Statistical Computing - Assessed Coursework 1

Conor Newton

Contents

1 The Package

I have created a package that has provides functions for both gradient descent and stochastic gradient descent.

The package and all of the files for this project can be found here on github:

https://www.github.com/conornewton/sc1-optimization

1.1 Installation

This package can be installed directly from github using the following command in an R shell if `devtools` is installed

```
devtools::install_github("conornewton/sc1-optimization")
```

This package has no required dependencies.

1.2 Documentation

The documentation for this package is generated automatically from the source files using `roxygen2`.

The package exports two functions, `gradDescent` and `stocGradDescent`. The documentation for them can be accessed from the shell using the `?gradDescent` and `?stocGradDescent` commands.

Alternatively, the documentation can be accessed in a pdf here:

https://www.github.com/conornewton/sc1-optimization/doc/man.pdf

1.3 Usage

Here are some basic example of how to use the `gradDescent` and `stocGradDescent` functions.

Firstly, we can use gradDescent to estimate the argument of a local minimum of the Rosenbrock function

```
# Rosenbrock function
f <- function(x) (1 - x[1])^2 + 100 * (x[2] - x[1]^2)^2
grad_descent(f, c(0, 0), n = 100000, step_method = "BB")
```

Secondly, we can use stocGradDescent to estimate the argument that minimises the mean square error

```
# Summand of the objective function
f <- function(w, x, y) (sum(w * c(1, x)) - y)^2

# Generating a data set which will appear in the summand
y <- mapply(function(x1, x2) sum(c(20, 1) * c(x1, x2)) + 2, 1:100, 1:100)
```

```
    data <- data.frame(1:100, 1:100, y)

    stoc_grad_descent(f, data, c(0, 0, 0))
```

1.4 Testing

This package uses `testthat` for unit testing. Both the `gradDescent` and `stocGradDescent` have unit tests to ensure that they work for a variety of edge cases. These test are found in the `tests/testthat` directory. If `testthat` is installed locally, the package will be tested automatically on installation.

After installation, the tests can be run manually using the following command in the R shell

```
    devtools::test("sc1-optimization")
```

2 Gradient Descent

3 Stochastic Gradient Descent