Rapid Deployment of Automatic Scoring Models to Hadoop Production Systems

System Overview, Case Study, and Recommendations

@amitaigolub

amitai.golub@innogames.com

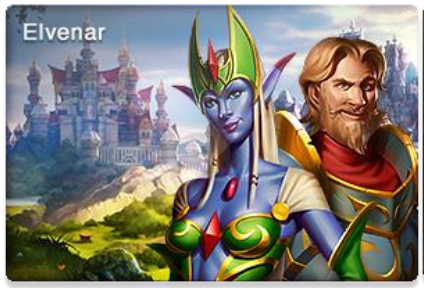
Who am I? Who is InnoGames?

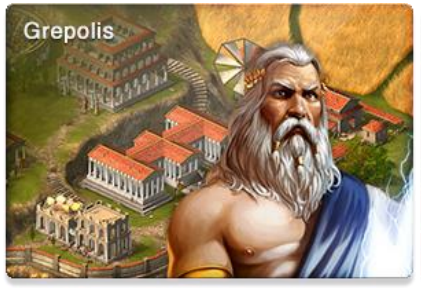
About me:

- Studied Statistics in the Hebrew University in Jerusalem, with a focus on non-numerical data and graphical models.
- Consultant for bio-tech, gambling and IT companies.
- Since 2014 data mining analyst at InnoGames GmbH in Hamburg, Germany

About InnoGames:

- Started as a hobby-project in 2003 by our managing directors; The first game “Tribal Wars” is still growing.
- F2P business model: moved from browser to cross platform developer & publisher.
- +350 employees from 30 nations.
- 135M registered player.

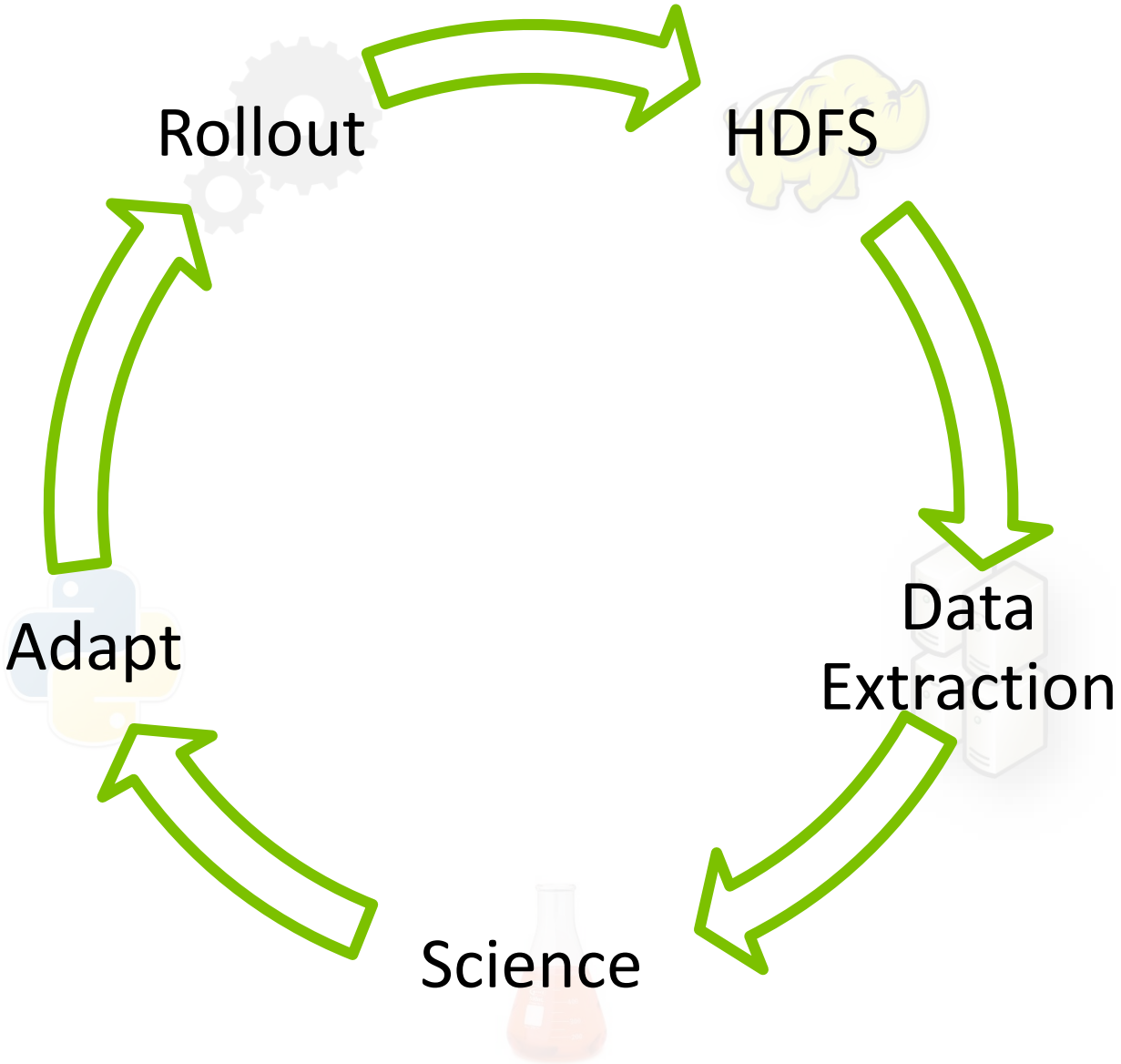




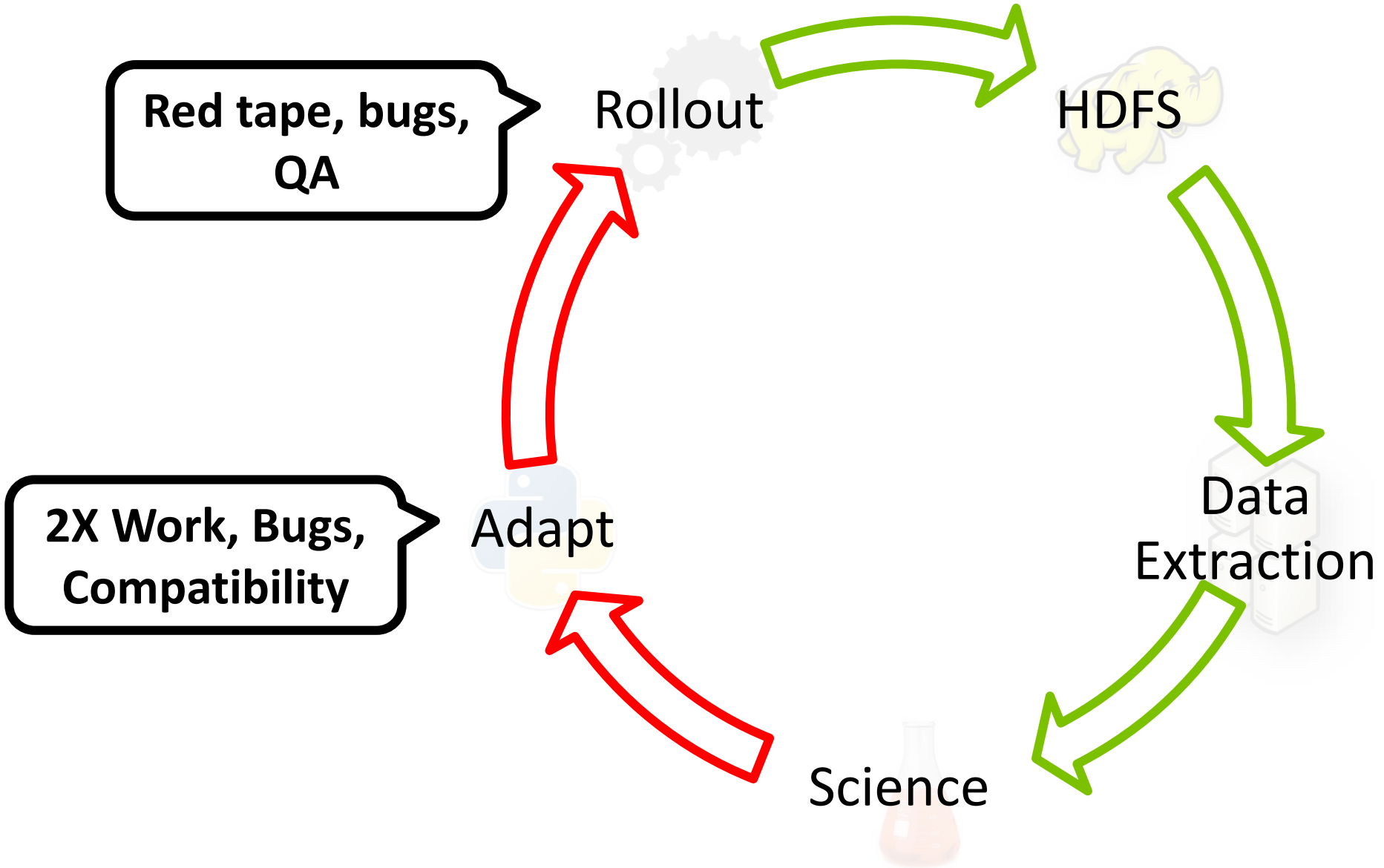
Motivation

Data Scientists are data consumers, but have a hard time becoming data suppliers. I want to help data scientists become efficient suppliers of data.

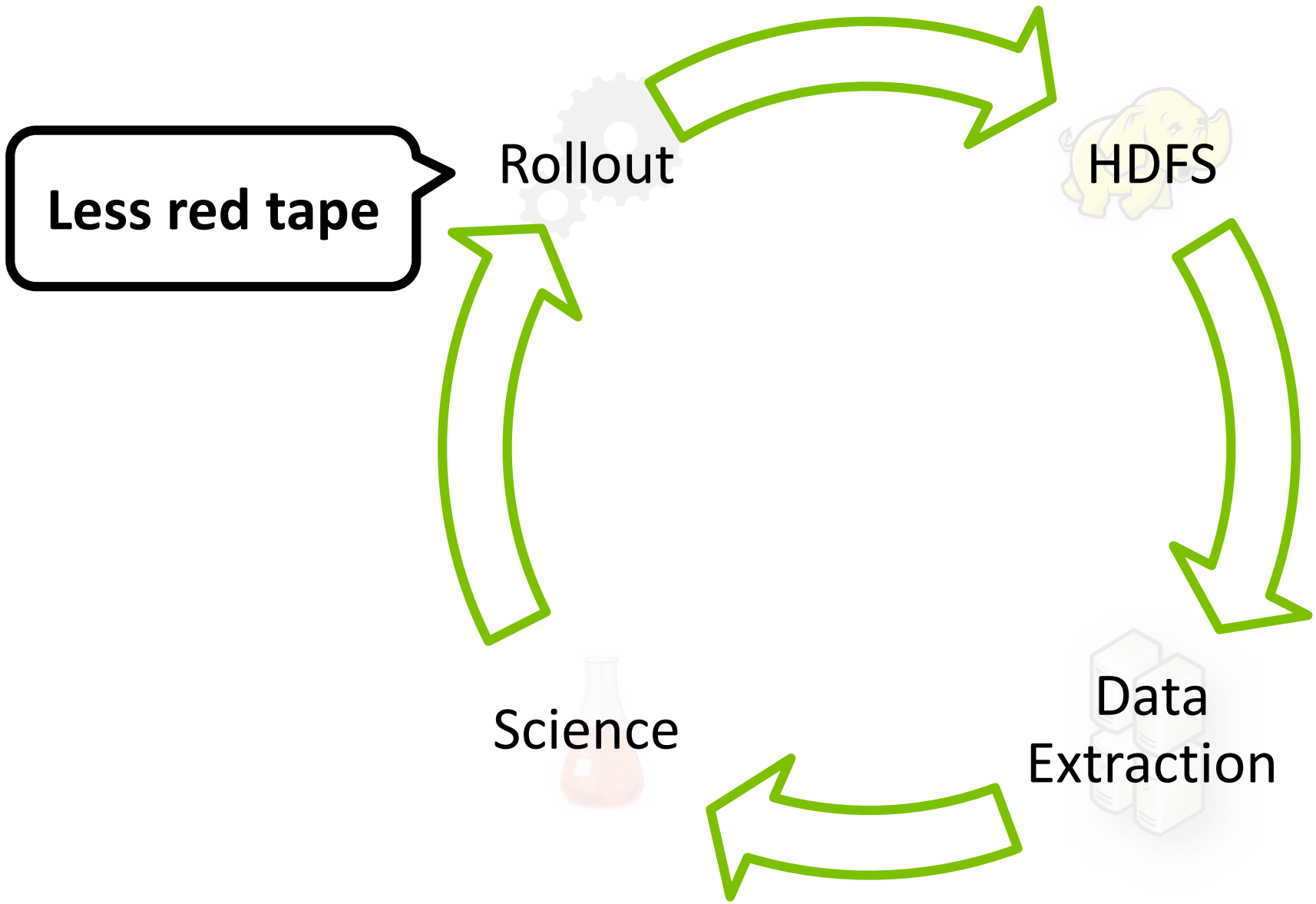
Production Cycle



Production Cycle



Production Cycle



The New Packages You Need + Some Setup

rmr2

- The basic building blocks of RHadoop.
- Allows building MapReduce functions in R

Rhdfs

- HDFS file management from within R (hdfs terminal)
- Read, write, copy, rename, etc., etc.

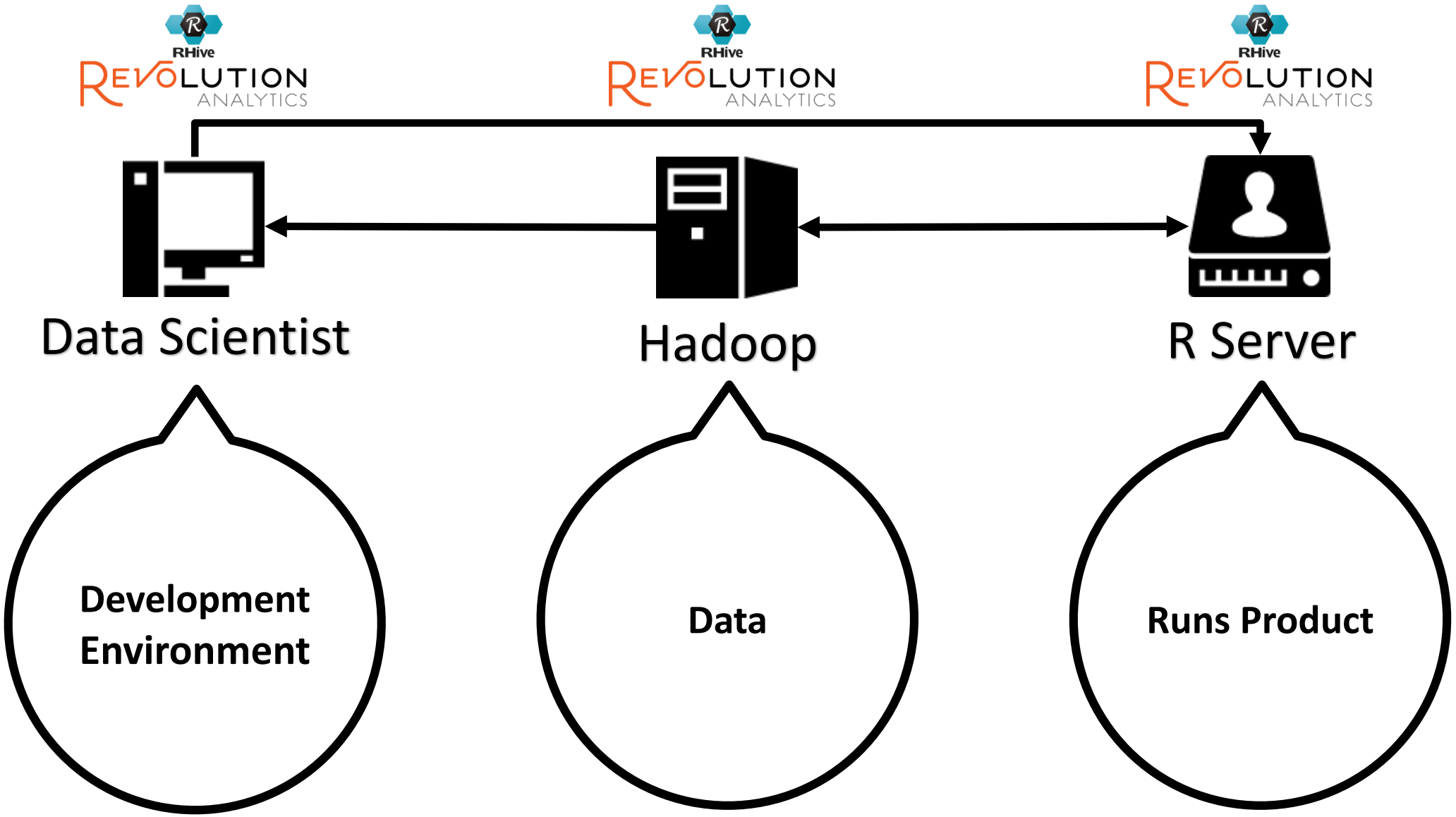
plyrmr

- A higher level function toolkit.
- This is the package the Data Scientist will most likely want to use when analyzing data en masse.

Rhive

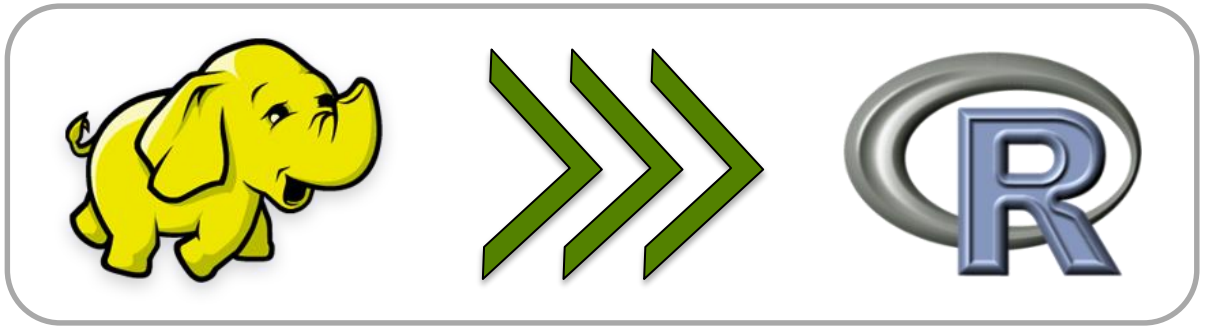
- Hive functionality in R.
- Great replacement for ODBC driver issues
- Also contains HDFS functions
- ***Doesn't work on Windows***

Setup



https://icons8.com/

```
get_score(get_data, model_data, make_output,...)
```



```
get_score(get_data, model_data, make_output,...)
```

http://ekonometrics.blogspot.de/2011/04/painting-picture-of-statistical.html

```
get_score(get_data, model_data, make_output,...)
```

Initialization

```
> require('RHive')
> require('mixtools')
>
> Sys.setenv("HADOOP_CMD" = '/usr/bin/hadoop')
> Sys.setenv("HADOOP_STREAMING" = '/usr/lib/hadoop-mapreduce/hadoop-streaming.jar')
>
> require('plyrmr')
>
> rhive.init(hiveHome   = '/usr/lib/hive',
+            hadoopHome = '/usr/lib/hadoop',
+            hadoopConf = '/etc/hadoop/conf/’)
>
> rhive.connect(host        = '<ip_address>',
+               port        = 10000,
+               hiveServer2 = T,
+               defaultFS   = 'hdfs_namenode_url',
+               user        = 'hdfs',
+               password    = '')
```

Process

```
> get_data_mvnormal <- function(table.name){
+   query <- paste('select * from', table.name)
+   return(rhive.query(query = query))
+ }
```

```
> model_data_mvtnorm_em <- function(data){
+   res <- mvnormalmixEM(data)
+   score <- apply(res$posterior, 1, which.max)
+   return(cbind(data, score))
+ }
```

```
> make_output_matrix_to_hive <- function(score.df){
+   rhive.write.table(score.df, 'results', rowName = F)
+ }
```

Process

```
> get_score <- function(get_data, model_data, make_output, ...){

  extra_input <- list(...)

  Get_Data    <- match.fun(get_data)
  Model_Data  <- match.fun(model_data)
  Make_Output <- match.fun(make_output)

  Get_Data(extra_input$table_name) %>%
      Model_Data

  Make_Output(results)

  return(0)
}
```

Process

```
> get_data_mvnormal <- function(table.name){
+   query <- paste('select * from', table.name)
+   return(rhive.query(query = query))
+ }
```

```
> model_data_mvtnorm_em <- function(data){
+   res <- mvnormalmixEM(data)
+   score <- apply(res$posterior, 1, which.max)
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+ }
```

```
> make_output_matrix_to_hive <- function(score.df){
+   rhive.write.table(score.df, 'results', rowName = F)
+ }
```

Process

```
> get_data_mvnormal <- function(tbl_name_1, tbl_name_2){
+   query_1 <- paste('select * from', tbl_name_1)
+   query_2 <- paste('select * from', tbl_name_1)
+   res_1 <- rhive.query(query = query_1)
+   res_2 <- rhive.query(query = query_2)
+
+   p_res <- combine_and_process_data(res_1, res_2)
+   return(p_res)
+ }
```

```
> model_data_mvtnorm_em <- function(data){
+   res <- mvnormalmixEM(data)
+   score <- apply(res$posterior, 1, which.max)
+   return(cbind(data, score))
+ }
```

```
> make_output_matrix_to_hive <- function(score.df){
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+ }
```
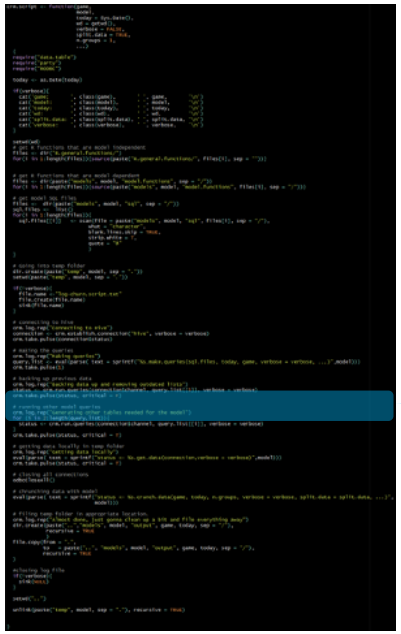
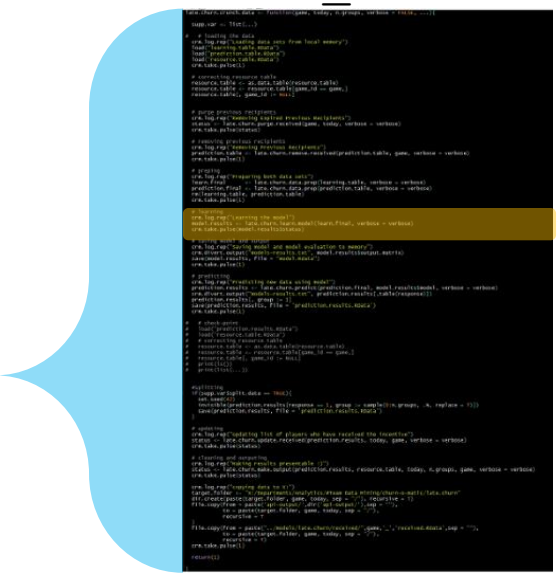

(Greatly) Increasing Complexity

main.R

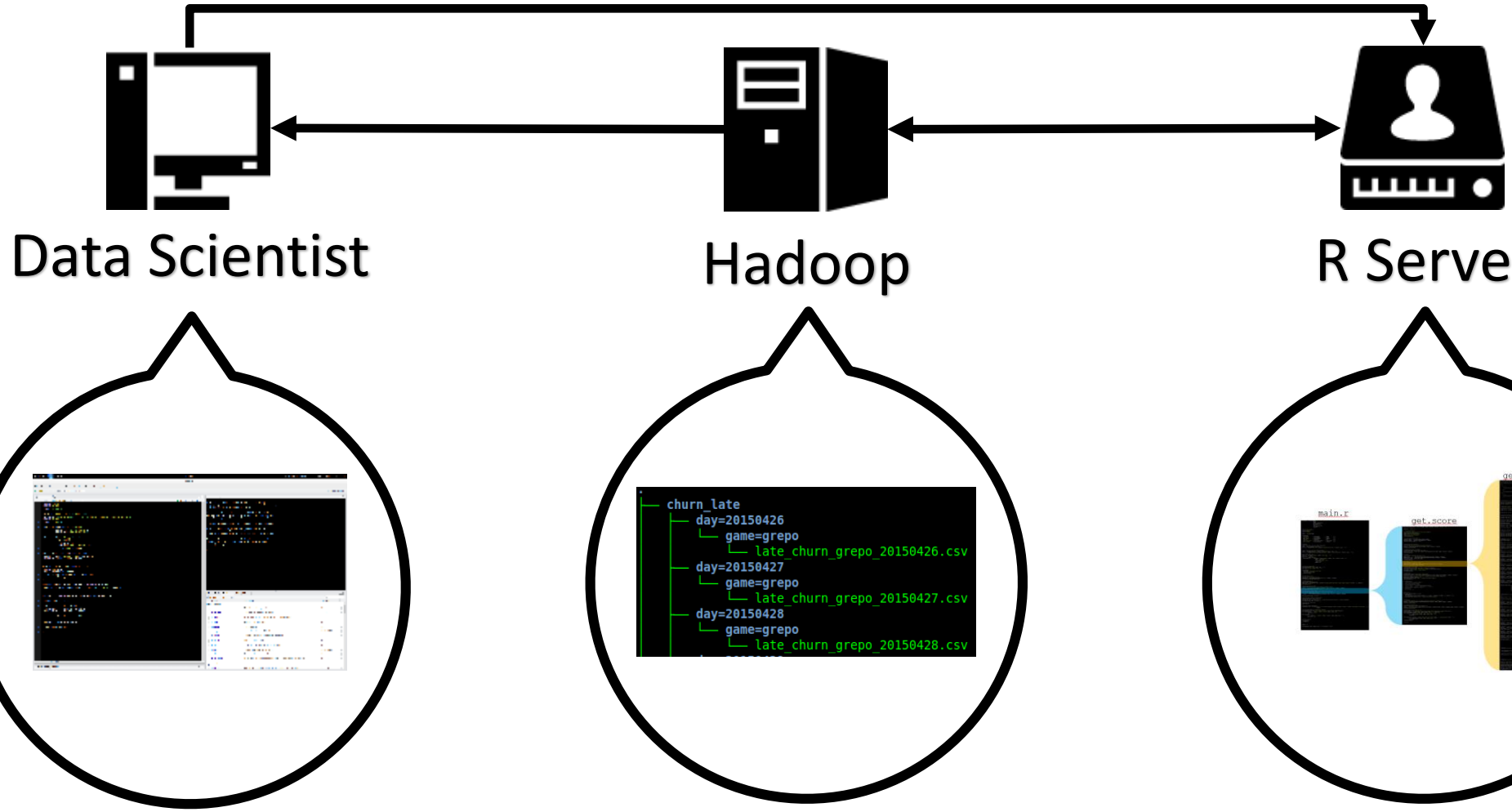


Get_score



get_data

Result



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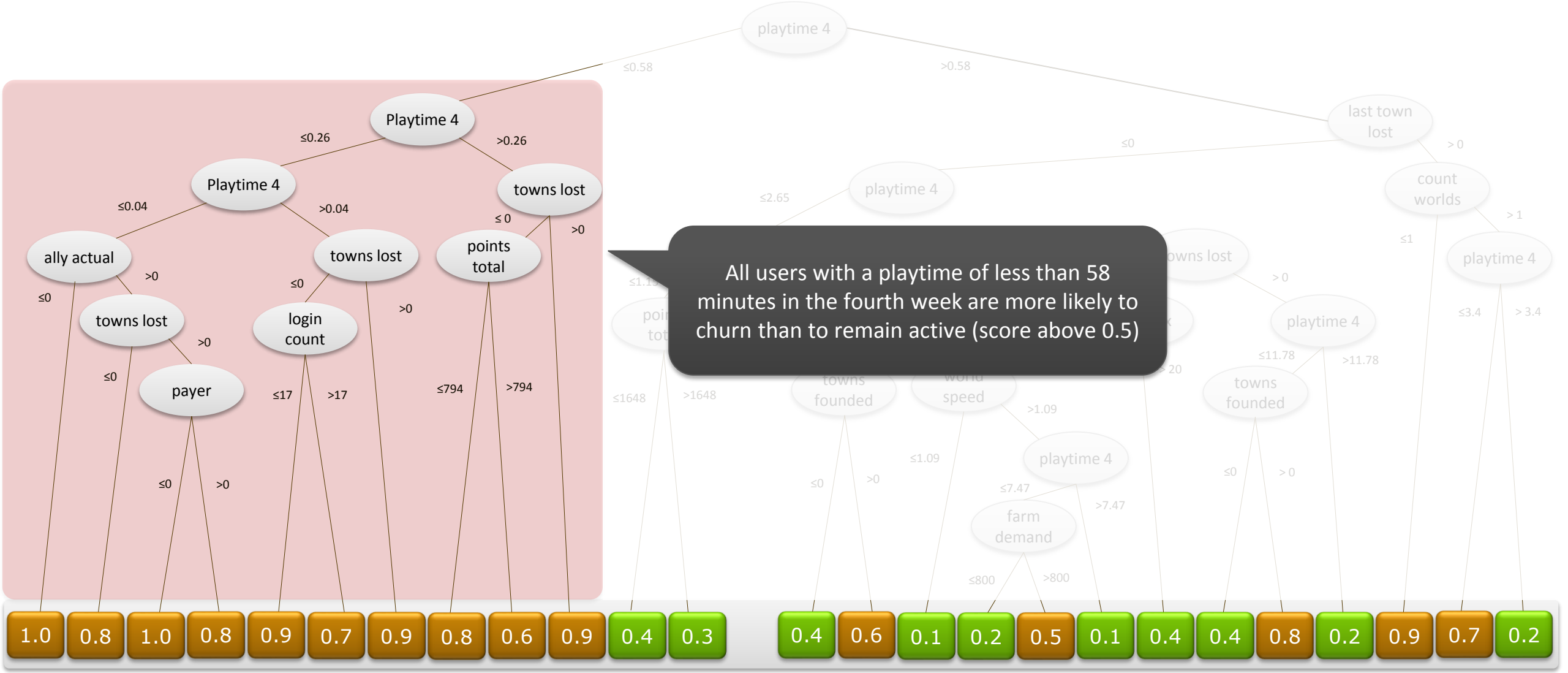
Churn Models



All users with a playtime of less than 58 minutes in the fourth week are more likely to churn than to remain active (score above 0.5)

Social Network Analysis