

Intro to Stan

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What is Stan?



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+ interfaces.

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Developed by Andrew Gelman (Columbia),
Matt Hoffman (Adobe Labs), and others.

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Penalized regression

$$\hat{y} = b_1 x_1 + b_0$$
$$\min_{b_0, b_1} (y - \hat{y})^2 \text{ subj. to. } |b_0| + |b_1| < t$$

(Which method is this?)

Under the hood

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HMC (Hamiltonian Monte Carlo).

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Limited-memory BFGS (quasi-newton optimization algorithm, also "state of the art").

Different APIs to play with

You don't use Stan by itself. Instead, you interact with it through the following :

- RStan (R)

- PyStan (Python)

- MatlabStan (MATLAB)

- Stan.jl (Julia)

- StataStan (Stata)

- CmdStan (command-line)

Commands are fairly consistent across the interfaces.

Examples

Setting up Stan

Two parts to running a model with Stan.
Describe the model in a .stan file.

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Two parts to running a model with Stan.

- Describe the model in a .stan file.

- Pass the file to the "stan()" function in your favorite programming language.

Example: Normal Regression

$$\begin{aligned}y_i &= \beta_0 + \beta_1 * x_{i,1} + \cdots + \beta_M * x_{i,M} + \epsilon_i \\ \epsilon_i &\sim \textit{Normal}(0, \sigma^2) \\ i &= 1, \dots, N\end{aligned}$$

Example: 8 Schools

A hierarchical model used to model the effect of coaching programs on college admission tests.

$$\begin{aligned}y_j &\sim \text{Normal}(\theta_j, \sigma_j^2) \\ \theta_j &\sim \text{Normal}(\mu, \tau^2) \\ j &= 1, \dots, 8\end{aligned}$$

Homework Time!

Homework

Can be done in any language you prefer.
Maybe R/Python would be the easiest.

We will send you all this later :

- description for a simple model
- a sample .stan file
- and some instructions. :-)

Want to practice? Go to github.com and search for "set-phasers-to-stan".