VPS Customer churn prediction - Part 2

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Introduction

Motivation

This is the continuation of the presentations:

- https://github.com/JacekPardyak/vps/blob/master/vps-part-1.pdf ,
- https://github.com/JacekPardyak/vps/blob/master/vps-part-2.pdf ,
- https://github.com/JacekPardyak/vps/blob/master/vps-part-3.pdf.

In this presentation we:

- demonstrate how to use **sparklyr** R interface for Apache Spark

Apache Spark

Setting up Spark connection

```
library(tidyverse)
library(sparklyr)
spark_install(version = "3.1")
sc <- spark_connect(master = "local")
connection_is_open(sc)
```

```
## [1] TRUE
```

```
#spark_disconnect(sc)
```

Copy local data frames to a remote src

```
vps <- read_csv("./data/vps_churn_data.txt")
```

```
## Rows: 283 Columns: 23
```

```
## -- Column specification --------------------------------
## Delimiter: ","
## dbl (23): id, cpu_load_mean_m_3, disk_octets_read_mean_m
```

```
##
## i Use `spec()` to retrieve the full column specification
## i Specify the column types or set `show_col_types = FALS
```

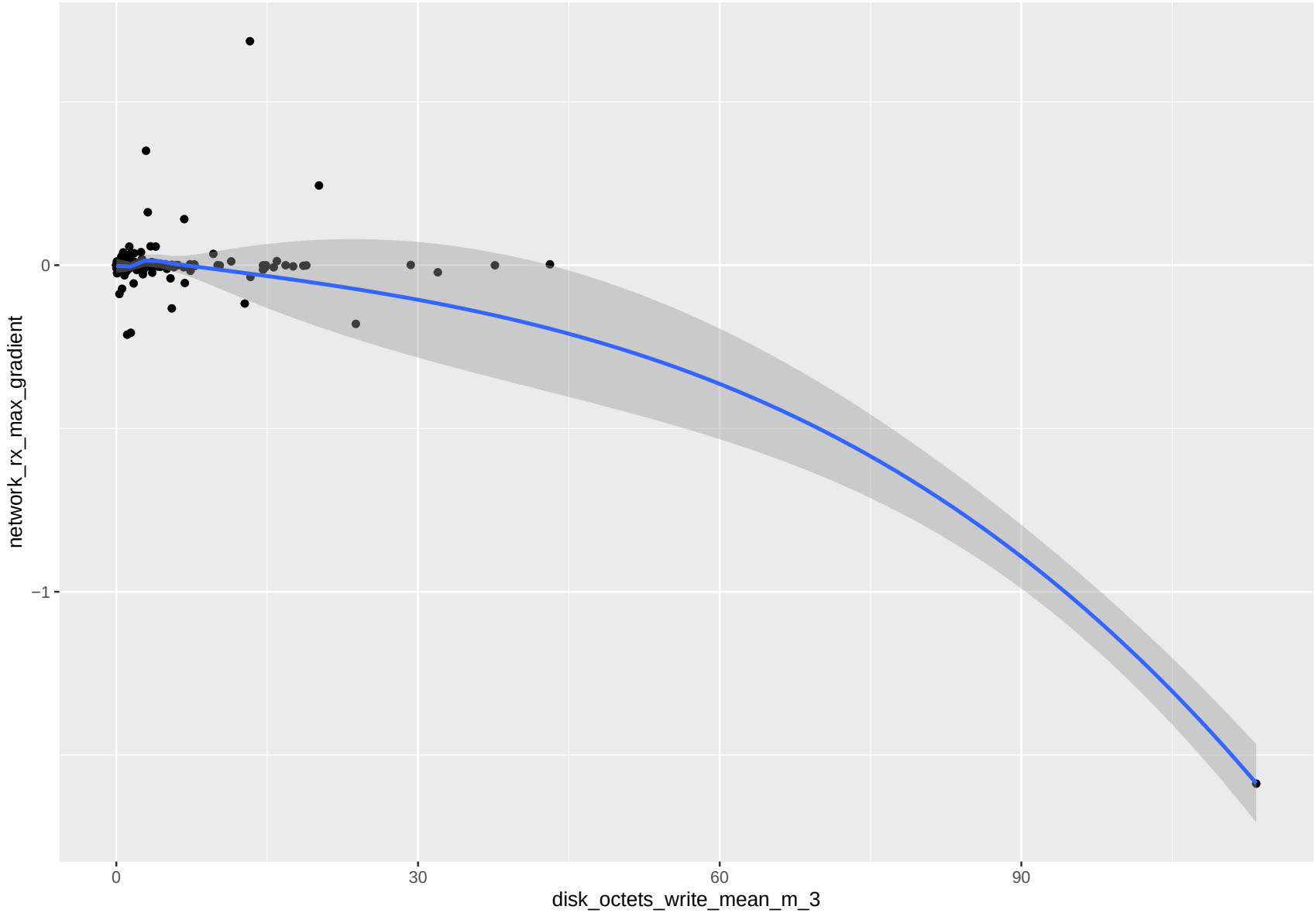
```
pro <- read_csv("./data/vps_test_data.txt")
```

```
## Rows: 95 Columns: 23
```

```
## -- Column specification --------------------------------
## Delimiter: ","
## dbl (22): id, cpu_load_mean_m_3, disk_octets_read_mean_m
## lgl  (1): is_churn
```

Plot some data from Spark

```
## `geom_smooth()` using method = 'loess' and formula 'y ~
```

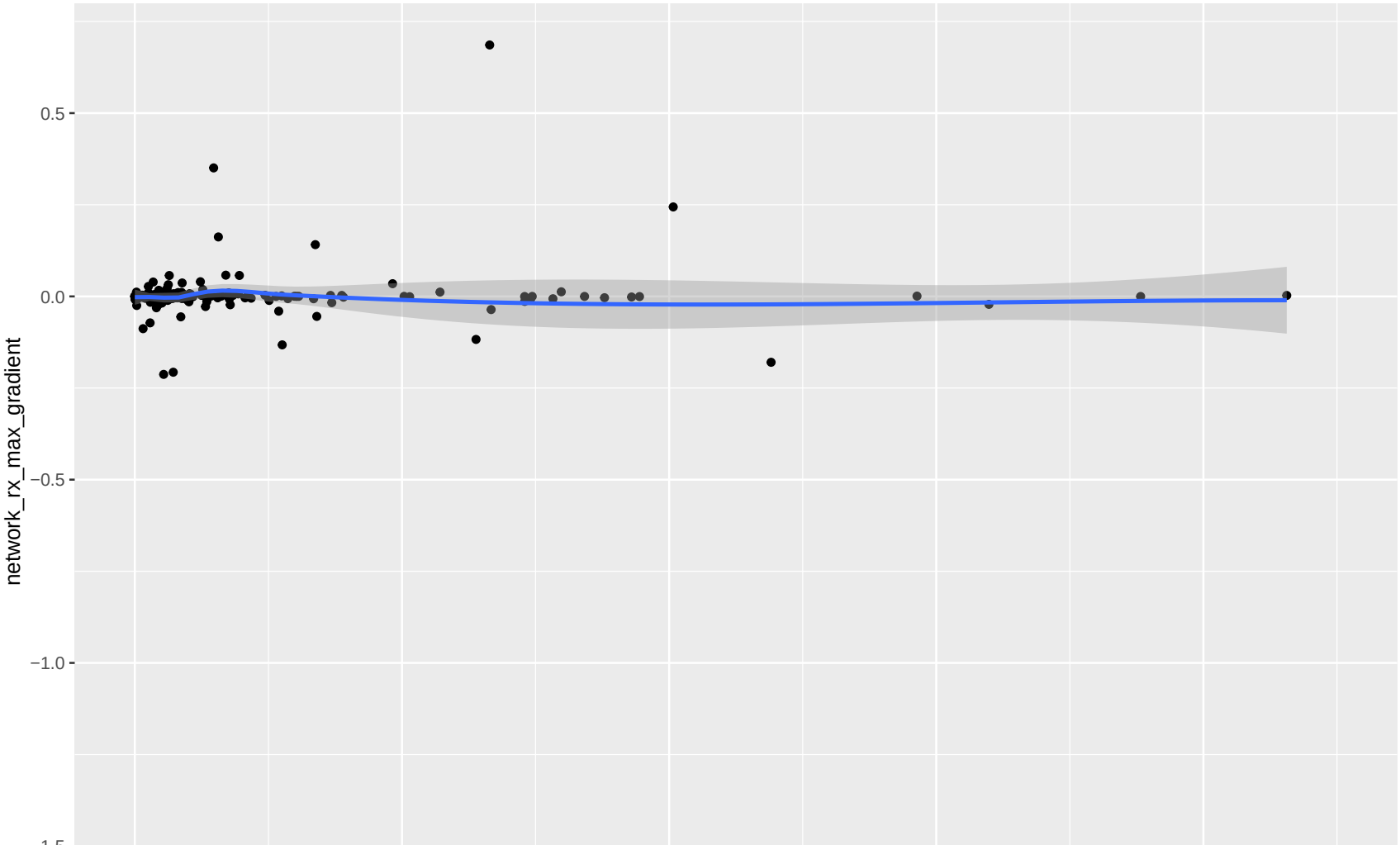


Plot some other data from Spark

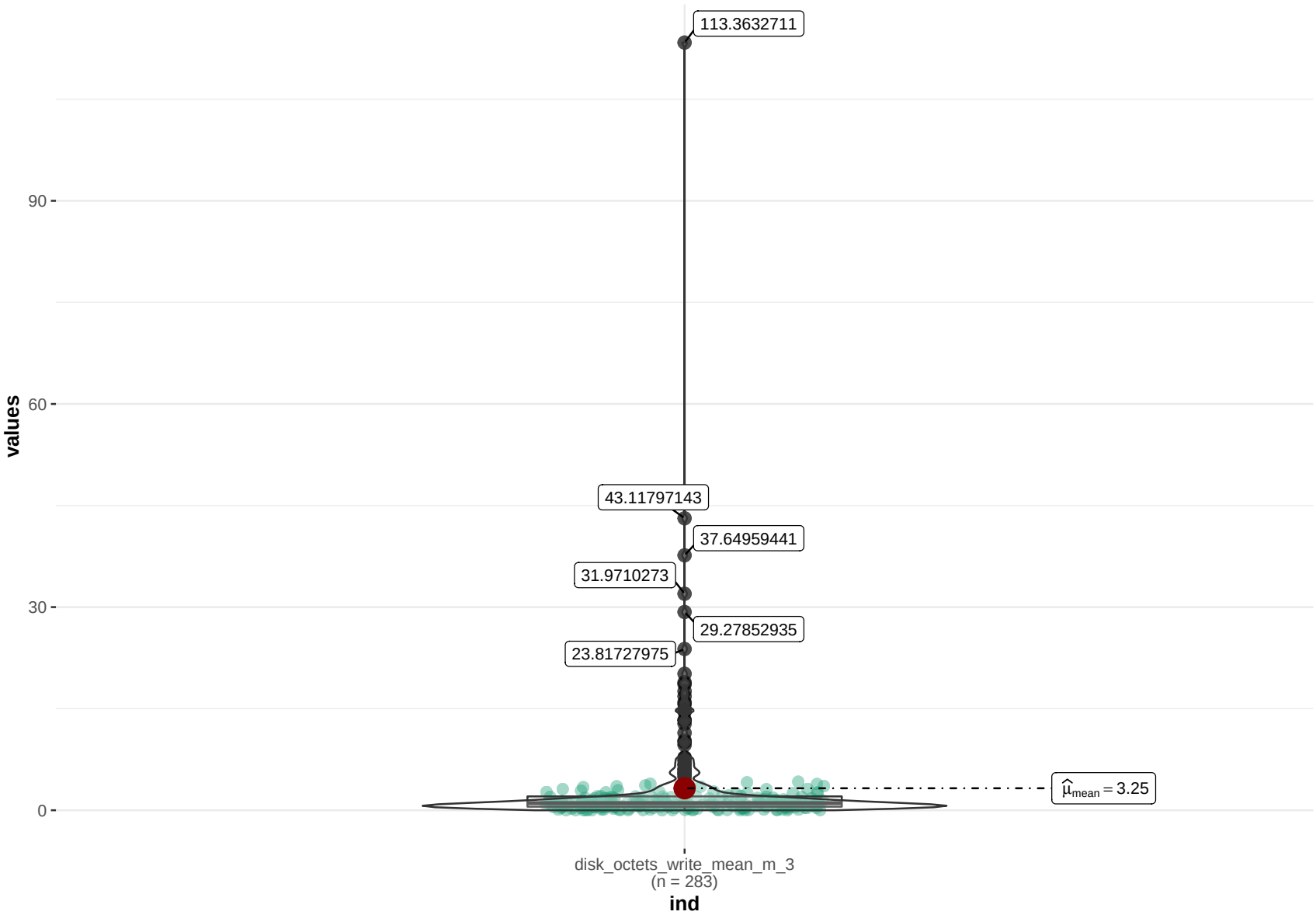
```
## `geom_smooth()` using method = 'loess' and formula 'y ~

## Warning: Removed 1 rows containing non-finite values (st

## Warning: Removed 1 rows containing missing values (geom_
```



Data with outliers



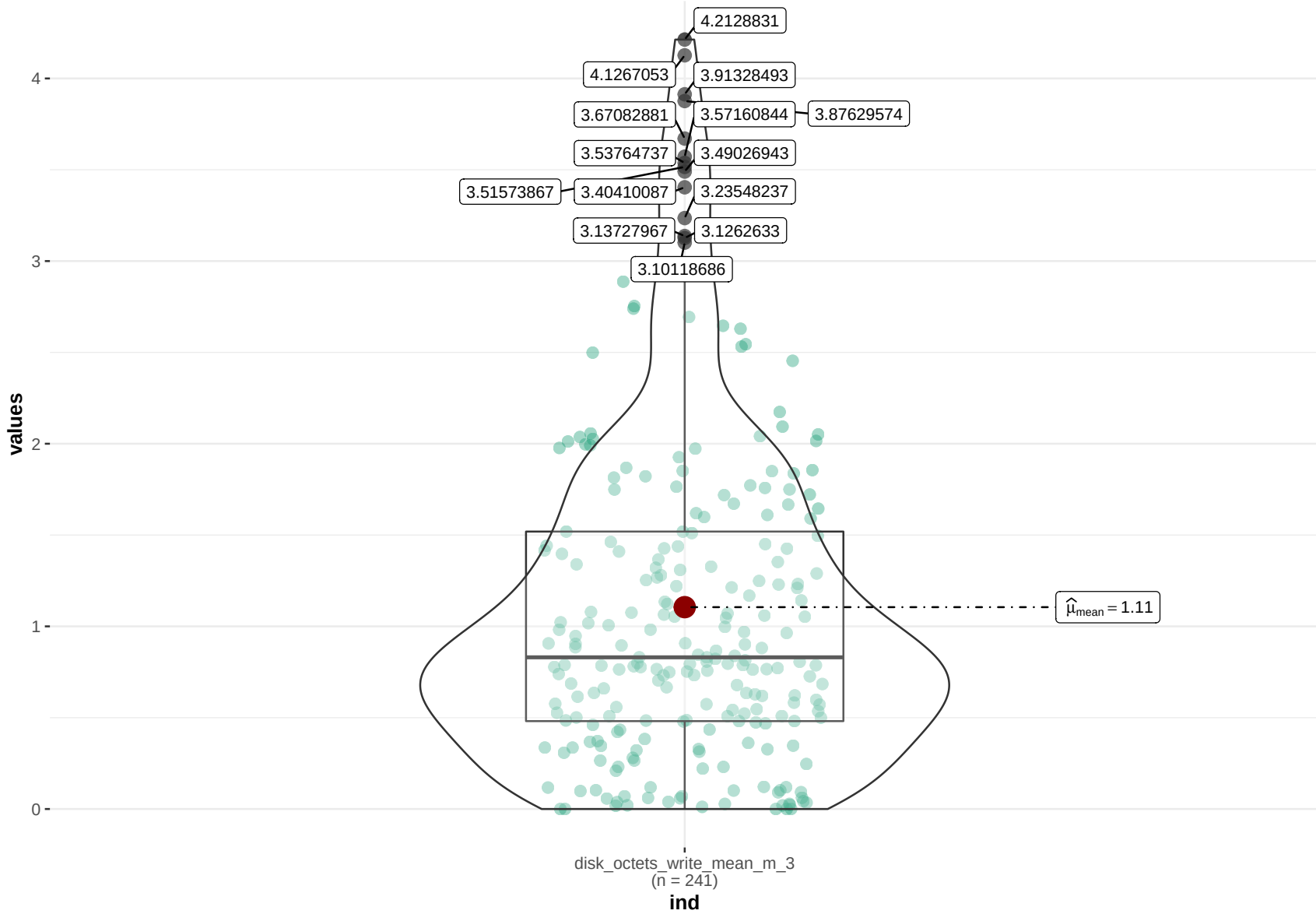
Outliers removal

```
var = 'disk_octets_write_mean_m_3'
tbl <- tbl(sc, 'vps') %>% select('id', all_of(var)) %>% col
summary(tbl)
```

```
##        id         disk_octets_write_mean_m_3
##  Min.   :100.0   Min.   :  0.0000
##  1st Qu.:170.5   1st Qu.:  0.5245
##  Median :241.0   Median :  1.0526
##  Mean   :241.0   Mean   :  3.2483
##  3rd Qu.:311.5   3rd Qu.:  2.0462
##  Max.   :382.0   Max.   :113.3633
```

```
Q <- tbl %>% select(!! sym(var)) %>% pull() %>% quantile(pr
iqr <- tbl %>% select(!! sym(var)) %>% pull() %>%  IQR()
#up <-  Q[2]+1.5*iqr # Upper Range
#low<- Q[1]-1.5*iqr # Lower Range
proper <- tbl %>% filter((!! sym(var) > (Q[1] - 1.5*iqr) &
```

Data without outliers



Using SQL

```
##      id cpu_load_mean_m_3 disk_octets_read_mean_m_3 disk_
## 1   100          13.379892                38.82583205
## 2   101          16.902043                 0.00328473
## 3   102         248.935914                19.37152776
## 4   103          14.054194                 0.10182502
## 5   104          85.793333                15.49345957
## 6   105          39.394301                11.36519674
## 7   106           1.288280                 0.00176921
## 8   107          79.788387                27.30295340
## 9   108          68.253118                18.10863666
## 10  109           8.866774                 1.17613777
##     disk_ops_read_mean_m_3 disk_ops_write_mean_m_3 networ
## 1              336.69720430                6.770323
## 2                0.08150538                2.793979
## 3              213.16032260              194.558280
## 4                2.18870968                9.634839
## 5              280.23193550                9.595376
## 6              793.13655910               55.020000
```

Machine Learning

Random forest, all vars, evaluation on training data

```
rf_model <- vps_tbl %>%
  ml_random_forest(is_churn ~ ., type = "classification")

rf_predict <- ml_predict(rf_model, vps_tbl) %>%
  ft_string_indexer("is_churn", "is_churn_idx") %>% collect

table(rf_predict$is_churn_idx, rf_predict$prediction)
```

```
##
##         0   1
##   0 139   9
##   1  21 114
```

Random forest, all vars, evaluation on test data

```
partitions <- tbl(sc, "vps") %>%
  sdf_random_split(training = 0.6, test = 0.4, seed = 888)

rf_model <- partitions$training %>%
  ml_random_forest(is_churn ~ ., type = "classification")

rf_predict <- ml_predict(rf_model, partitions$test) %>%
  ft_string_indexer("is_churn", "is_churn_idx") %>%
  collect
table(rf_predict$is_churn_idx, rf_predict$prediction)
```

```
##
##       0  1
##    0 39 22
##    1 28 24
```

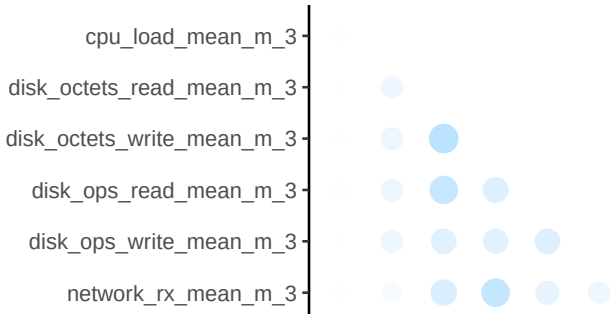
Correlations

```
## Warning: package 'corrr' was built under R version 4.1.1

## New names:
## * `` -> ...1
## * `` -> ...2
## * `` -> ...3
## * `` -> ...4
## * `` -> ...5
## * ...

##
## Correlation method: 'pearson'
## Missing treated using: 'pairwise.complete.obs'

## Don't know how to automatically pick scale for object of
```



Random forest, chosen vars, evaluation on test data

```
features <- c( "cpu_load_mean_m_3",
               "disk_octets_read_mean_m_3",
               "disk_octets_write_mean_m_3",
               "disk_ops_read_mean_m_3",
               "disk_ops_write_mean_m_3",
               "network_rx_mean_m_3",
               "network_tx_mean_m_3",
               "cpu_load_monthly_mean_delta",
               "network_tx_monthly_mean_delta",
               "network_rx_monthly_mean_delta",
               "disk_ops_read_monthly_mean_delta",
               "disk_ops_write_monthly_mean_delta",
               "disk_octets_write_monthly_mean_delta",
               "disk_octets_read_monthly_mean_delta",
               "cpu_load_max_gradient",
               "disk_octets_read_max_gradient",
               "disk_octets_write_max_gradient",
               "disk_ops_read_max_gradient",
```

Further steps

Further steps

- discuss with domain experts: outliers detected, crossing variables for feature engineering