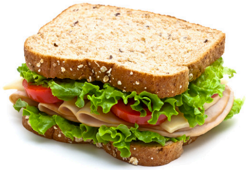
greta

simple and scalable statistical modelling in R

Nick Golding

greta-dev.github.io/greta

types of statistical software



one model

DirFactor, effectFusion

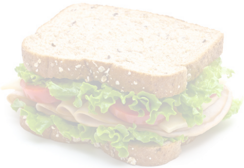
one class of model

glm, lme4, INLA

(almost) any model

BUGS, JAGS, Stan

types of statistical software



one model

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BUGS, JAGS, Stan, greta

example

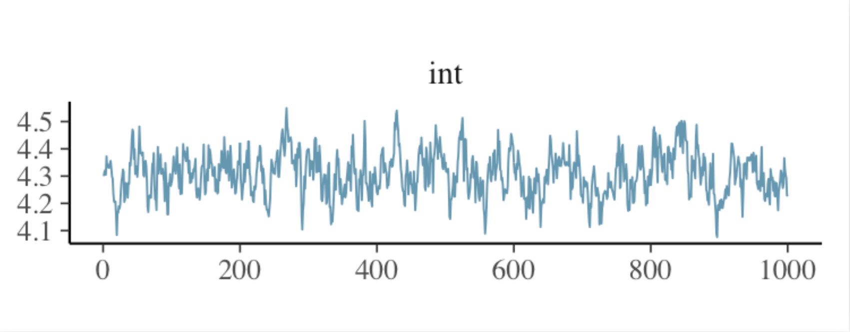
```
x <- iris$Petal.Length
y <- iris$Sepal.Length

int = normal(0, 5)
coef = normal(0, 3)
sd = lognormal(0, 3)

mean <- int + coef * x
distribution(y) = normal(mean, sd)
```

```
m <- model(int, coef, sd)
```

```
draws <- mcmc(m, n_samples = 1000)
bayesplot::mcmc_trace(draws)
```



simple

Stan

```
data {
  real alpha;
  real beta;
  real<lower=0> sigma2;
  int<lower=0> J;
  int y[J];
  vector[J] Z;
  int n[J];
}

transformed data {
  real<lower=0> sigma;
  sigma <- sqrt(sigma2);
}

parameters {
   real theta1;
   real theta2;
   vector[J] X;
}

model {
  real p[J];
  theta1 ~ normal(0, 32);   // 32^2 = 1024
  theta2 ~ normal(0, 32);
  X ~ normal(alpha + beta * Z, sigma);
  y ~ binomial_logit(n, theta1 + theta2 * X);
}
```

JAGS

```
for(j in 1 : J) {
   y[j] ~ dbin(p[j], n[j])
   logit(p[j]) <- theta[1] + theta[2] * X[j]
   X[j] ~ dnorm(mu[j], tau)
   mu[j] <- alpha + beta * Z[j]
}
theta[1] ~ dnorm(0.0, 0.001)
theta[2] ~ dnorm(0.0, 0.001)
```

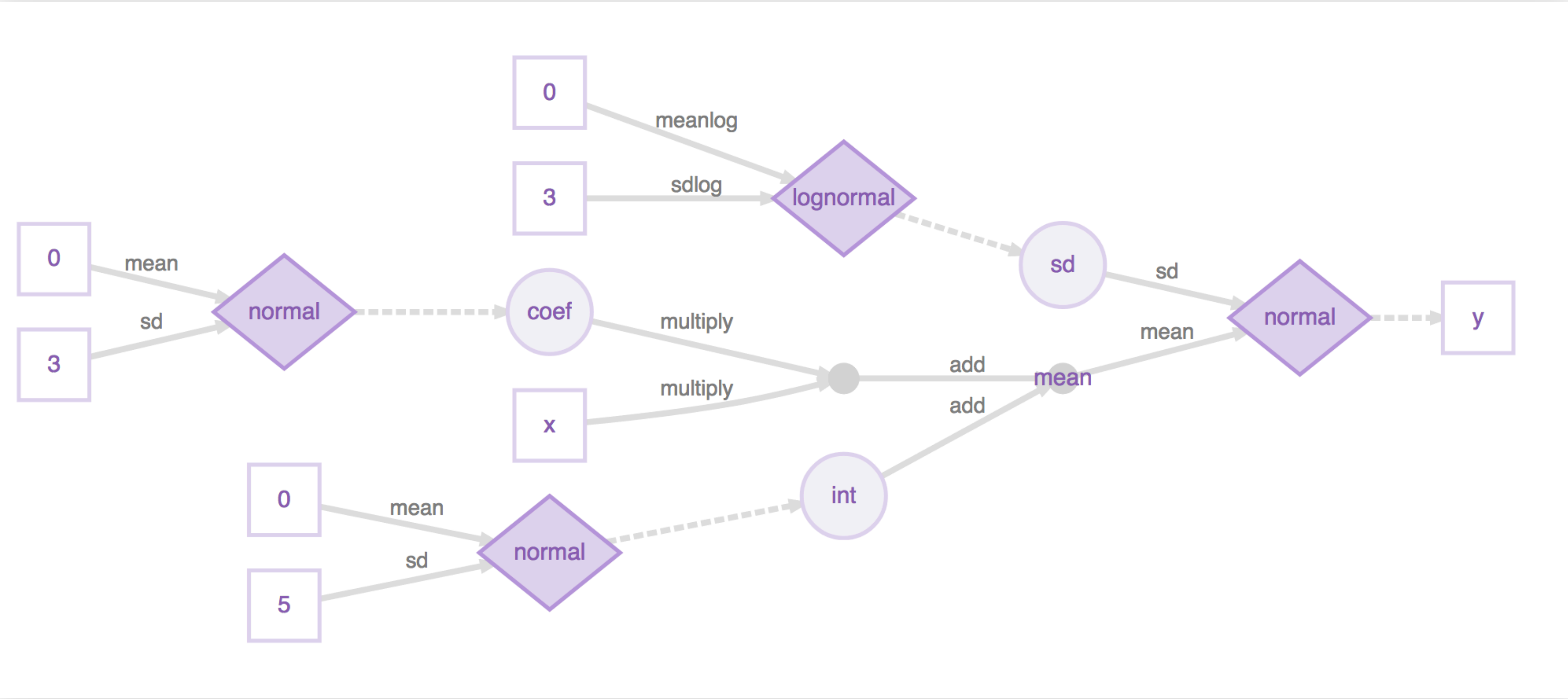
greta

```
theta = normal(0, 32, dim = 2)
mu <- alpha + beta * Z
X = normal(mu, sigma)
p <- ilogit(theta[1] + theta[2] * X)
distribution(y) = binomial(n, p)
```

intuitive

```
int = normal(0, 5)
coef = normal(0, 3)
sd = lognormal(0, 3)
```

```
mean <- int + coef * x
distribution(y) = normal(mean, sd)
```



documented

greta-dev.github.io/greta

greta

get started | examples | docs | more |

Get started with greta

Installation

You can install the stable version of greta from CRAN:

```
install.packages("greta")
```

Alternatively, you can install the latest release, or the development version, from GitHub using the devtools package:

```
devtools::install_github("greta-dev/greta")  # latest release
devtools::install_github("greta-dev/greta@dev")  # development version
```

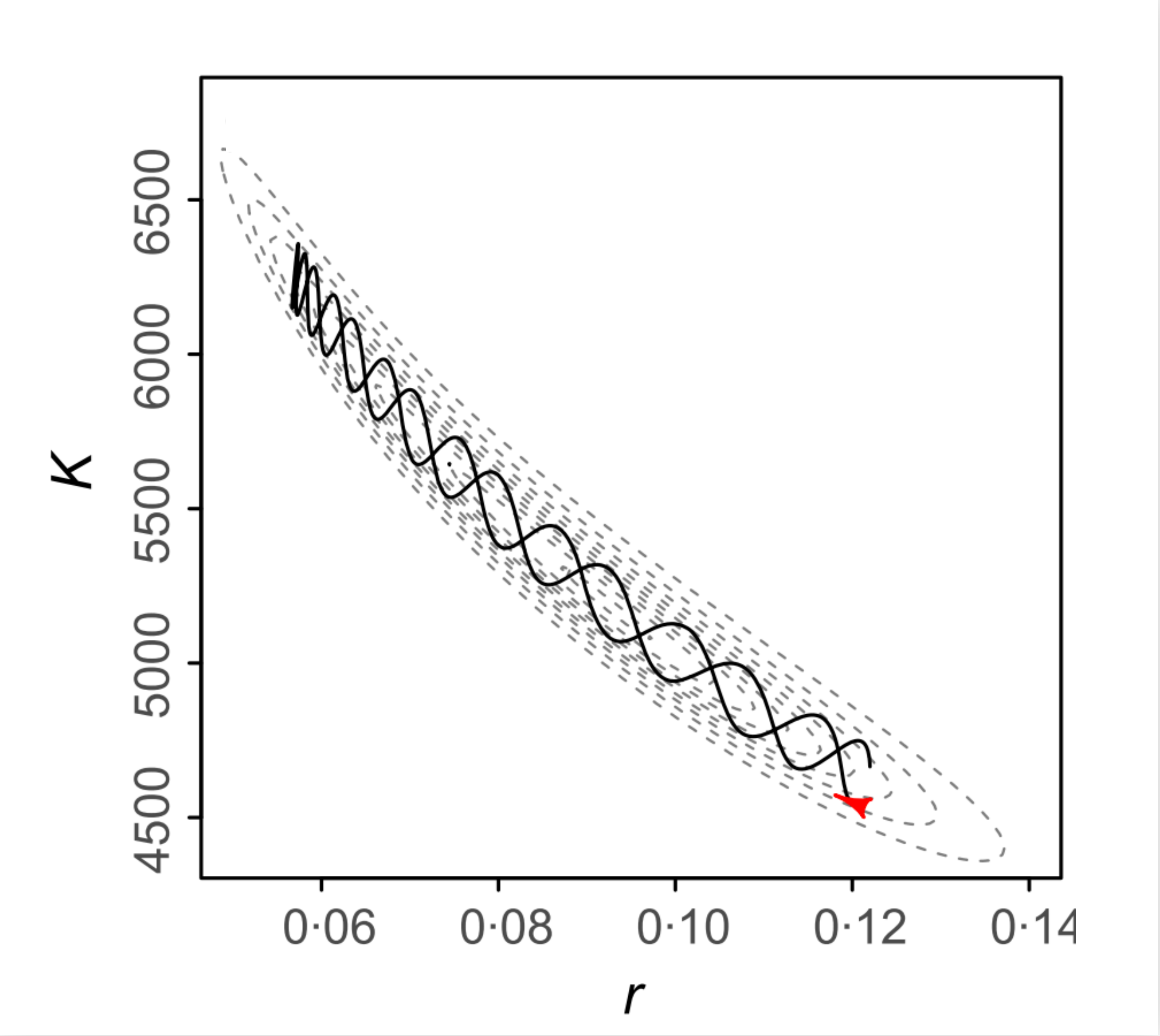
```
library(greta)
```

TensorFlow

Before you can fit models with greta, you will also need to have a working installation of Google's TensorFlow python package (version 1.0.0 or higher). greta exports `install_tensorflow()` from the `tensorflow` R package, which will attempt to install the latest version of TensorFlow from within your R session.

```
install_tensorflow()
```

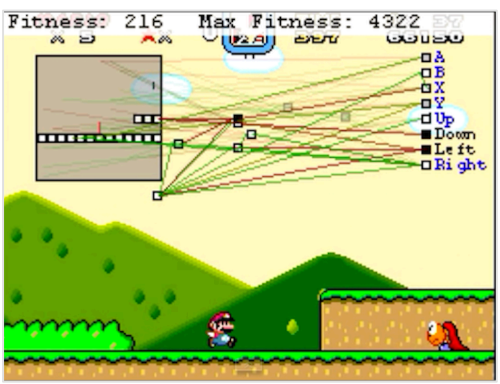
gradient-based inference



Monnahan *et al.* 2016

google tensorflow

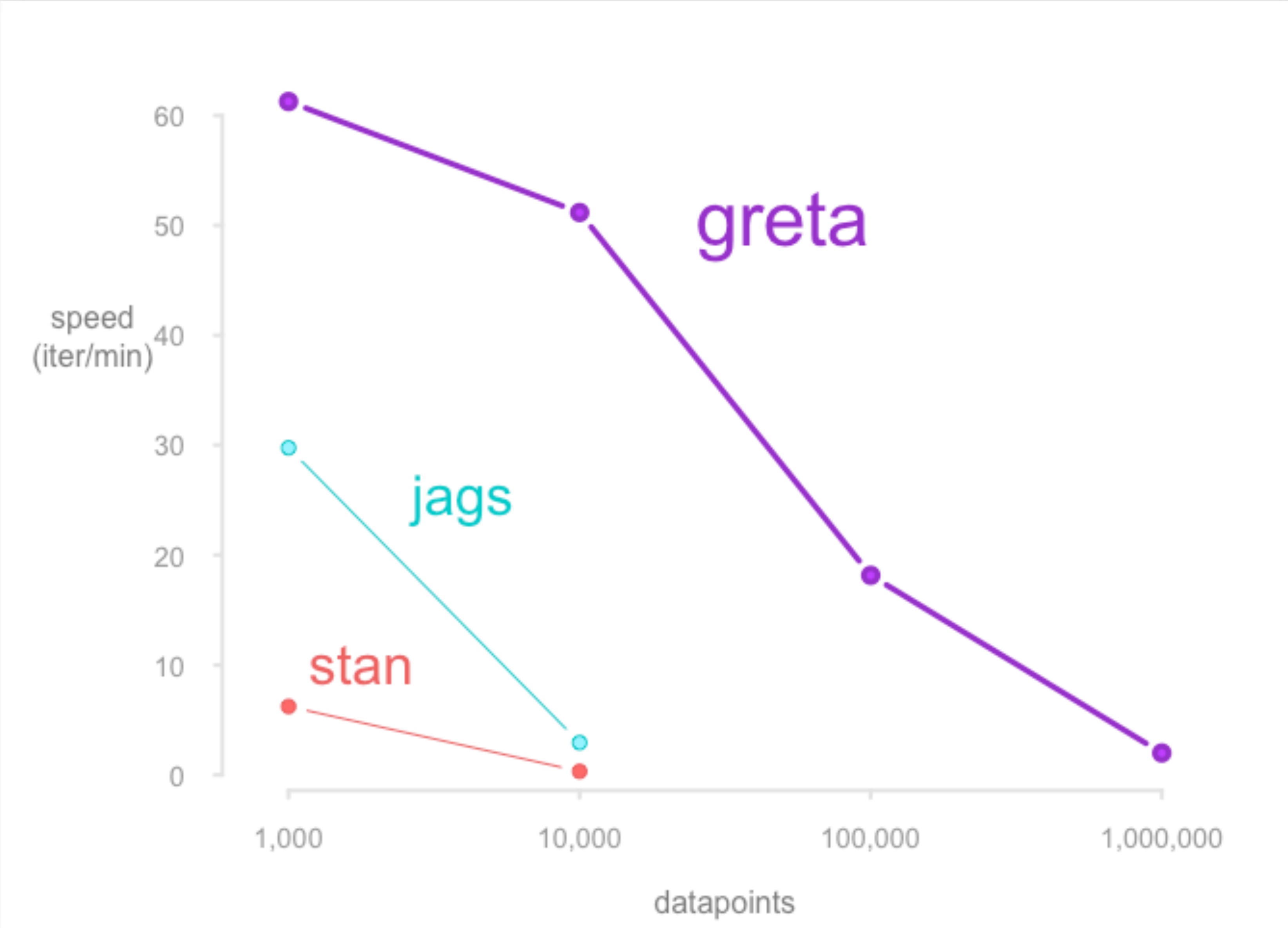
- automatic differentiation
- efficient linear algebra
- highly parallel



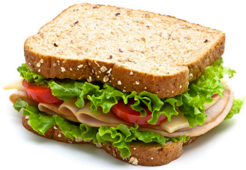
Google Translate

scalable

probit regression with 50 predictors



types of statistical software



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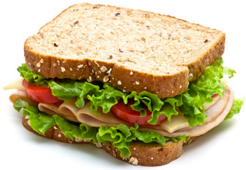
deep learning software is less redundant



canned estimators

↑

keras

↑

tensorflow

extendable

greta.dynamics

a greta extension for modelling dynamical systems

R ★ 1 2 Updated 12 days ago

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greta.gp

a greta extension for Gaussian process modelling

R ★ 4 1 Updated on 9 Sep

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greta.multivariate

a greta extension for multivariate modelling

1 Updated on 26 Aug

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greta.gam

a greta extension for generalised additive modelling using mgcv

R ★ 3 2 Updated on 23 Aug

extendable

greta.gp

Gaussian processes in greta

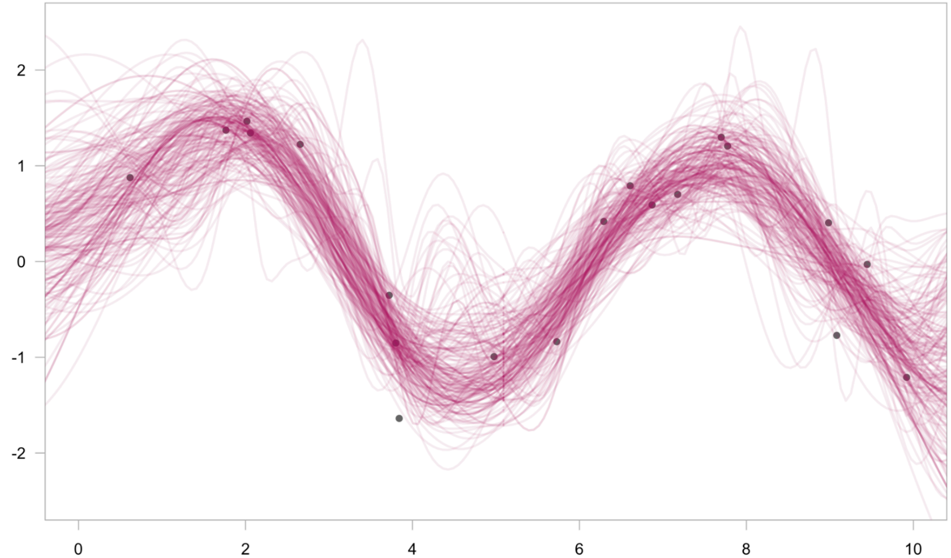
`greta.gp` extends greta to let you define Gaussian processes as part of your model. It provides a syntax to create and combine GP kernels, and use them to define either full rank or sparse Gaussian processes.

build passing codecov 98%

```
# kernel & GP
kernel <- rbf(rbf_len, rbf_var) + bias(1)
f = gp(x, kernel)

# likelihood
distribution(y) = normal(f, obs_sd)

# prediction
f_plot <- project(f, x_plot)
```



github.com/greta-dev/greta.gp

what next?

- variational inference
- samplers for big data
- discrete samplers
- differential equations

why 'greta'?

Grete Hermann (1901-1984)

wrote the first algorithms for computer algebra

... without a computer

(I didn't want people saying 'greet', so spelled the package *greta* instead)