

Topic 4 - Stochastic Optimization

Assignment 1: Logistic regression smoothing

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Objectives

Minimize the penalized negative log likelihood

estimating β for fixed λ

Using polynomial basis functions Using B-spline basis functions

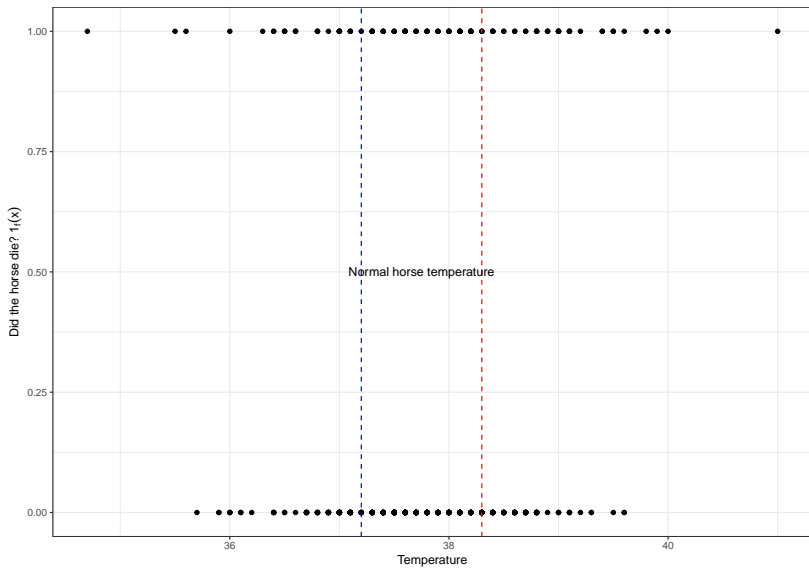
Test using horse data and simulated data

Compare stochastic gradient to other optim algo How different choices of basis (default b-spline basis or demmler-reinsch basis) affect convergence

Test if the implementation is correct Implement alternative solutions Restructure code (s3, modularization, abstraction etc) improve readability Benchmarking performance What are the bottlenecks (profiling) what do to about them?

Algorithm

Horse data

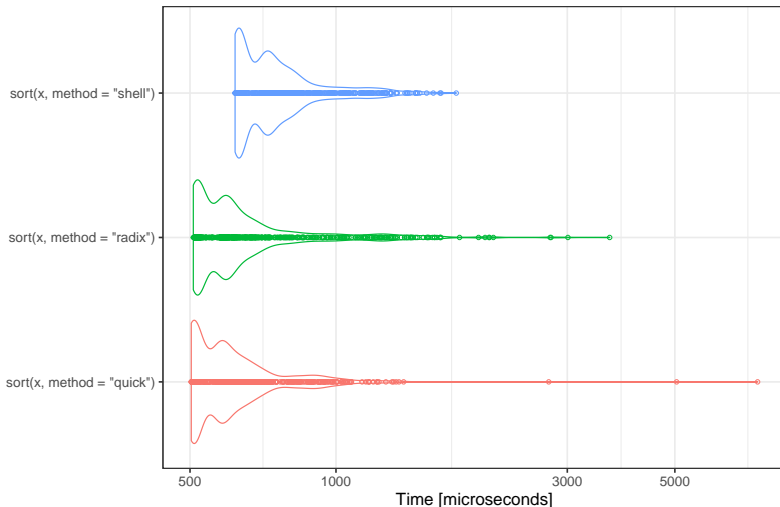


Sorting operation (used in knot definitions)

- ▶ quick: Hoare's Quicksort method
- ▶ Default: radix

Benchmarking results with 1000 evaluations

`x <- rnorm(10000)`



1. Speed-up the sorting operation

How impactful is this improvement?

Alternatives to diff function

We use diff function for computing the vector of knot differences (b-a) to construct the penalty matrix.

```
diff_v2 <- function(v) {  
  v[2:length(v)] - v[1:(length(v) - 1L)]  
}
```

```
# Use byte compiling for faster diff()  
diff_v3 <- compiler::cmpfun(function(v) {  
  v[2:length(v)] - v[1:(length(v) - 1L)]  
})
```

```
# Save length to a variable instead of  
# two calls  
diff_v4 <- compiler::cmpfun(function(v) {  
  l <- length(v)  
  v[2:l] - v[1:(l - 1L)]  
})
```

Test accuracy of alternatives

```
all(diff(x10) == diff_v2(x10))
```

```
[1] TRUE
```

```
all(diff(x10) == diff_v3(x10))
```

```
[1] TRUE
```

```
all(diff(x10) == diff_v4(x10))
```

```
[1] TRUE
```


2.2. Compare the speed of diff alternatives

Benchmarking results with 100 evaluations

```
x <- rnorm(10000)
```

