

Running Toy Example

Row	distance Int64	n Int64	y Int64
1	2	1443	1346
2	3	694	577
3	4	455	337
4	5	353	208
5	6	272	149

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$$\mathbf{y}_j \mid \mathbf{f}_j \sim \text{Binomial}(n_j, g(\mathbf{f}_j))$$

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$$g(x) := (1 + e^{-x})^{-1}$$

Running Toy Example

Go to code