Distributed Machine Learning with H2O

Joint Statistical Meeting 2018

Vancouver, British Columbia, Canada

Navdeep Gill
@Navdeep_Gill_

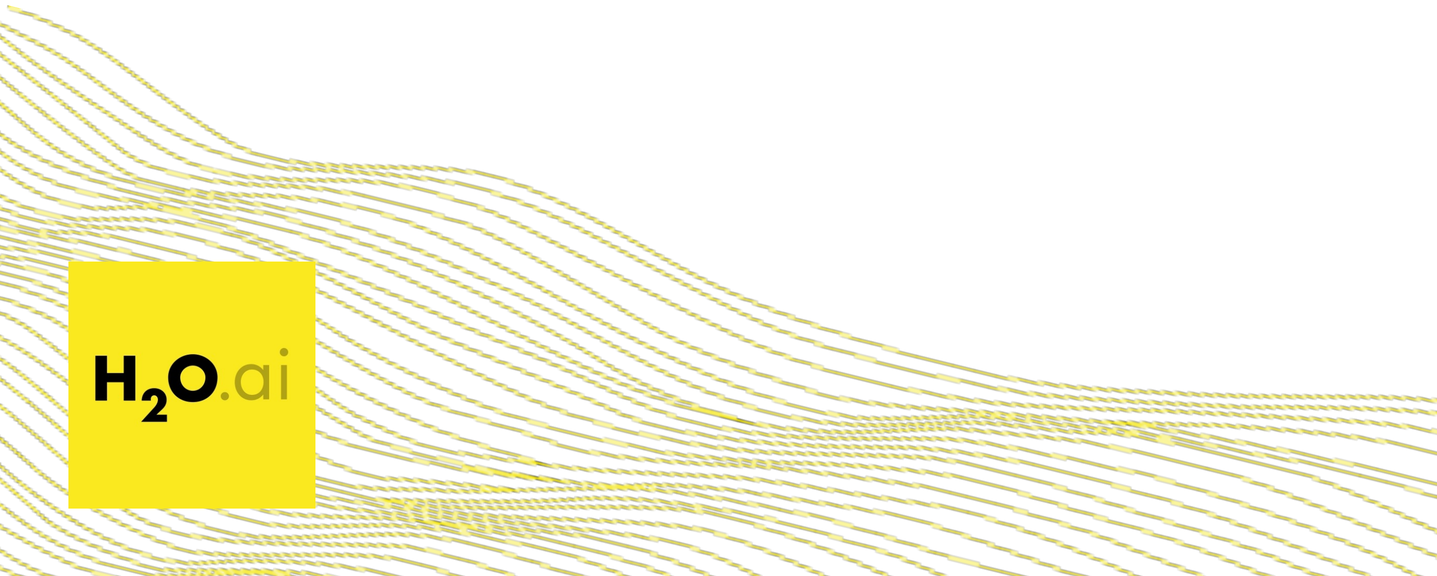
About Me

- Data Scientist & Software Engineer at H2O.ai in Mountain View, California, USA
- B.S. in Statistics, B.A. in Psychology (minor in Mathematics), & M.S. in Computational Statistics from California State University, East Bay
- Work I have done at H2O.ai:
  - H2O-3 (https://github.com/h2oai/h2o-3)
    - #12 contributor (based on Github contributions)
    - Co-author of AutoML/Stacked Ensembles
    - Worked heavily on the R/Python APIs
    - Development of H2O-3 Java backend (data munging tasks, bug fixes, etc.)
    - Day-to-day software stuff…
  - H2O4GPU (https://github.com/h2oai/h2o4gpu)
    - #2 contributor (based on Github contributions)
    - Implemented Truncated SVD and PCA in CUDA
    - Heavy development of Python/R API's
    - Day-to-day software stuff…
  - Rsparkling (https://github.com/h2oai/rsparkling)
    - #1 contributor ((based on Github contributions)
    - Running H2O's Sparkling Water in R
    - Day-to-day software stuff…
- Currently focused on machine learning interpretabiliyt (MLI)
  - Co-developed MLI capabilities in H2O Driverless.ai
    - https://www.h2o.ai/driverless-ai/
    - http://docs.h2o.ai/driverless-ai/latest-stable/docs/booklets/DriverlessAIBooklet.pdf
    - http://docs.h2o.ai/driverless-ai/latest-stable/docs/booklets/MLIBooklet.pdf
    - https://www.safaribooksonline.com/library/view/an-introduction-to/9781492033158/
    - https://github.com/h2oai/mli-resources
    - Day-to-day software stuff…

Agenda

- H2O Introduction
- H2O Core Overview
- H2O API
- Demo

H2O Introduction



Company Overview

Founded	2011 Venture-backed, Debuted in 2012
Products	• **H_2O Open Source In-Memory AI Prediction Engine** • Sparkling Water (H_2O + Spark) • H2O4GPU (H2O on GPUs) • Enterprise Steam • Driverless AI
Mission	Operationalize Data Science & Provide a Platform to Build Beautiful Data Products
Team	75+ employees • Distributed Systems Engineers doing Machine Learning • World-class Visualization Designers
Headquarters	Mountain View, CA

Scientific Advisory Council

Dr. Trevor Hastie

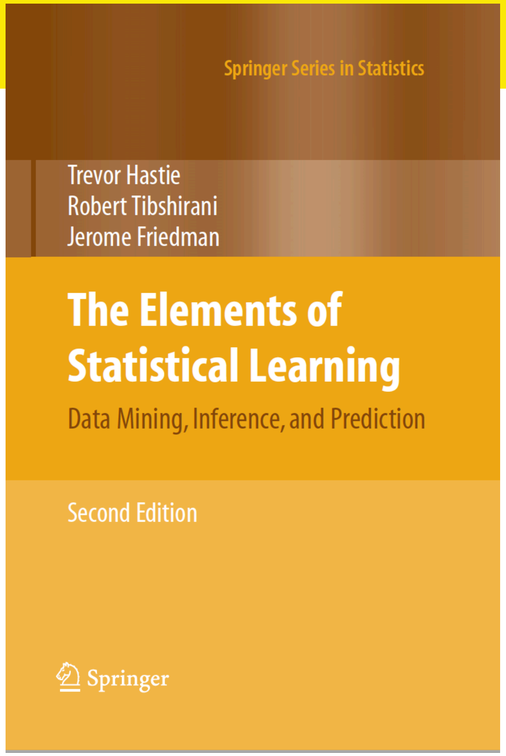
- PhD in Statistics, Stanford University
- John A. Overdeck Professor of Mathematics, Stanford University
- Co-author, *The Elements of Statistical Learning: Prediction, Inference and Data Mining*
- Co-author, *Generalized Additive Models*
- 108,404 citations (via Google Scholar)

Dr. Robert Tibshirani

- PhD in Statistics, Stanford University
- Professor of Statistics and Health Research and Policy, Stanford University
- COPPS Presidents' Award recipient
- Co-author, *The Elements of Statistical Learning: Prediction, Inference and Data Mining*
- Author, *Regression Shrinkage and Selection via the Lasso*
- Co-author, *An Introduction to the Bootstrap*

Dr. Steven Boyd

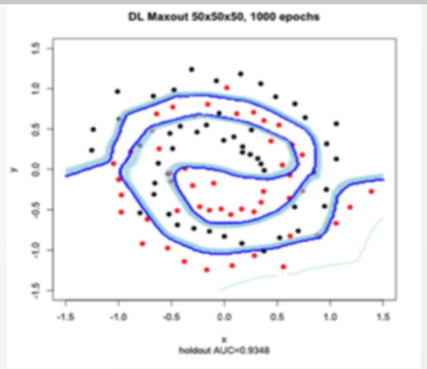
- PhD in Electrical Engineering and Computer Science, UC Berkeley
- Professor of Electrical Engineering and Computer Science, Stanford University
- Co-author, Convex Optimization
- Co-author, Linear Matrix Inequalities in System and Control Theory
- Co-author, *Distributed Optimization and Statistical Learning via the Alternating Direction Method of Multipliers*



H2O.ai

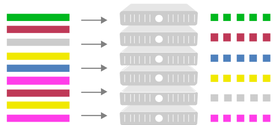
What is H2O?

Java-Based Software for **In-Memory** **Data Modeling**

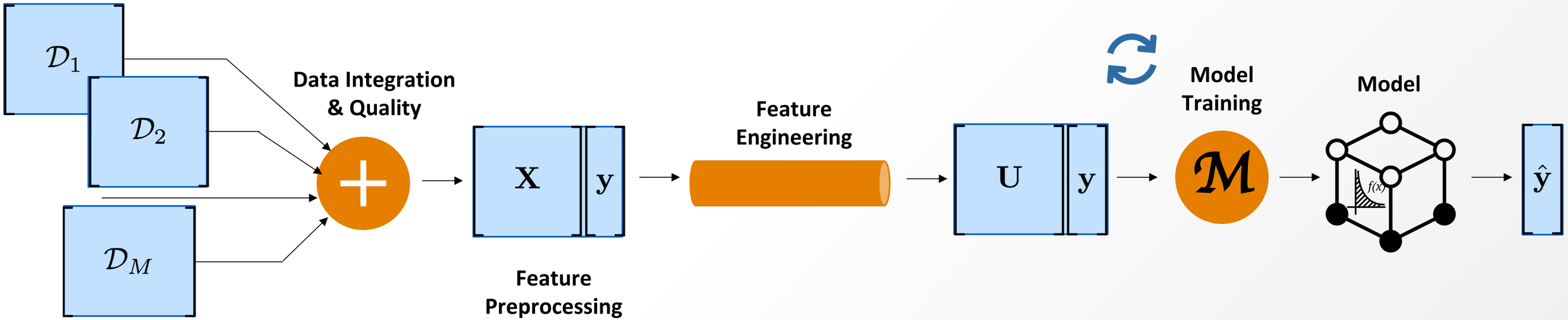
Open Source	Big Data Ecosystem	Flexible Interface	Smart and Fast Algorithms
			

What is H2O?

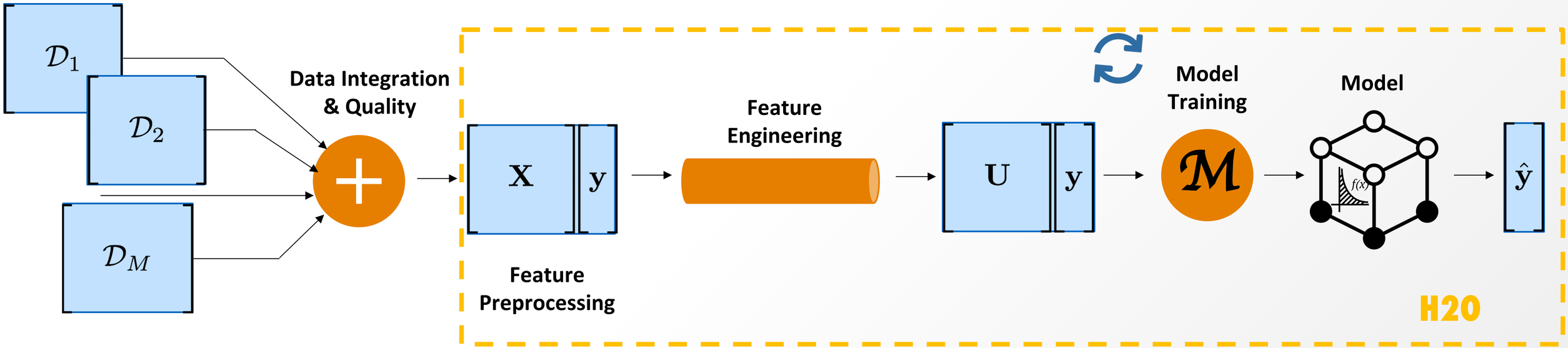
Java-Based Software for **In-Memory** **Data Modeling**

Scalability and Performance	Rapid Model Deployment	GPU Enablement*	Cloud Integration
	• Highly portable models deployed in Java (POJO) • Automated and streamlined scoring service deployment with Rest API*		  
• Distributed In-Memory Computing Platform • Distributed Algorithms • Fine-Grain MapReduce			

The Machine Learning Pipeline



Where H2O Fits



Current Algorithm Overview

Statistical Analysis

- Linear Models (GLM)
- Naïve Bayes

Ensembles

- Random Forest
- Gradient Boosting Machine
- Stacking / Super Learner

Deep Neural Networks

- MLP
- Autoencoder
  - Anomaly Detection
  - Deep Features

H2O AutoML

- Automatic Machine Learning in H2O

Clustering

- K-Means (Auto-*K*)

Dimension Reduction

- Principal Component Analysis
- Generalized Low Rank Models

Word Embedding

- Word2Vec

Time Series

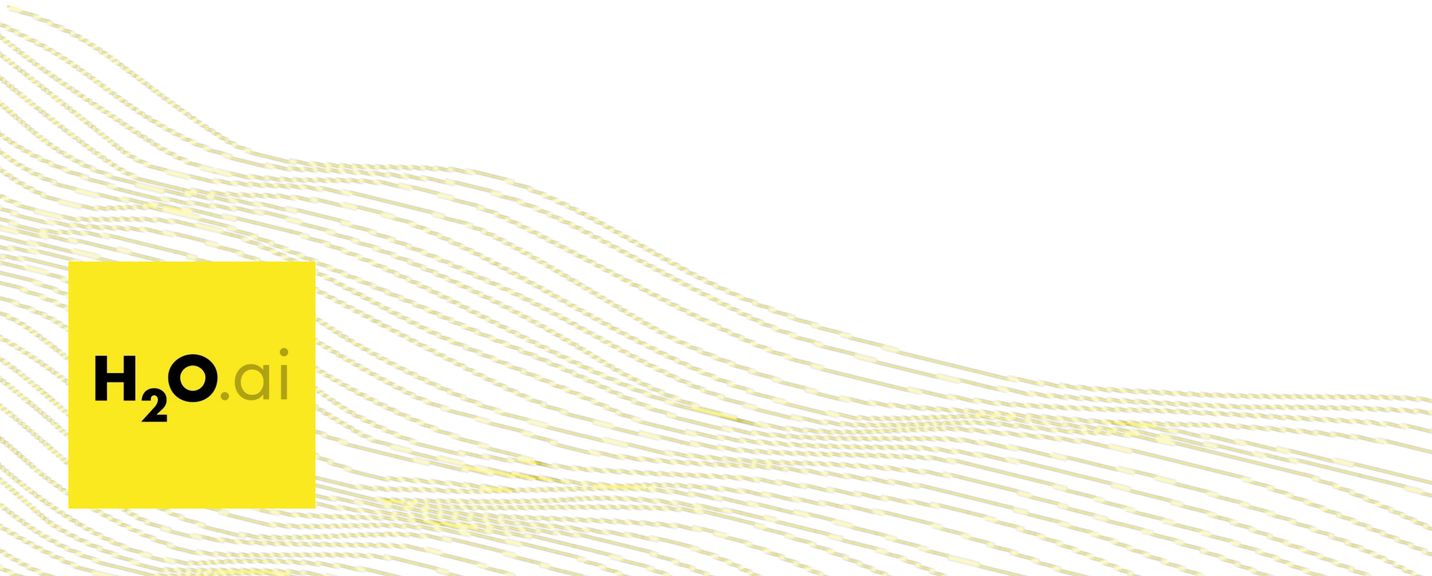
- iSAX

Machine Learning Tuning

- Hyperparameter Search
- Early Stopping

H2O Core Overview

Behind the Scenes



How H2O Core Works

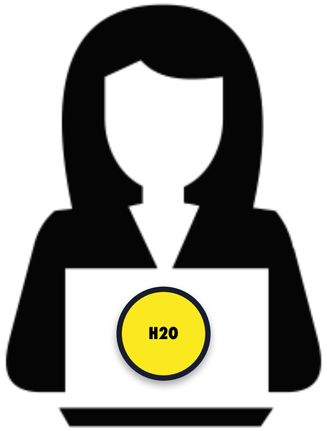
H2O

How H2O Core Works

(just a java application)

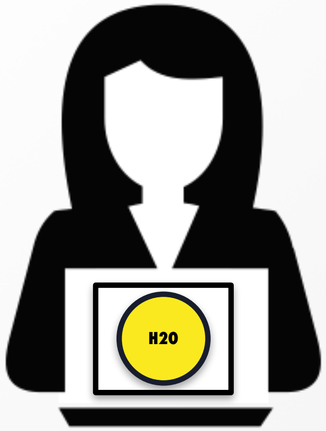
How H2O Core Works

How H2O Core Works



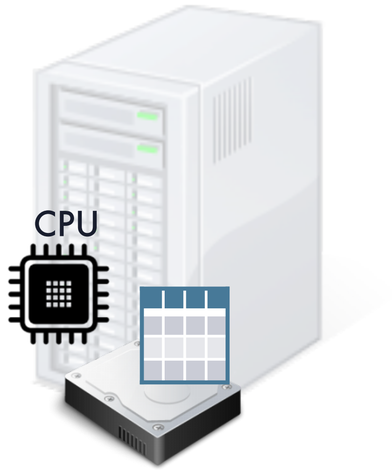
on a laptop

on a virtual machine

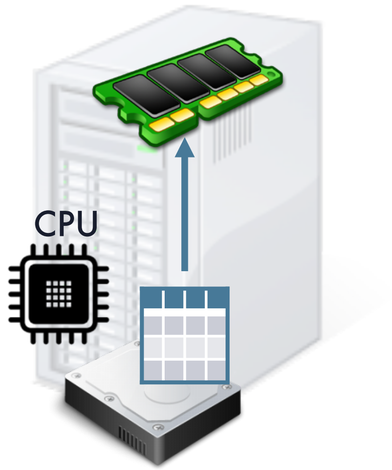


in a container

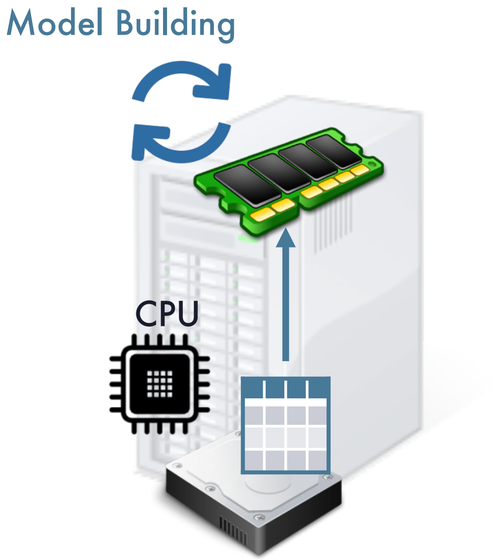
H2O Core



H2O Core



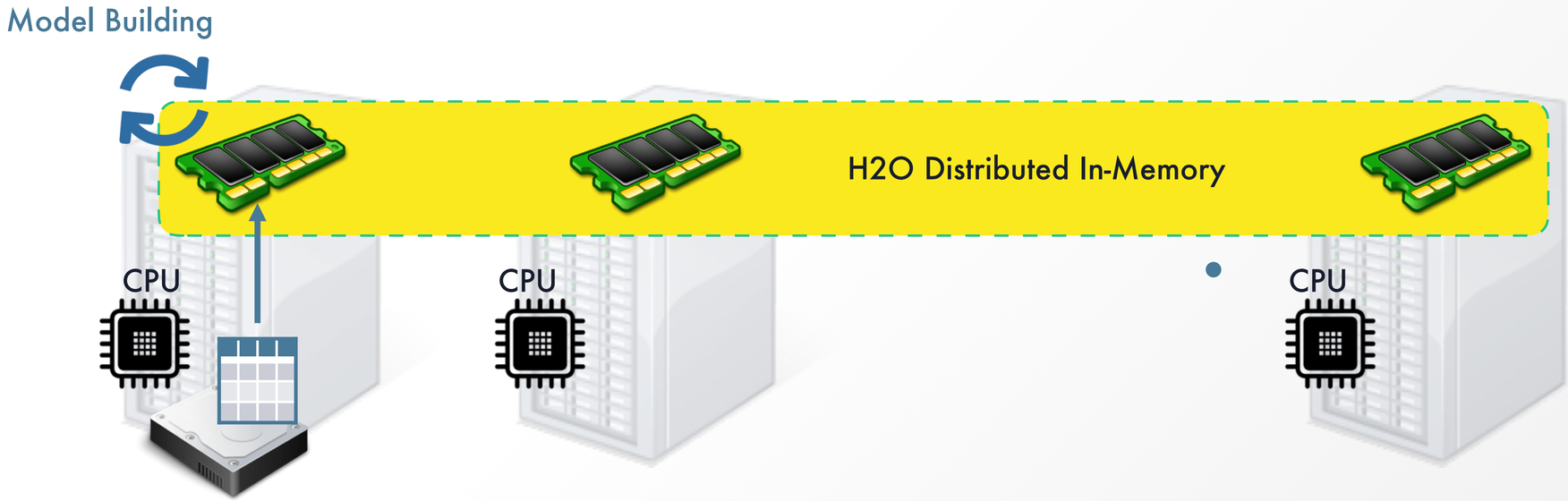
H2O Core



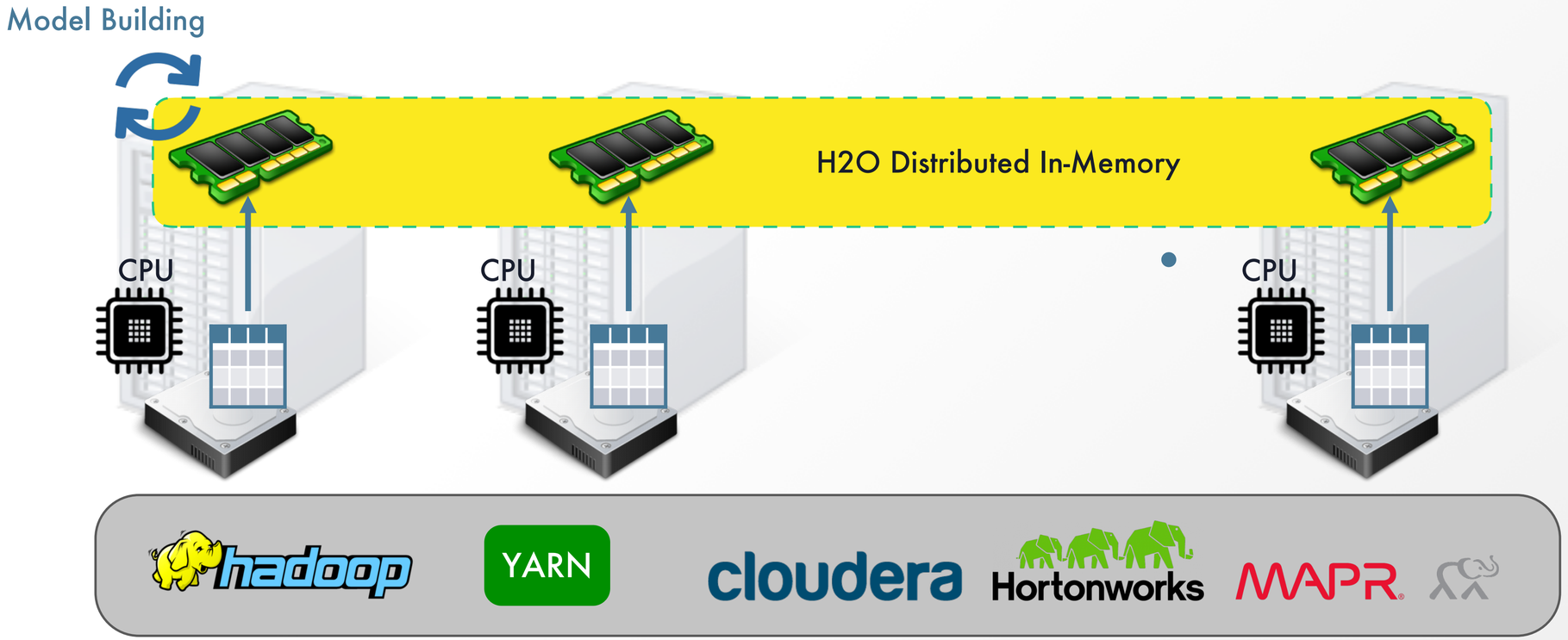
H2O Core

H2O Core

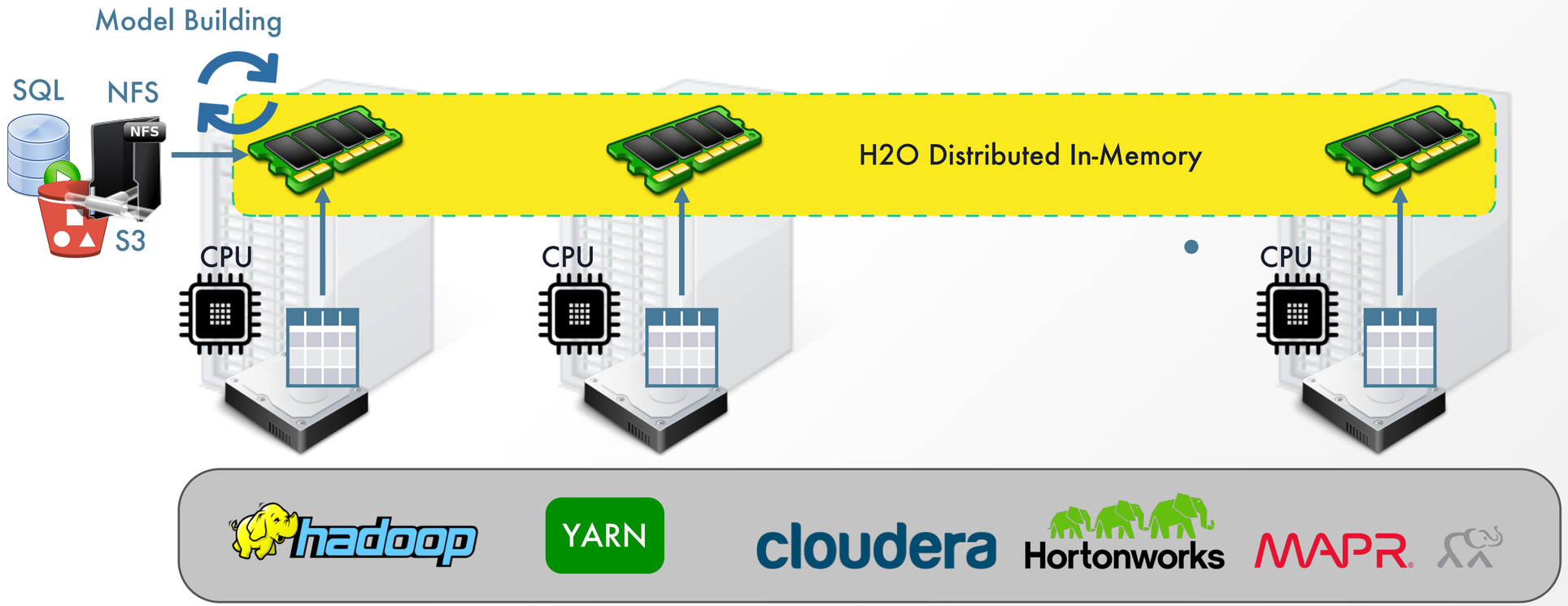
H2O Core



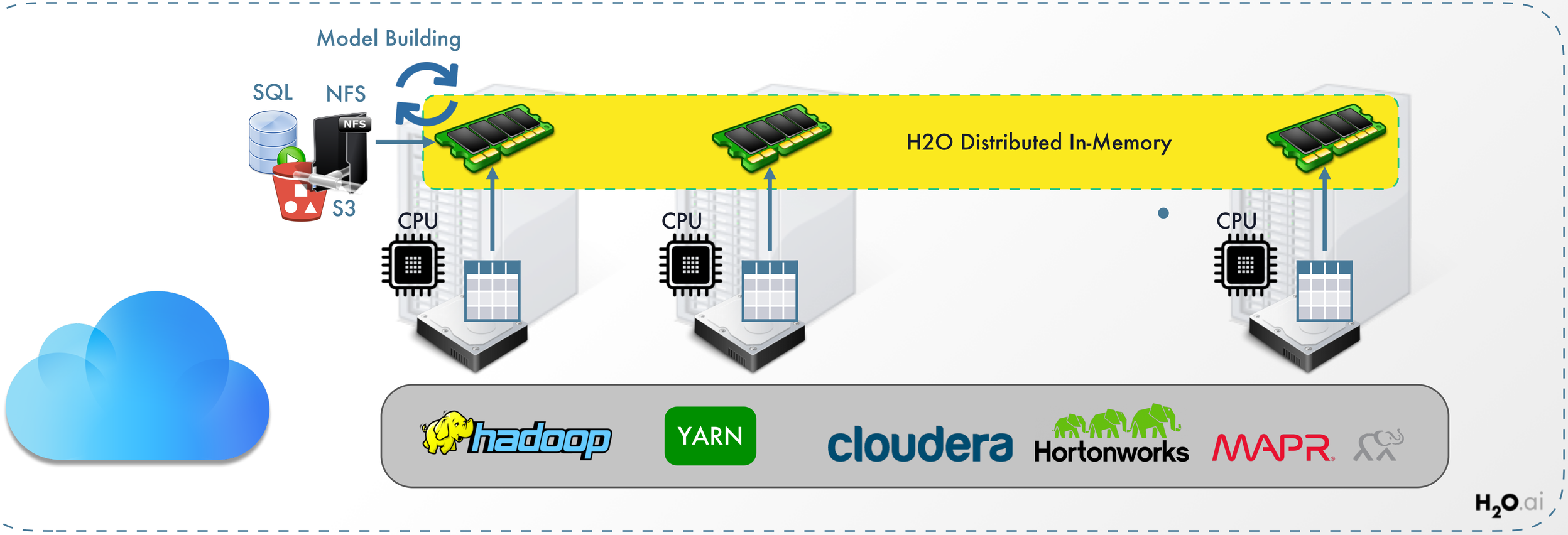
H2O Core with Hadoop



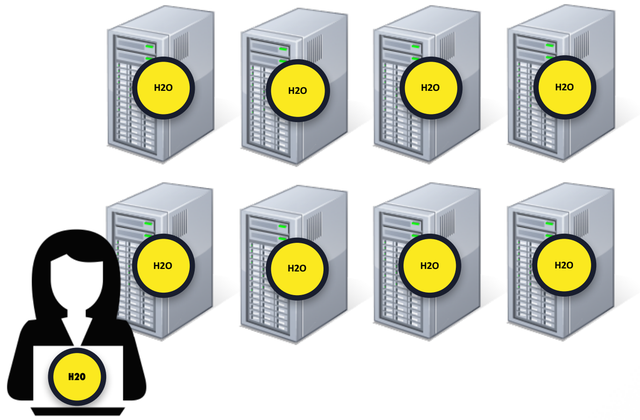
H2O Core with Other Data Sources



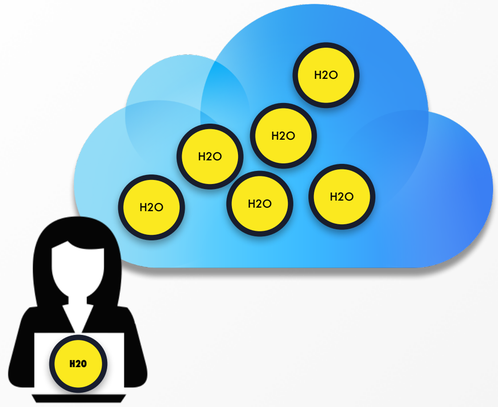
H2O Core on the Cloud



H2O Distributed Environments



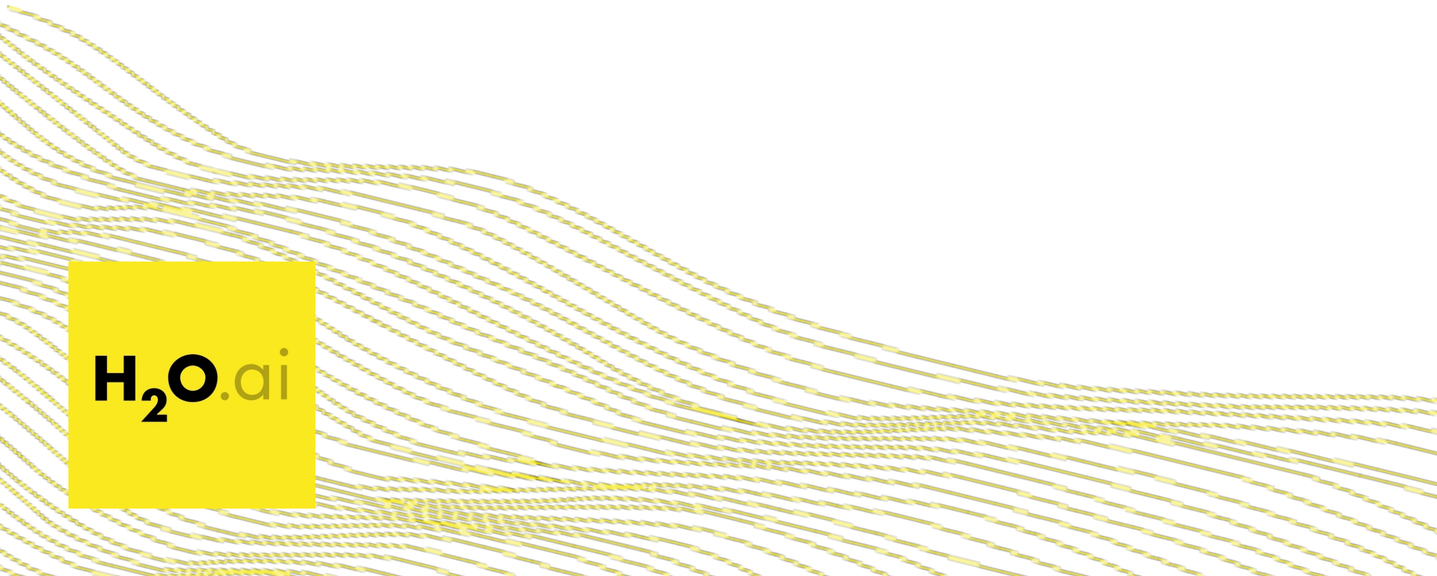
distributed across multiple machines



distributed on the cloud

H2O API

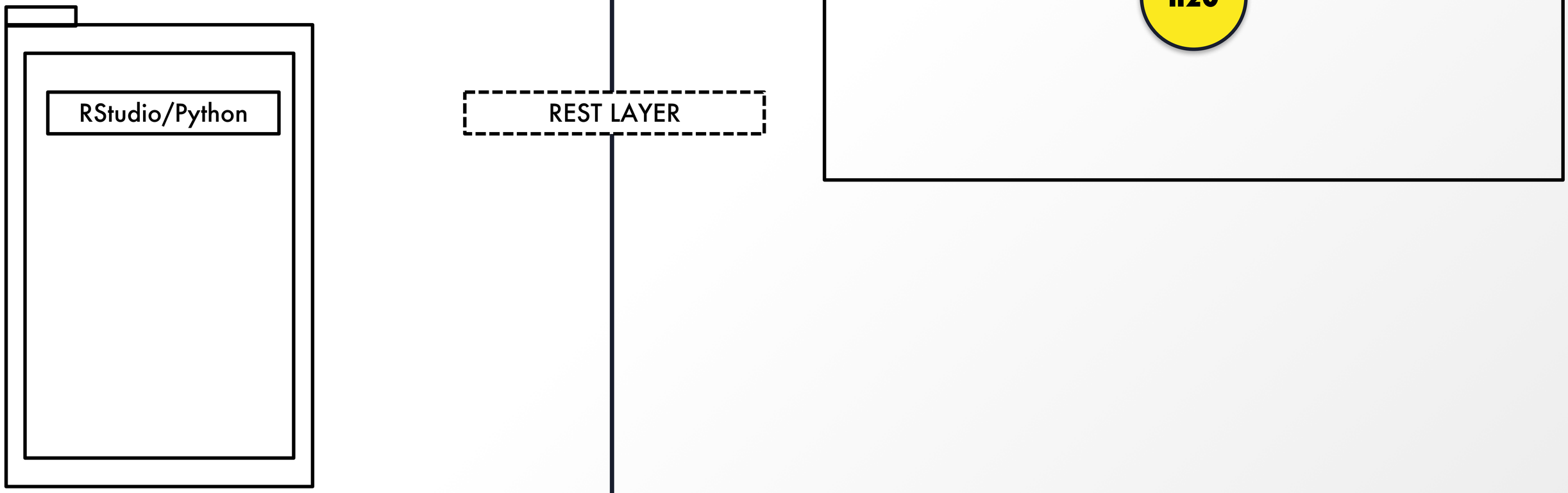
How the client & cluster communicate



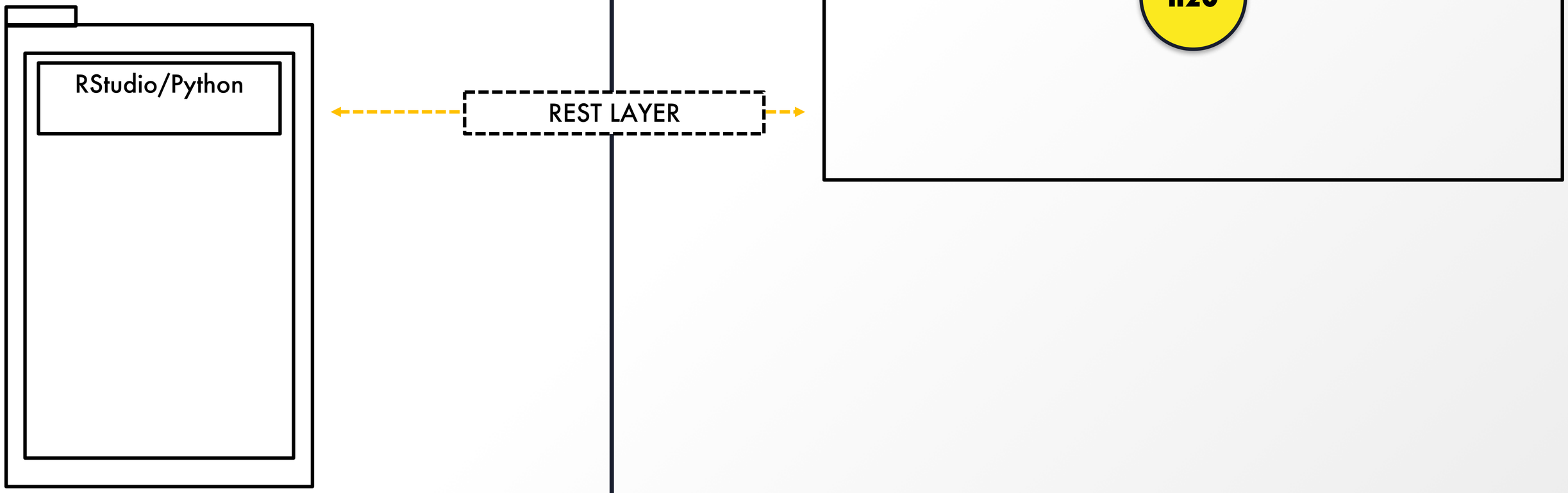
H2O API

H2O API

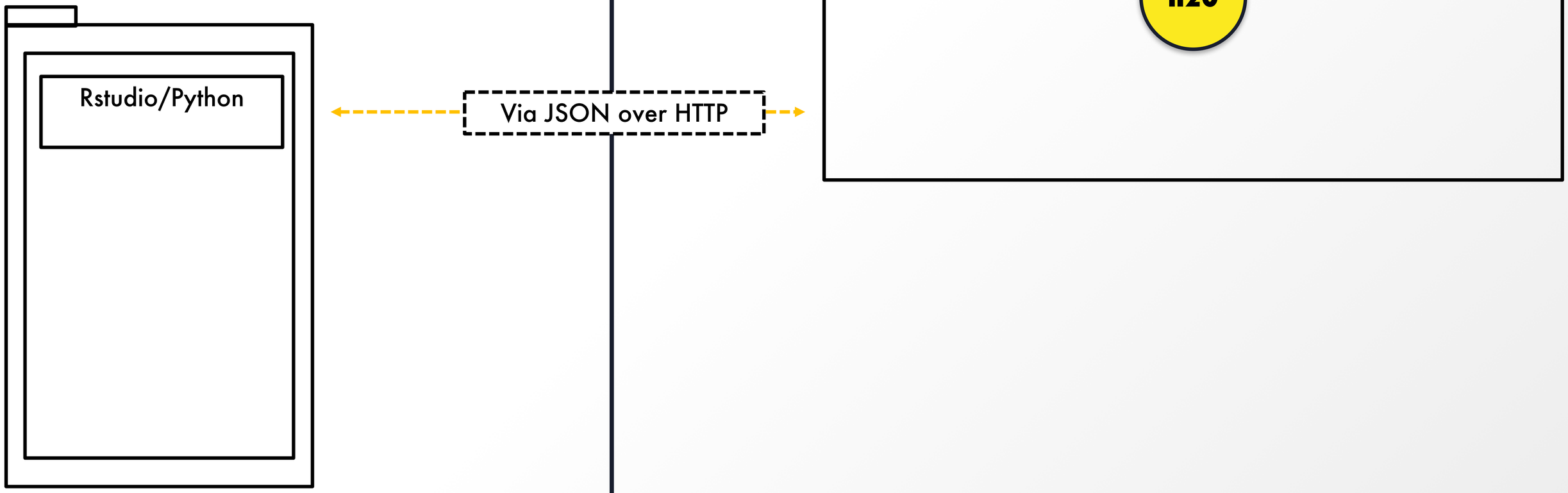
H2O API



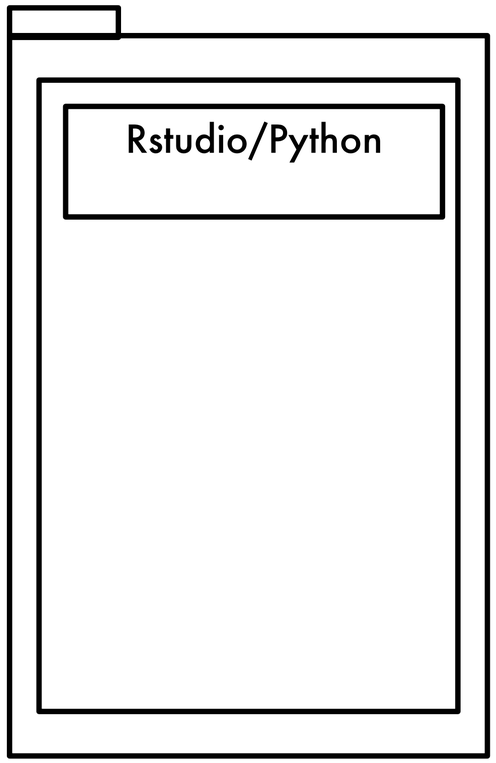
H2O API



H2O API



H2O API



Via JSON over HTTP

H2O

Data is held here in the JVM

Data is NOT in the R process

Client & Cluster Communication

H2O Client

REST/
JSON

H2O Cluster

Communication Layers: Interface

Standard R Interface

the Client

RStudio Interface

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

Communication Layers: Code Script

RStudio

the Client

Rstudio using H2O Package

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

Communication Layers: A Command

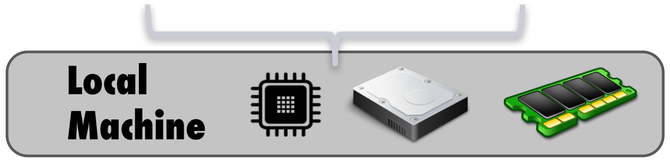
Importing Big Data with R Code

R Commands

the Client

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

`h2o.importFile(…)`



H2O.ai

Communication Layers: A Command

Importing Big Data with R Code

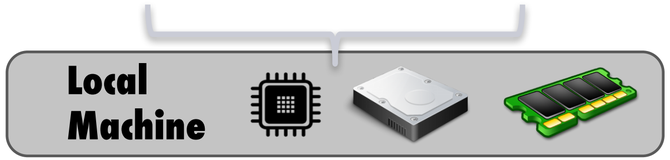
R Commands

the Client

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

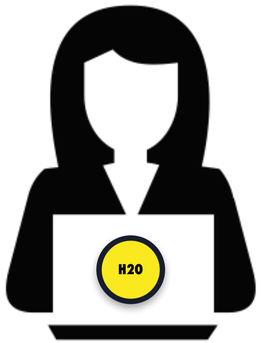
Path to Your Dataset

```
h2o.importFile(…)
```



H2O.ai

Fourth: Communicate

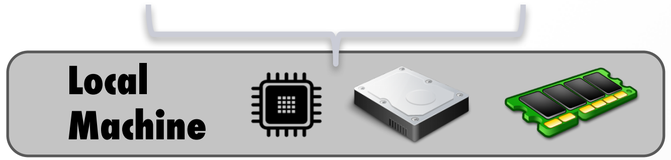


`h2o.importFile(…)`
`requests file import`

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/ ➦

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

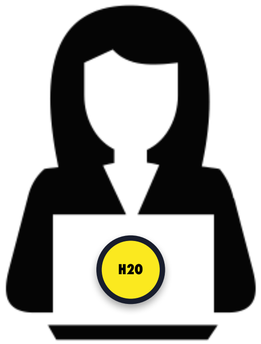
REST
/
JSON

H2O Cluster

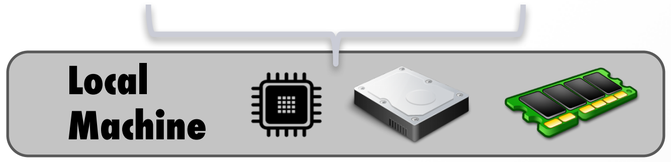


H2O.ai

Fifth: Cluster Does Heavy Lifting




```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

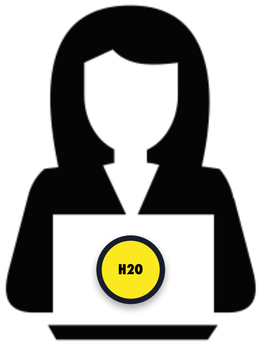


REST/
JSON

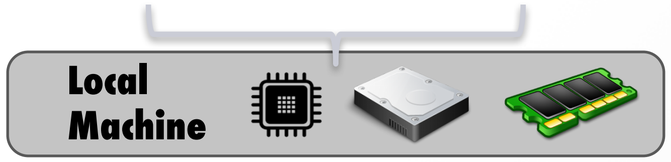
H2O Cluster

H2O.ai

Fifth: Cluster Does Heavy Lifting

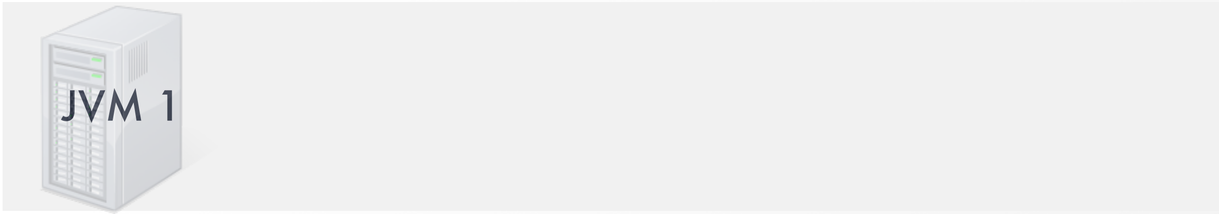


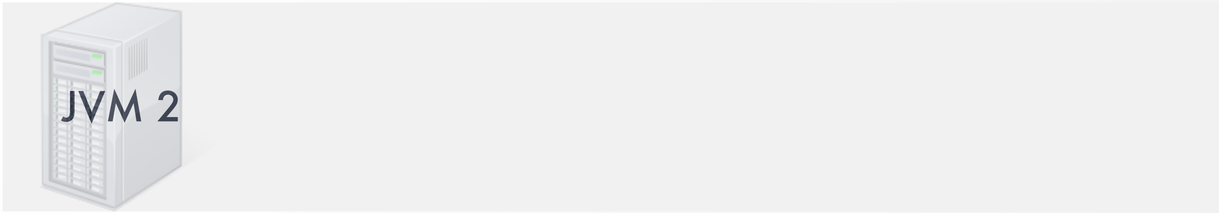

```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/ ➦

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

> |
```

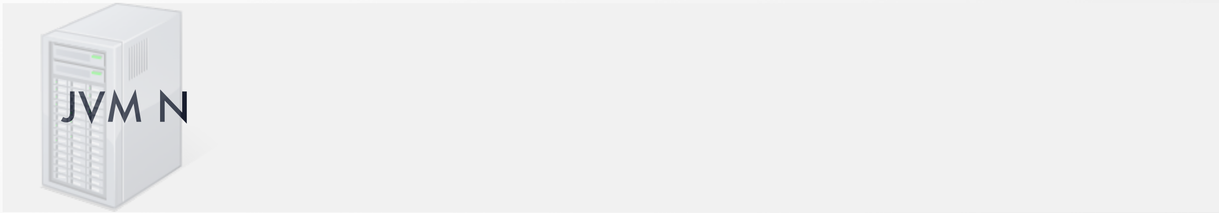


REST/
JSON

H2O Cluster

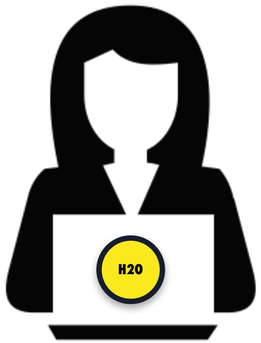




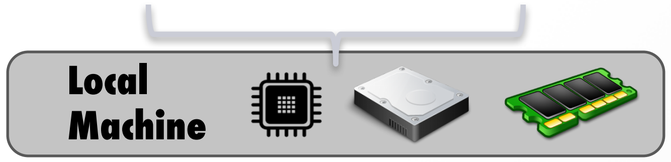


H2O.ai

Fifth: Cluster Does Heavy Lifting

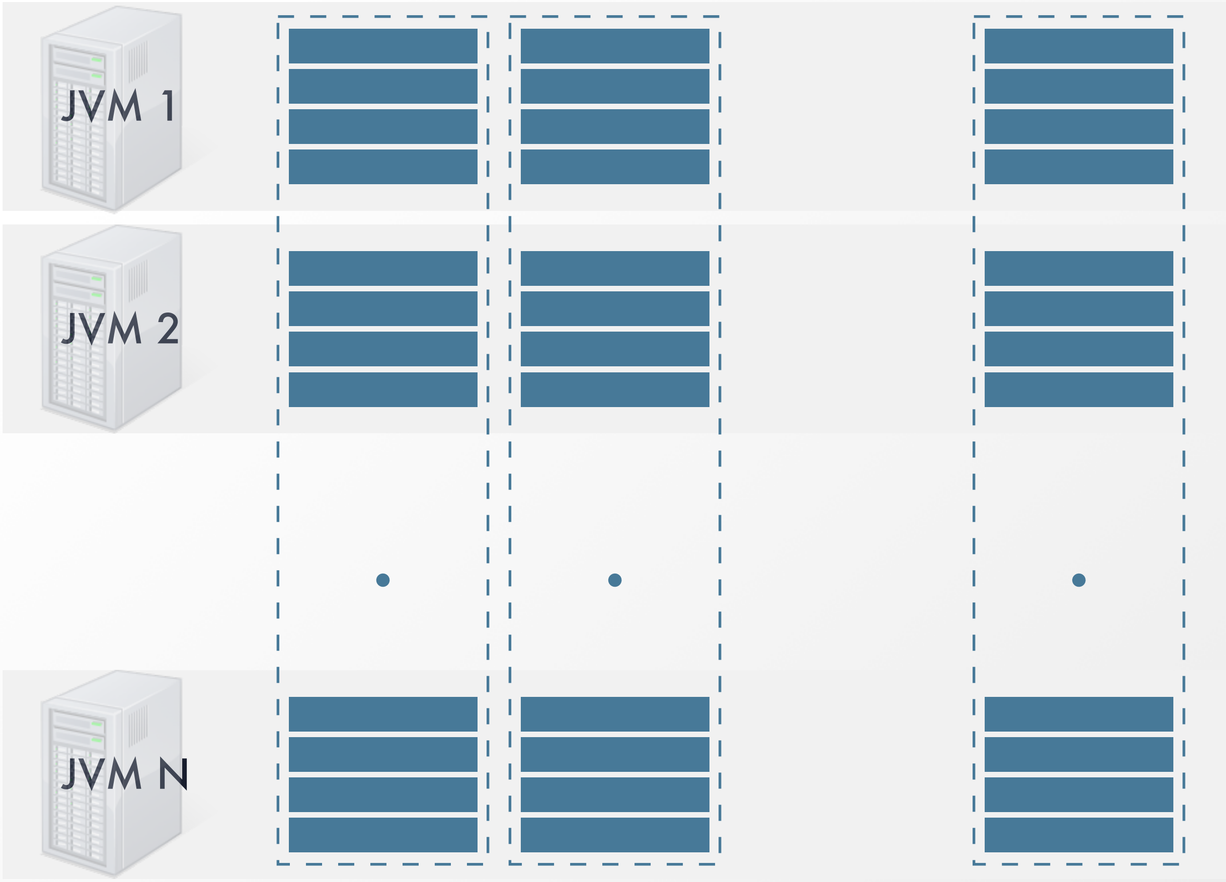



```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/ ➦

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```



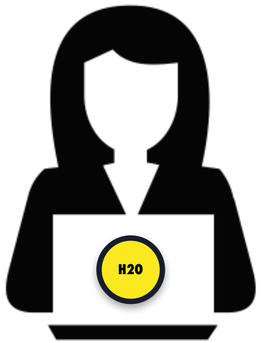
REST/
JSON

H2O Cluster

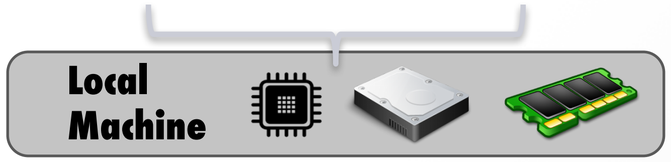


H2O.ai

Fifth: Cluster Does Heavy Lifting




```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x88sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x88sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```



REST/
JSON

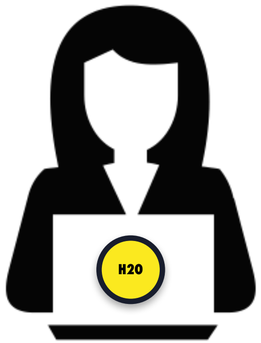
H2O Cluster

x_1	x_2	x_3	…	x_p	y

H2O.ai

H2O Client

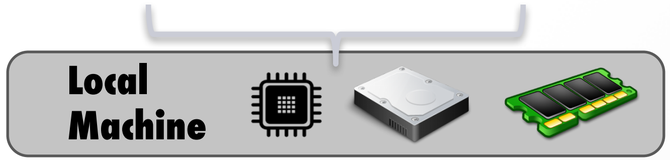
cluster returns frame key




```
Console  Terminal
~/Desktop/rencontres-R-2018/h2o-deeplearning/

H2O is not running yet, starting it now...

Note:  In case of errors look at the following log files:
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.out
    /var/folders/55/rj4cny_s29q4vn1wjt_x08sm0000gn/T//RtmpH6ZkxR/h2o_navdeepgill_started_from_r.err

java version "1.8.0_101"
Java(TM) SE Runtime Environment (build 1.8.0_101-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.101-b13, mixed mode)

Starting H2O JVM and connecting: . Connection successful!

R is connected to the H2O cluster:
    H2O cluster uptime:         3 seconds 970 milliseconds
    H2O cluster timezone:       America/Los_Angeles
    H2O data parsing timezone:  UTC
    H2O cluster version:        3.20.0.2
    H2O cluster version age:    12 days
    H2O cluster name:           H2O_started_from_R_navdeepgill_kdm352
    H2O cluster total nodes:    1
    H2O cluster total memory:   3.56 GB
    H2O cluster total cores:    8
    H2O cluster allowed cores:  8
    H2O cluster healthy:        TRUE
    H2O Connection ip:          localhost
    H2O Connection port:        54321
    H2O Connection proxy:       NA
    H2O Internal Security:      FALSE
    H2O API Extensions:         XGBoost, Algos, AutoML, Core V3, Core V4
    R Version:                  R version 3.4.0 (2017-04-21)

>
```

REST/ JSON

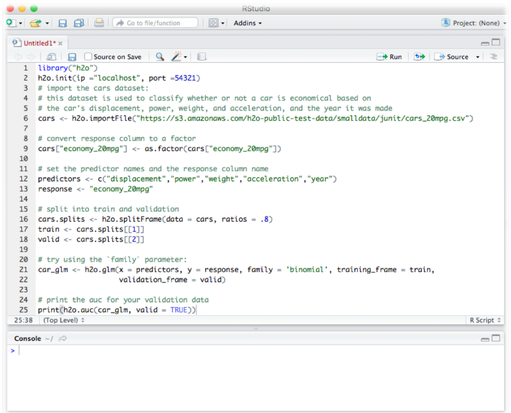
x1	x2	x3	...	xp	y



H2O.ai

What does the Client Do?

Clients Only Tells the Cluster What to Do

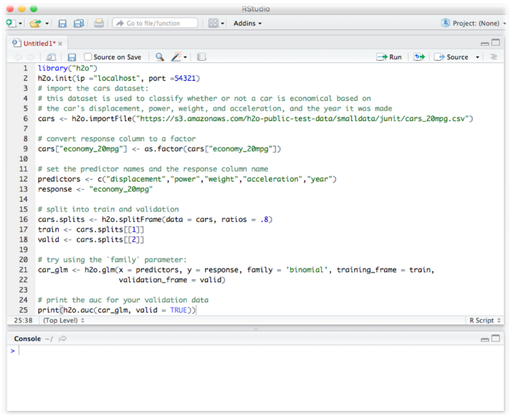


Hi Cluster,
Can you please get me …

H2O.ai

Client Only Passes Requests

Big Data Never Flows Through The Client
Unless **Explicitly** Asked



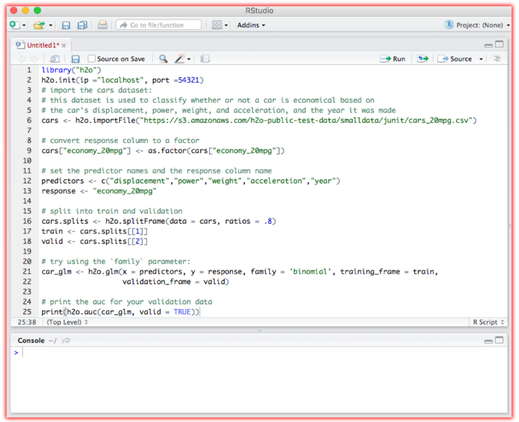
No, you take care of the heavy lifting

H2O.ai

What if?

Pulling Big Data into R Can Overwhelm Your Session


```
as.data.frame(my_big_dataframe)
```

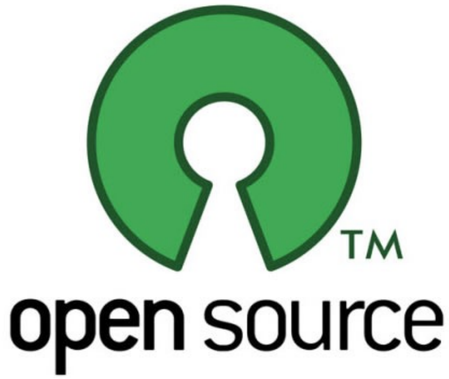


H2O.ai

H2O Resources

- Documentation: http://docs.h2o.ai
- Tutorials: https://github.com/h2oai/h2o-tutorials
- Slidedecks: https://github.com/h2oai/h2o-meetups
- Videos: https://www.youtube.com/user/0xdata
- Stack Overflow: https://stackoverflow.com/tags/h2o
- Google Group: https://tinyurl.com/h2ostream
- Gitter: http://gitter.im/h2oai/h2o-3
- Events & Meetups: http://h2o.ai/events

Contribute to H2O!

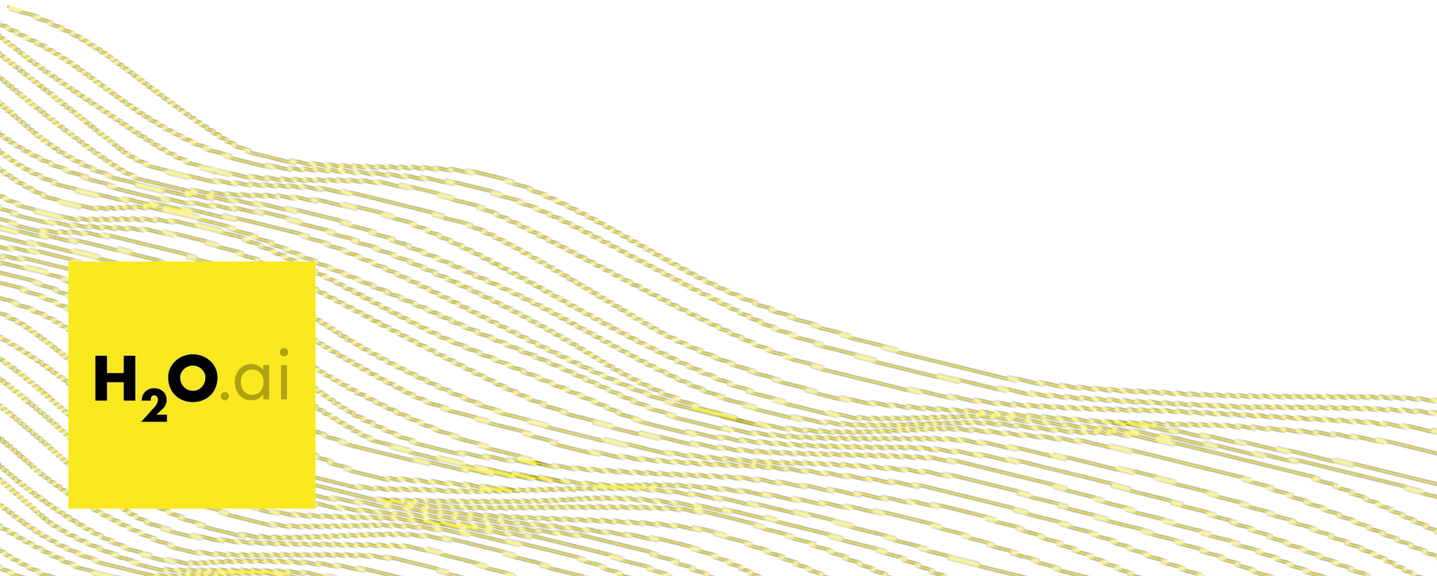


Get in touch over email, Gitter or JIRA.

https://github.com/h2oai/h2o-3/blob/master/CONTRIBUTING.md

Demo

https://github.com/navdeep-G/jsm-2018/blob/master/h2o_airlines.R



Thank you!

@navdeep-G on Github
@Navdeep_Gill_ on Twitter
navdeep@h2o.ai