rnn: Recurrent Neural Network architectures in native R

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Abstract

The R package **rnn** implements several Recurrent Neural Network (RNN) architectures in the R language. The native R implementations of these architectures allow scientists familiar with the R language, to develop an intuitive understanding of these architectures, something which is not possible with production frameworks, such as TensorFlow, PyTorch or CNTK.

1 About package rnn in R

The **rnn** package is available on CRAN at https://cran.r-project.org/package=rnn and can be installed using:

```
install.packages('rnn')
```

After installation, the package can be loaded using:

```
library(rnn)
```

A list of all the exported functions can be printed using:

```
ls('package:rnn')
```

```
## [1] "bin2int"          "epoch_annealing"  "epoch_print"
## [4] "int2bin"          "loss_L1"          "predictr"
## [7] "run.finance_demo" "run.rnn_demo"     "trainr"
```

A list of all the functions - including non-exported ones - can be printed using:

```
ls(getNamespace('rnn'), all.names=TRUE)
```

```
##  [1] ".__NAMESPACE__."      ".__S3MethodsTable__." ".packageName"
##  [4] "b2i"                  "backprop_gru"         "backprop_lstm"
##  [7] "backprop_r"           "backprop_rnn"         "bin2int"
## [10] "clean_lstm"           "clean_r"              "clean_rnn"
## [13] "epoch_annealing"      "epoch_print"          "i2b"
## [16] "init_gru"             "init_lstm"            "init_r"
## [19] "init_rnn"             "int2bin"              "loss_L1"
## [22] "predict_gru"          "predict_lstm"         "predict_rnn"
## [25] "predictr"             "run.finance_demo"     "run.rnn_demo"
## [28] "trainr"               "update_adagrad"       "update_r"
## [31] "update_sgd"
```

The `rnn` has one dependency, the `sigmoid` package, which is on CRAN at https://cran.r-project.org/package=sigmoid. The `sigmoid` package provides a collection of sigmoid functions such as the Rectified Linear Unit (`ReLU()`), `Gompertz()`, etc. Until version `0.8.0` of the `rnn` package, the sigmoid functions were included in the package, after which they were released as a separate package for more general use.

In addition to this, the `rnn` package includes a `Shiny` app demonstrating a Recurrent Neural Network analysis of a time series (Foreign Exchange rates). In order to run the app locally, the Shiny package needs to be installed.

2 Internals

We can show the code of a function as such (note that we can just remove them and add their definitions to the example code):

```
int2bin
```

```
## function(integer, length=8) {
##   t(sapply(integer, i2b, length=length))
## }
## <bytecode: 0x559a34fe0d78>
## <environment: namespace:rnn>
```


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