Machine Learning Using Splunk And R

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Itility

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Agenda

- About Itility
- Machine Learning Use Case
- Architecture And Challenges
- The New App
- Demo

About Itility

Our business

- IT consultancy
  - Data Science
  - IT infrastructure
  - Software development
  - Datacenter automation
  - IoT
  - …

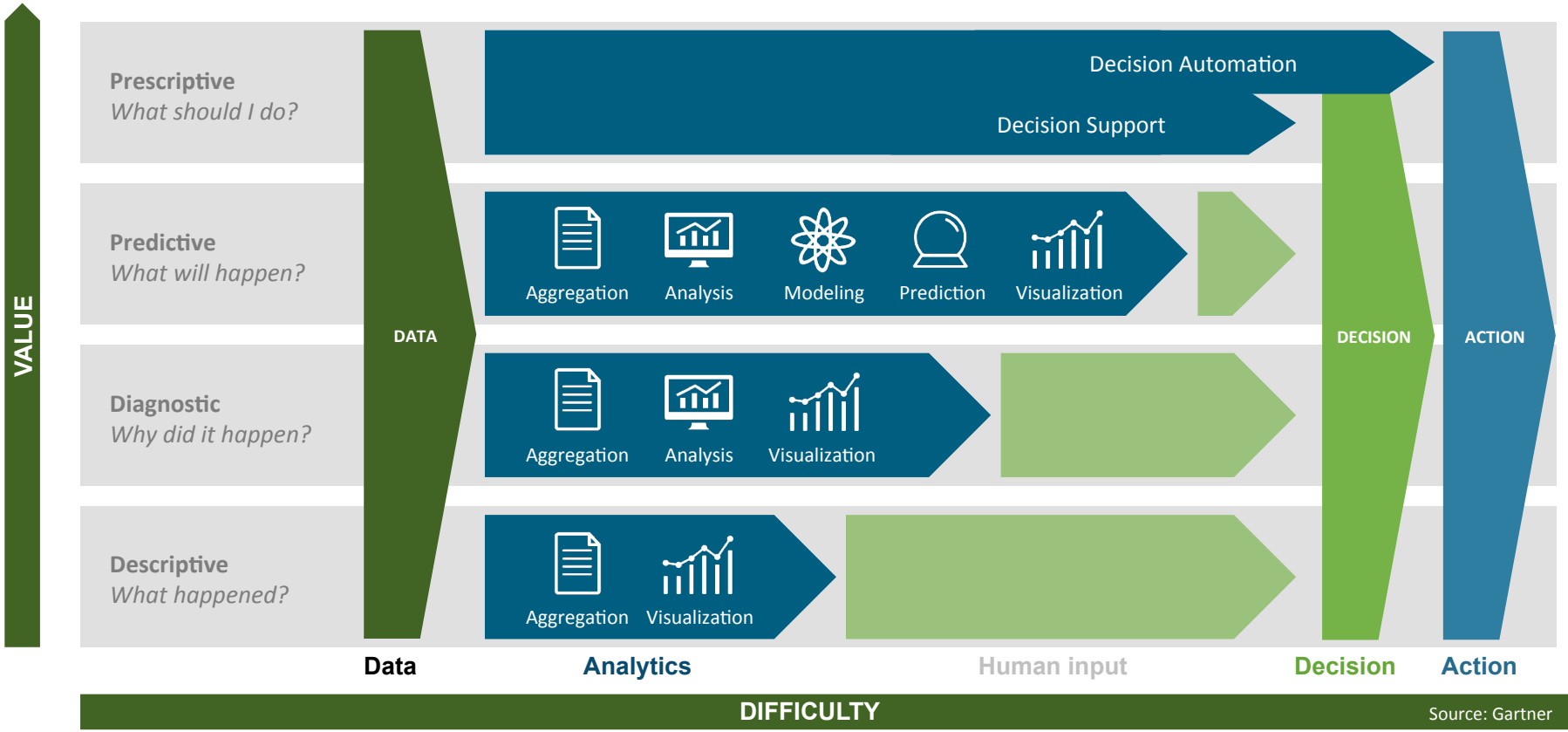
Our Customers

Data Science Goals

- We help our customers gain visibility into their data
- We use data to diagnose incidents and find root causes
- We predict and forecast to anticipate upcoming issues and problems
- We automate decisions to act on upcoming issues and problems

- … and we do so by using everything between basic statistics and the most advanced Machine Learning algorithms out there

Data Science Goals



Use case: Mishandled Bags (MHB's)

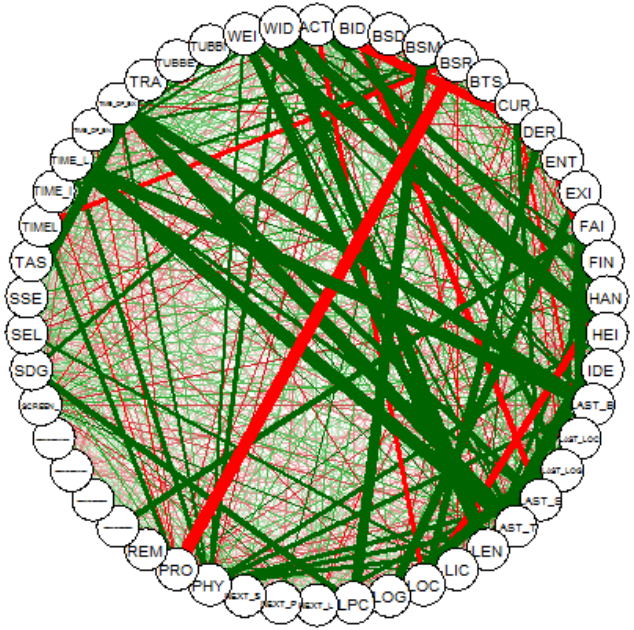
Use Case: Mishandled Bags (Mhb's)

- MHB's are bags that:
  - Are lost during handling
  - Miss their flight
  - Are put on the wrong airplane
- On a yearly basis the total cost of MHB's is **$2,4 bn**.
- Collaboration with a large airport and a manufacturer of baggage handling systems how to reduce these costs

The Data

Data of multiple sources in Splunk:

- Sample of over 30.000 unique bags
- 3 Month period
- 125 Variables for each bag, i.e:
  - Weight
  - Carrier
  - System entrypoint
  - Check-in to departure delta
  - Etc.
- 2% Was considered a MHB



The Approach

1. Use Splunk to combine and format the data
2. Use R to train a Boosted Decision Tree model, capable of performing Binary Logistic Classification (with 0=ok, 1=MHB)
3. Export the trained model as an R-package
4. Use the R-app to combine Splunk and R-code
5. Import the model and quickly classify new bags with a risk score
6. Extract the feature importance to assess which variables have the biggest impact on bags, causing MHB's

Risk Assessment

- The model returns a score between 0 and 1
- This is the probability of a bag becoming a MHB
- Use Splunk to filter low-risk bags
- Use Splunk alerting for high-risk bags

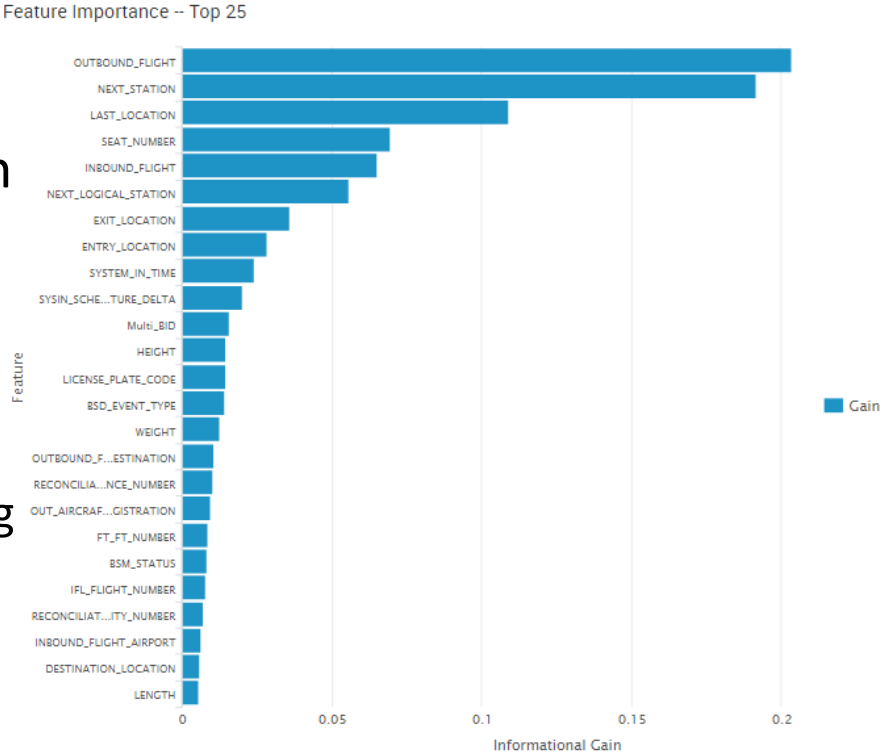
Bag Risk Assesment -- Risk > 5%

_time	LPC	Risk
2016-07-25 14:05:36	74363331	0.949320
2016-07-25 14:05:36	74919963	0.192906
2016-07-25 14:05:36	74698178	0.799526
2016-07-25 14:05:36	784716347	0.086178
2016-07-25 14:05:36	281689576	0.736813
2016-07-25 14:05:36	2141922645	0.973232
2016-07-25 14:05:36	2074538118	0.050471
2016-07-25 14:05:36	9352000179	0.953725
2016-07-25 14:05:36	74820613	0.110761
2016-07-25 14:05:36	784575182	0.066916
2016-07-25 14:05:36	74463944	0.093696
2016-07-25 14:05:36	7006297004	0.973772
2016-07-25 14:05:36	8006805224	0.327457
2016-07-25 14:05:36	7006649869	0.249184
2016-07-25 14:05:36	6006863284	0.915263
2016-07-25 14:05:36	74949557	0.821514
2016-07-25 14:05:36	74761598	0.086923
2016-07-25 14:05:36	2006226115	0.953627
2016-07-25 14:05:36	74310725	0.055793
2016-07-25 14:05:36	6006598858	0.087242

« prev 1 2 next »

Feature Importance

- "Reverse-engineered" the model to extract informational gain from each variable
- Several interesting finds:
  - Next station / Last location
  - Seat Number
  - Amount of Bag ID codes per unique bag
- Next steps: further investigate important variables with domain experts



Architecture And Challenges

- The R app on Spunkbase runs R on the Search Head
- Training models can be very CPU and Memory intensive
- Scaling a Search Head cluster becomes more complex

Architecture And Challenges

- The new R app communicates with a remote R server
- Training a model no longer impacts search performance
- Scale R independently from the Search Head cluster

The New App

- Is released TODAY!
- Contains several example dashboards and a new R code editor
- Contains new search commands for interacting with R
- Makes R an extention of SPL and allows you to create business value even faster

The New App

DEMO

R

Editor
Demo views

R app contents

This page is an overview of all the fun things you can do with R in Splunk.

Edit More Info

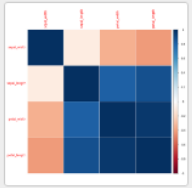
Filter

Editor

Script editor

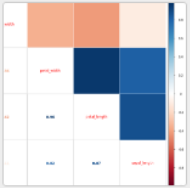
Run arbitrary R code on data from a Splunk search.

Demo views



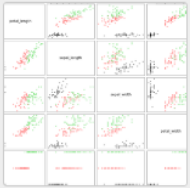
Correlation plot

Run the R corrplot command straight from a Splunk dashboard panel and display the graph.



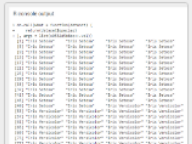
Correlation plot (mixed)

Run the R corrplot command straight from a dashboard panel and have different visualizations for top and bottom.



Pairs plot

Run the R pairs command straight from Splunk and display the graph in a dashboard panel.



Console output

Return the console output to a Splunk dashboard panel.

Demo view - Console output

Return the console output to a Splunk dashboard panel.

Edit More Info

R console output

```
> do.call(args = list(x0362c35718::.val), what = function(dataset) {
+     return(dataset$species)
+ })
  [1] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
  [5] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
  [9] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [13] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [17] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [21] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [25] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [29] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [33] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
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 [41] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [45] "Iris Setosa"     "Iris Setosa"     "Iris Setosa"     "Iris Setosa"
 [49] "Iris Setosa"     "Iris Setosa"     "Iris Versicolor" "Iris Versicolor"
 [53] "Iris Versicolor" "Iris Versicolor" "Iris Versicolor" "Iris Versicolor"
 [57] "Iris Versicolor" "Iris Versicolor" "Iris Versicolor" "Iris Versicolor"
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[145] "Iris Virginica"  "Iris Virginica"  "Iris Virginica"  "Iris Virginica"
[149] "Iris Virginica"  "Iris Virginica"
```
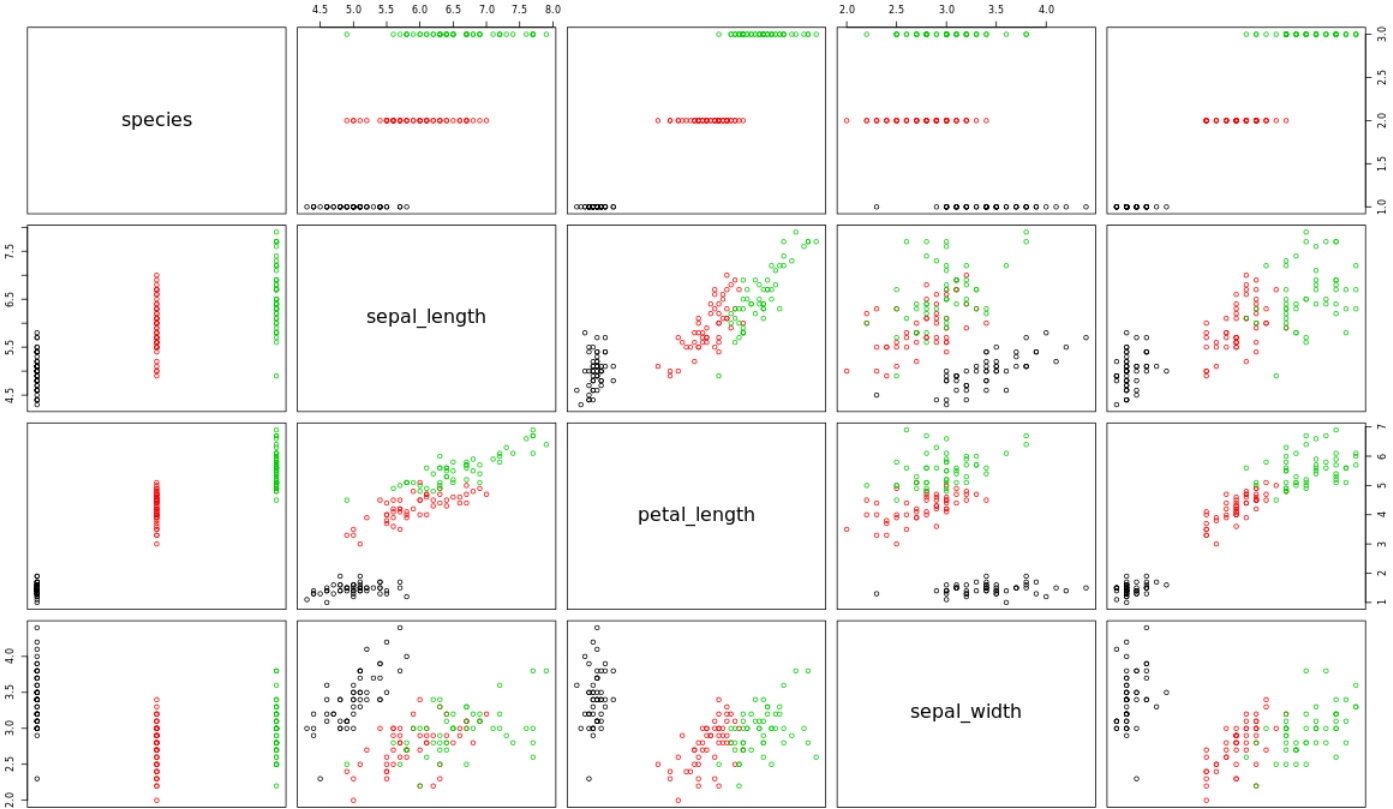

Demo view - Pairs

Run the R pairs command straight from Splunk and display the graph in a dashboard panel.

Edit More Info

R pairs command

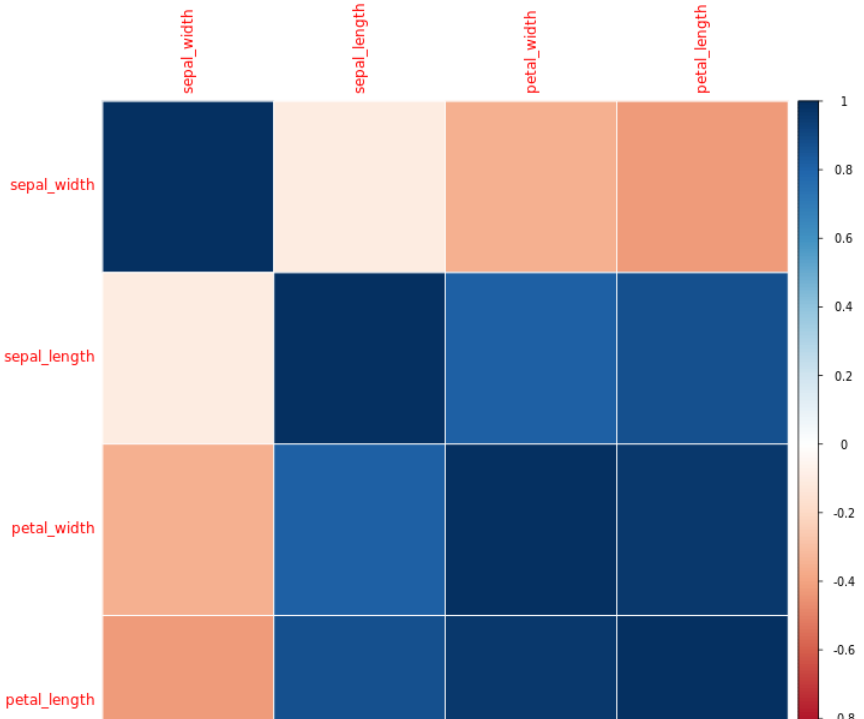


Demo view - Corrplot

Run the R corrplot command straight from a Splunk dashboard panel and display the graph.

Edit More Info

R correlation plot

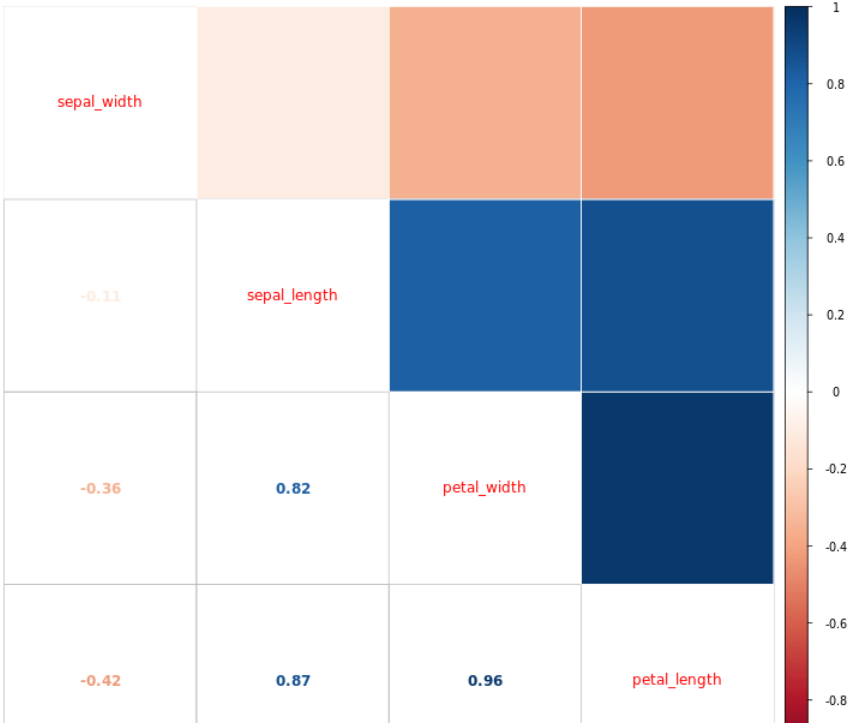


Demo view - Mixed corrplot

Run the R corrplot command straight from a dashboard panel and have different visualizations for top and bottom.

Edit More Info

R correlation plot mixed



Script editor

Run arbitrary R code on data from a Splunk search.

Edit | More Info

Query

```
| inputlookup iris.csv
```

All time

✓ 1 result (1/1/70 1:00:00.000 AM to 7/1/16 11:28:52.000 AM)

Job | Smart Mode

Script

```
# Convert the species column into a factor
dataset$species <- as.factor(dataset$species);

# Summarize the dataset
str(dataset);

# Visualize the relations
pairs(dataset, col = dataset$species);

# Print the entire dataset to console
print(dataset);
```

Run

Libraries

an

- AnomalyDetection
- Ckmeans.1d.dp
- lavaan
- pander
- quantreg
- randomForest
- translations

Functions

Filter

- AnomalyDetectionVec
- raw_data

AnomalyDetectionVec {AnomalyDetection} R Documentation

Anomaly Detection Using Seasonal Hybrid ESD Test

Description

A technique for detecting anomalies in seasonal univariate time series where the input is a series of observations.

Usage

```
AnomalyDetectionVec(x, max_anoms = 0.1, direction = "pos", alpha = 0.05,
  period = NULL, only_last = F, threshold = "None", e_value = F,
  longterm_period = NULL, plot = F, y_log = F, xlabel = "",
  ylabel = "count", title = NULL, verbose = FALSE)
```

Arguments

```
longterm_period = NULL, plot = F, y_log = F, xlabel = "",
ylabel = "count", title = NULL, verbose = FALSE)
```

Run

Arguments

Output

✓ 1 event (1/1/70 1:00:00.000 AM to 7/1/16 11:28:54.000 AM)

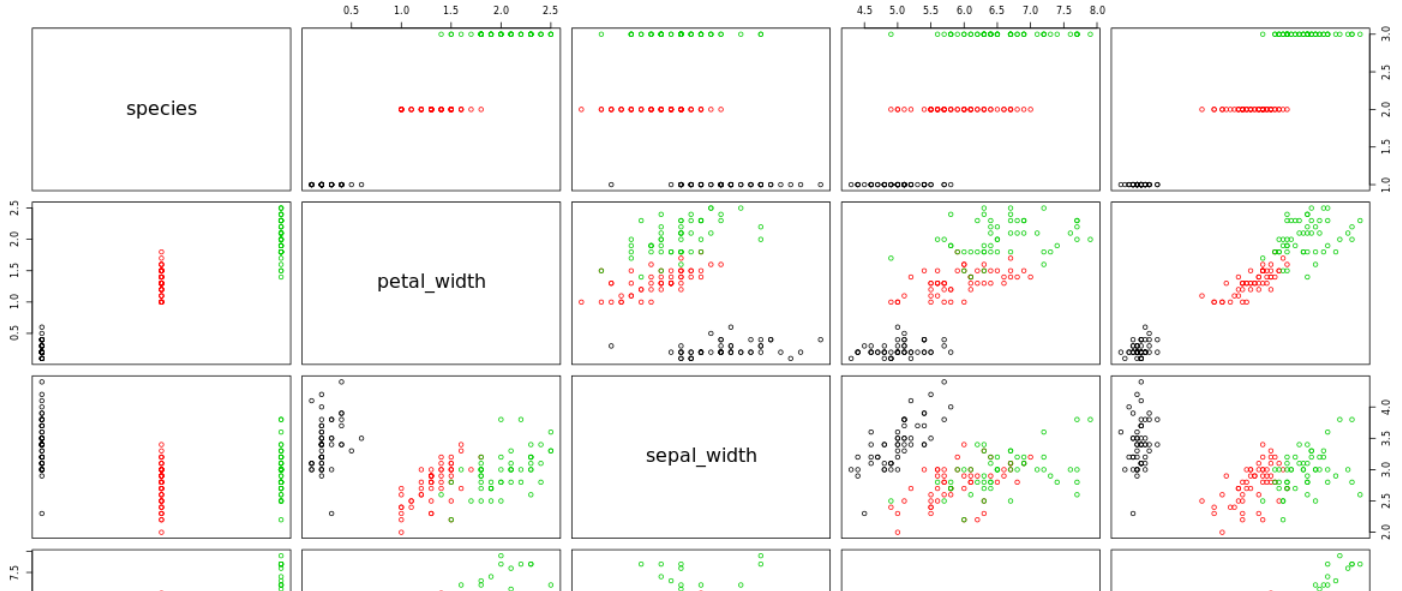
Job ⏸ ■ Smart Mode

Data Preview | R Console | R Graphics

R Graphics

Width 1200

Height 800



THANK YOU

splunk>