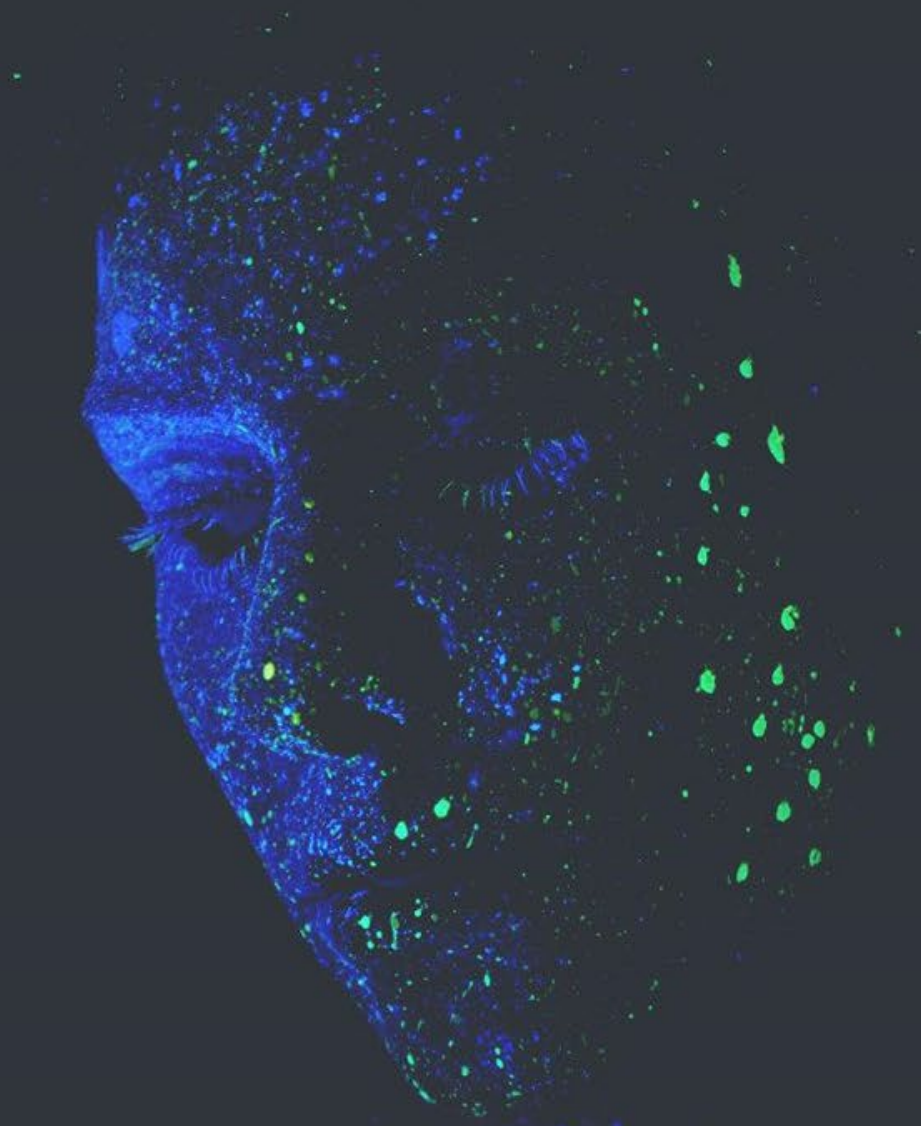
DIVERGENCE ACADEMY

Street Smart Machine Learning Part I: Breadth with Tableau, R & Spark



Drew Minkin
Lead Instructor and Curriculum Dev
Data Science Immersive Program
Nov 4 2022

Topics Overview

1. Tableau & R Integration
2. Spark and Big Data
3. Spark & R Integration
4. Street Smart Machine Learning

Who's Drew?

Previous Incarnations

SQL Support/Consulting 2000-06

Data Scientist 2010 – Now

4.5 Startups 2007-19

Analytics Architect/Dev

Entrepreneur

Current Incarnation

MCT, Data Science Instructor DIVERGENCE ACADEMY

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Tableau & R Integration

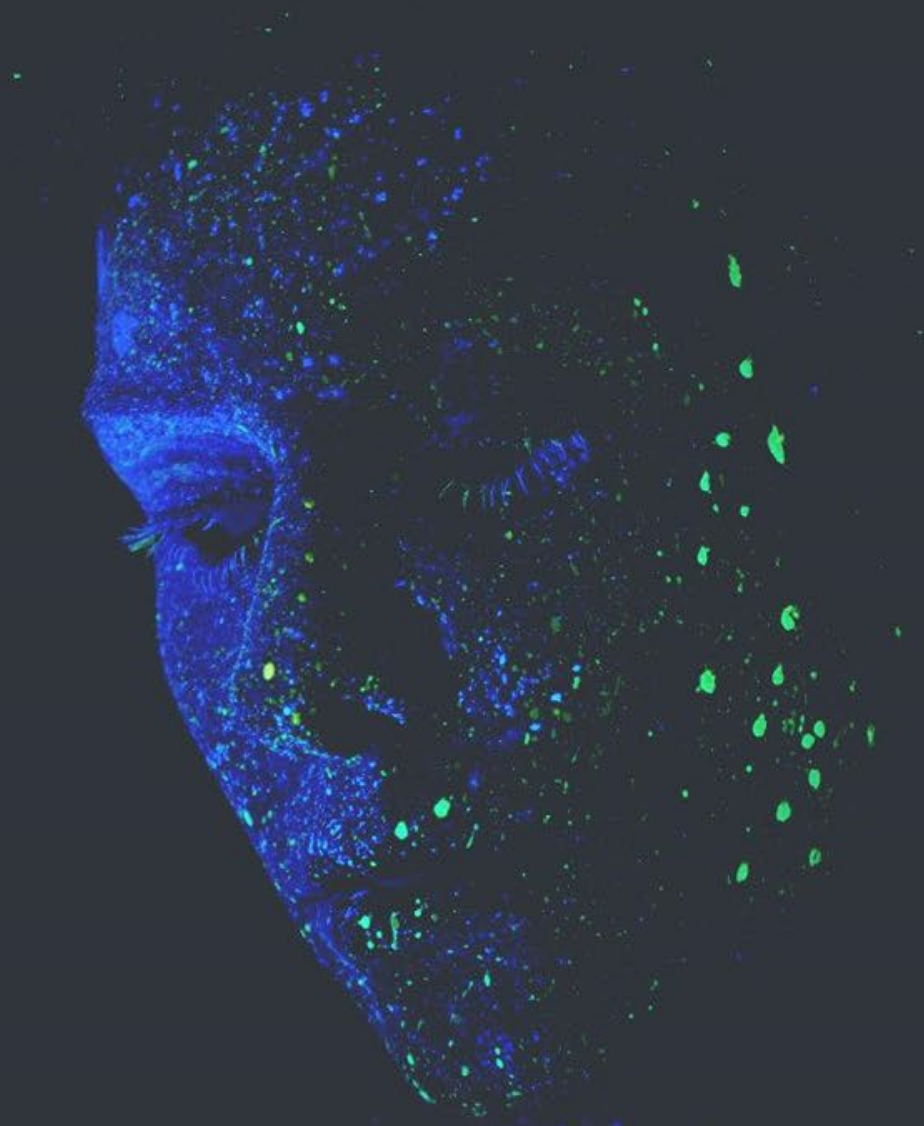
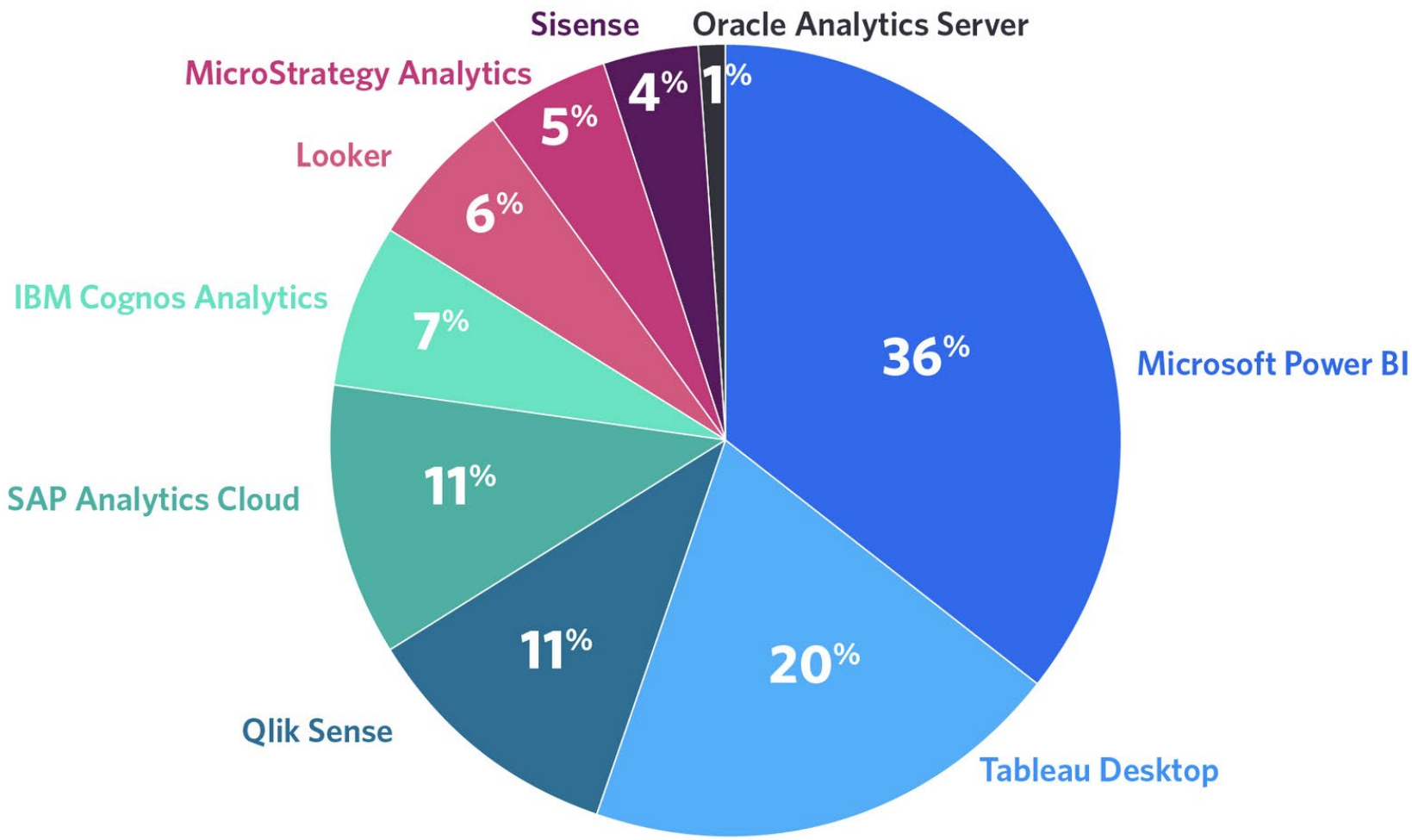


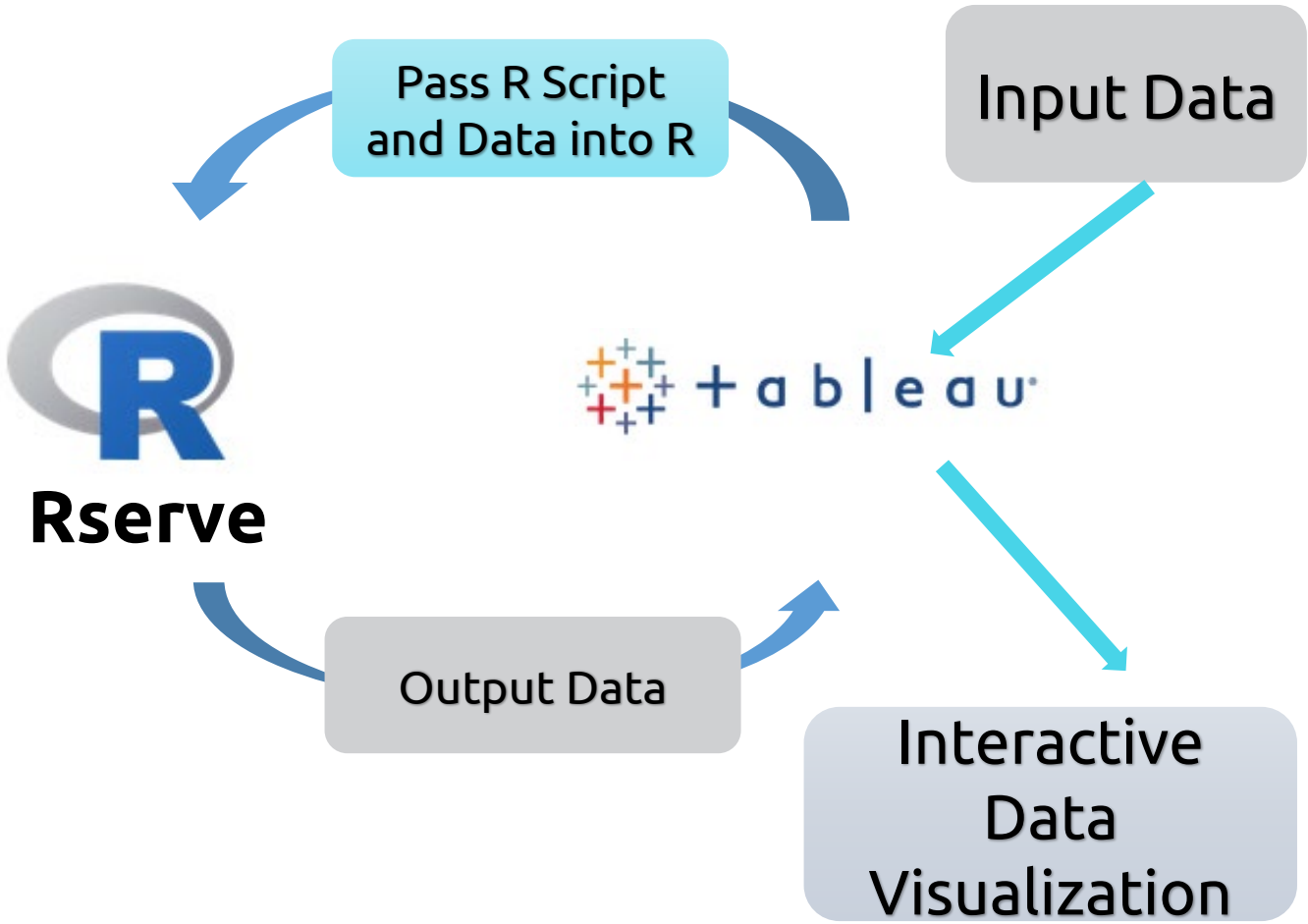
Tableau and Self-Service Business Analytics



Source: TrustRadius platform data collected in June 2021

Introduction to Tableau and R Integration

- Use one of the four functions
  - **SCRIPT_BOOL**: Return a **Boolean**
  - **SCRIPT_INT**: Return an **Integer**
  - **SCRIPT_REAL**: Return a **Real**
  - **SCRIPT_STR**: Return a **String**



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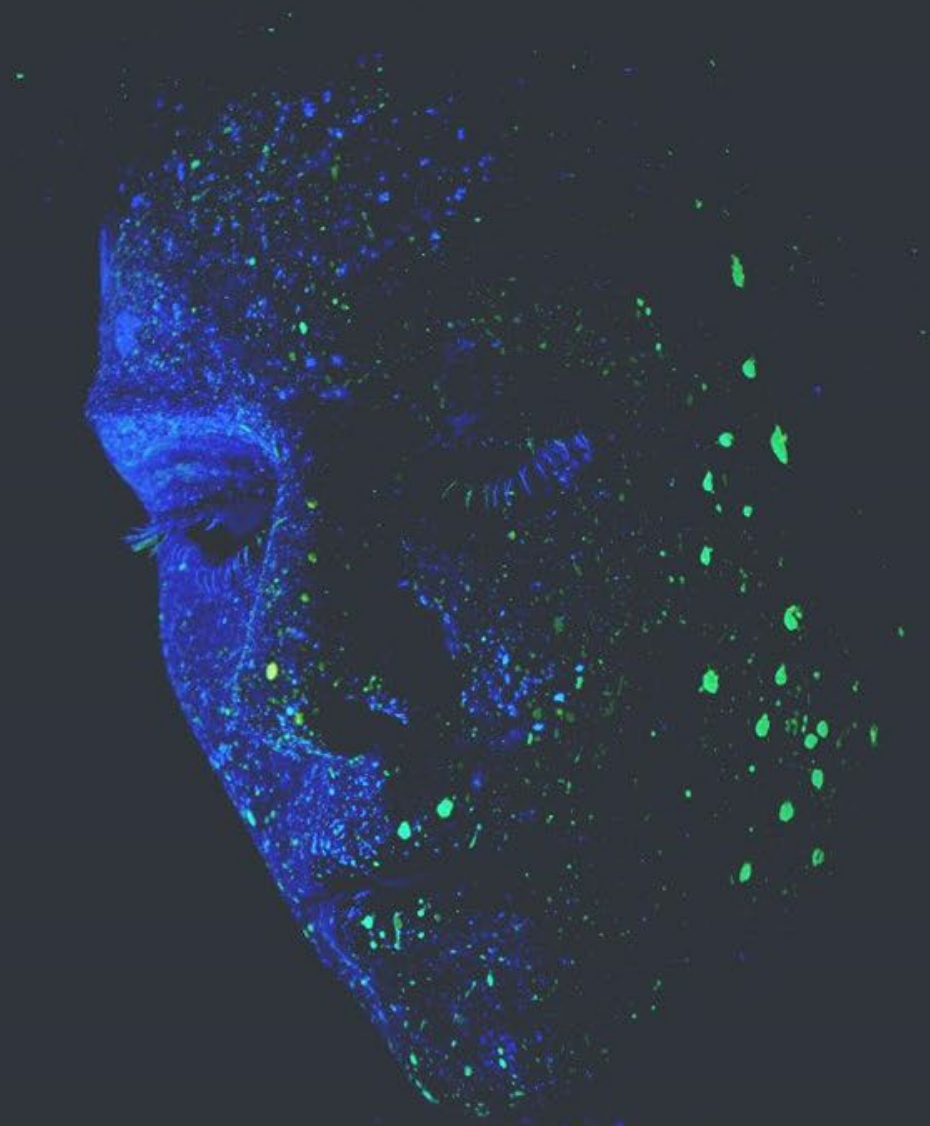
Demo:
Tableau & R Integration



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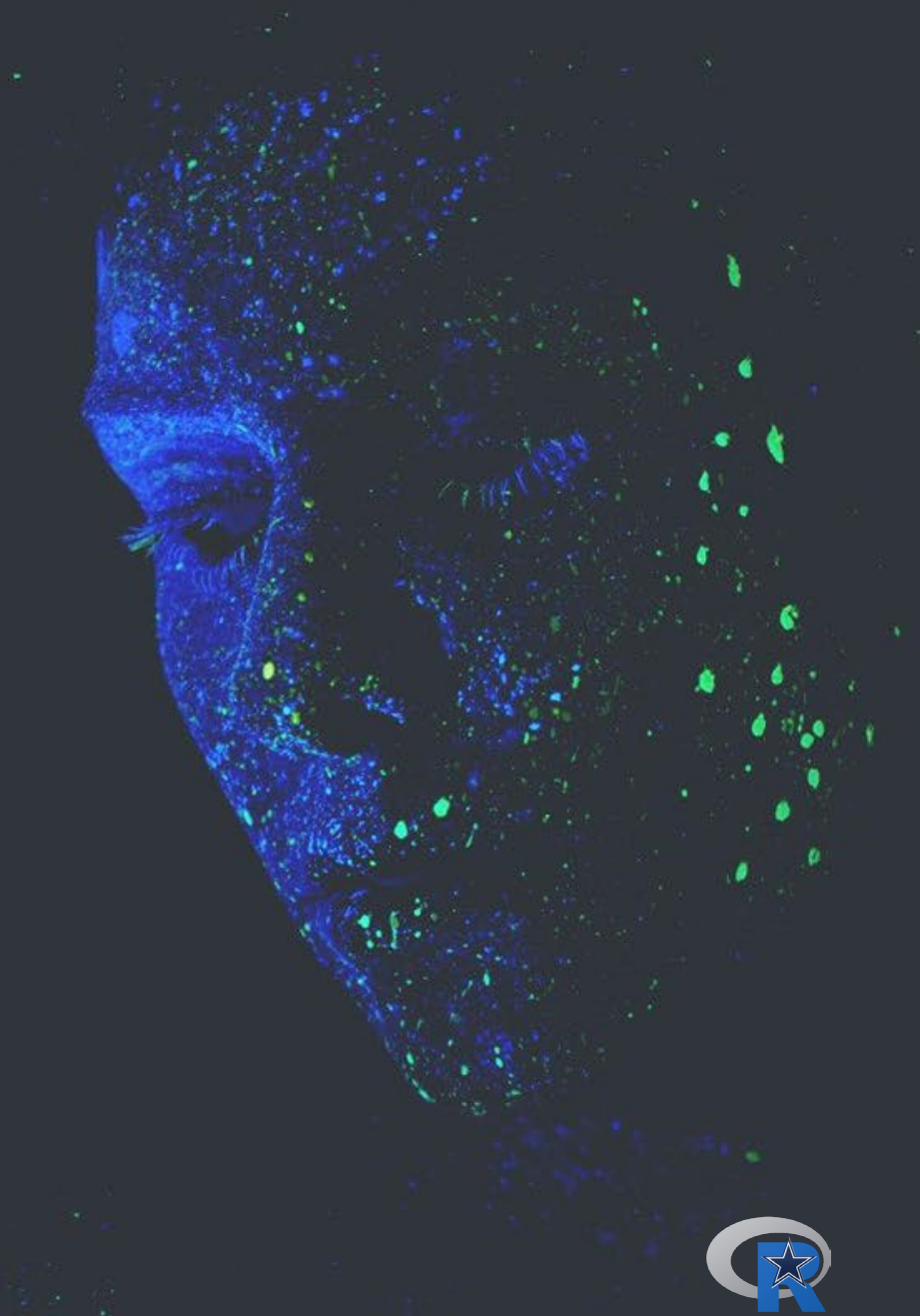
A Tale of Two Technologies And the Future of Data



Why Care about Big Data

THIN THE LINES
BETWEEN
OPERATIONAL AND
ANALYTICAL

DECENTRALIZED
WORKSPACES
CENTRALIZED STORAGE

COMPUTE IS
PAY AS YOU GO

Data Structures Beyond the Relational RDBMS

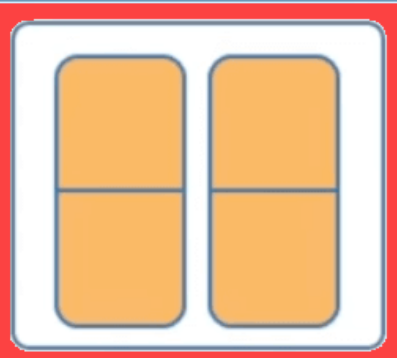
Key Value

Example:
Riak, Tokyo Cabinet, Redis server, Memcached, Scalaris

Document-Based

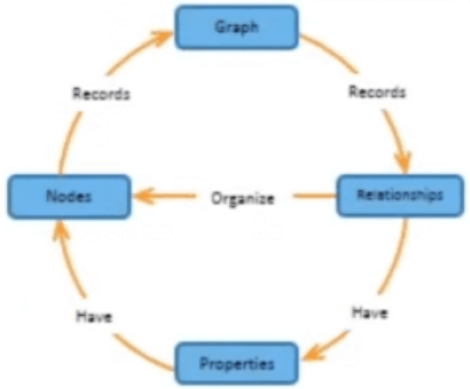
Example:
MongoDB, CouchDB, OrientDB, RavenDB

Column-Based



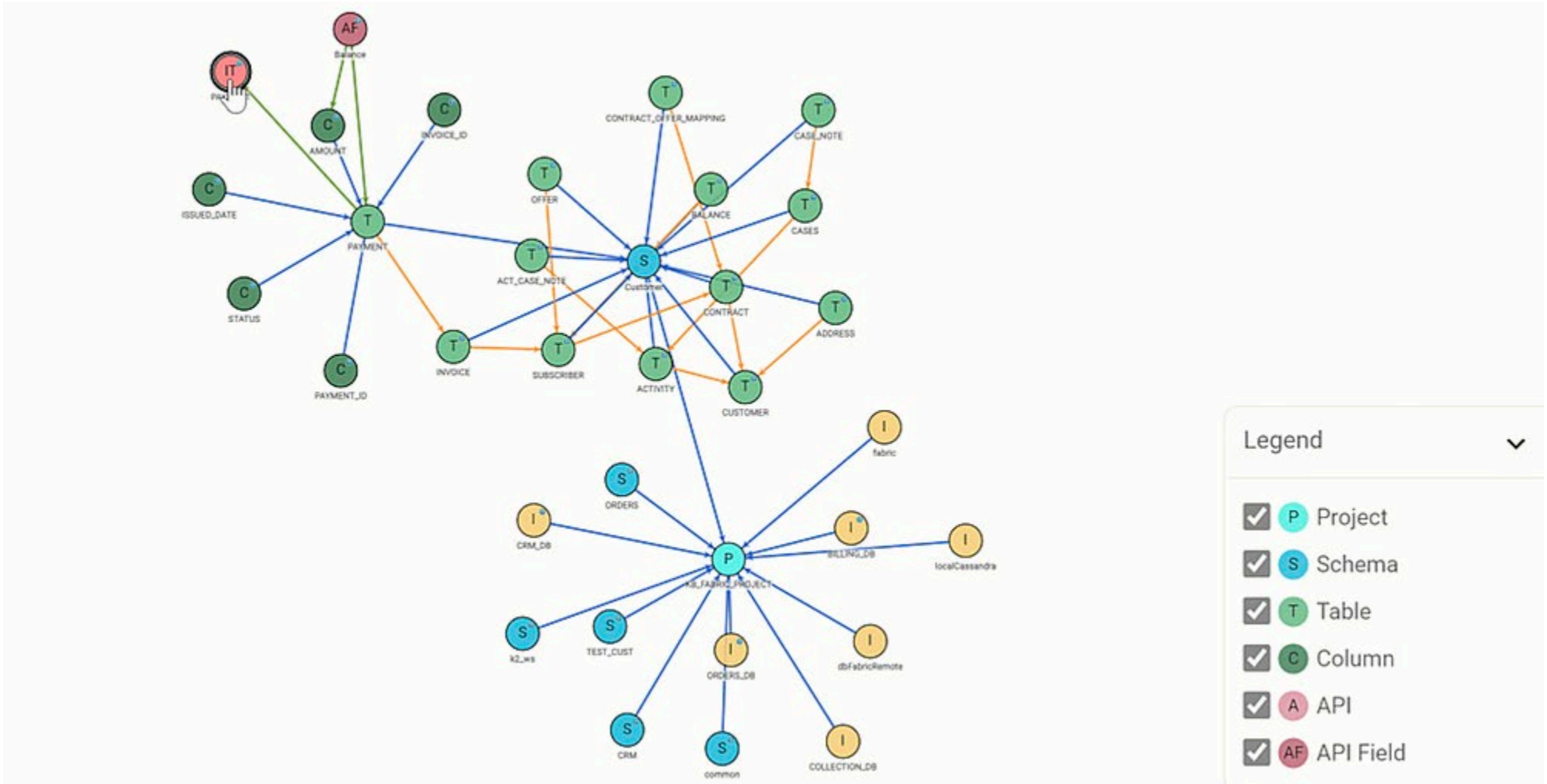
Example:
BigTable, Cassandra, Hbase, Hypertable

Graph-Based

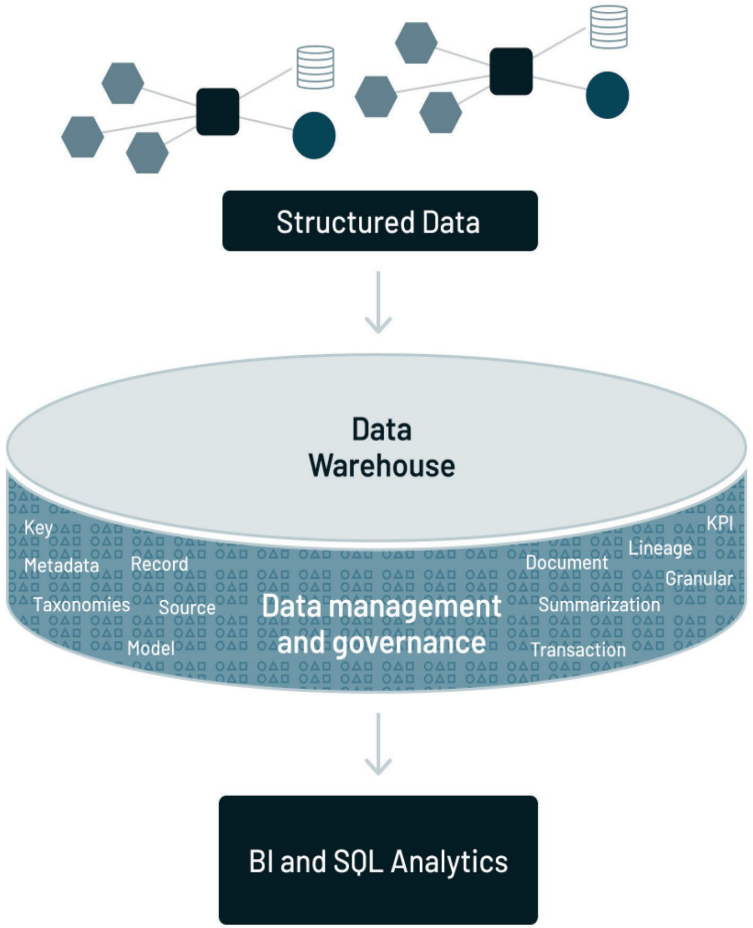


Example:
Neo4J, InfoGrid, Infinite Graph, Flock DB

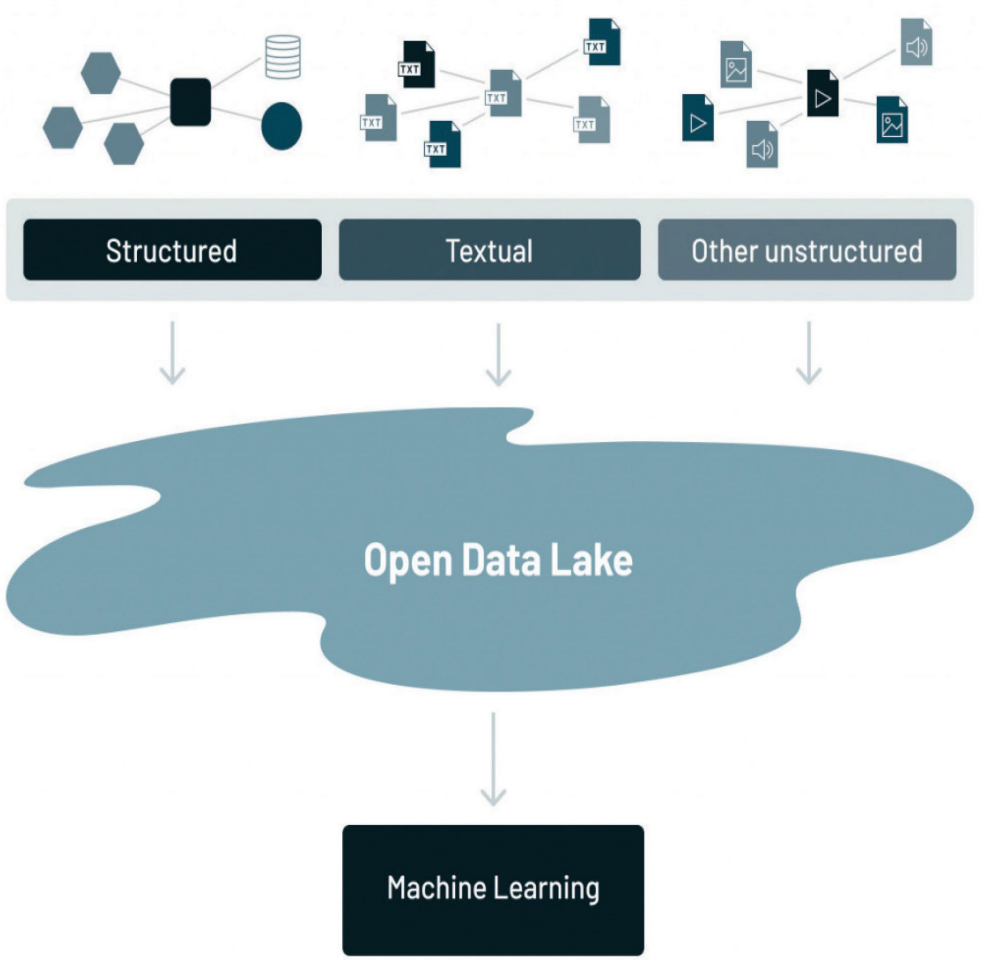
From data to information: the Knowledge Graph



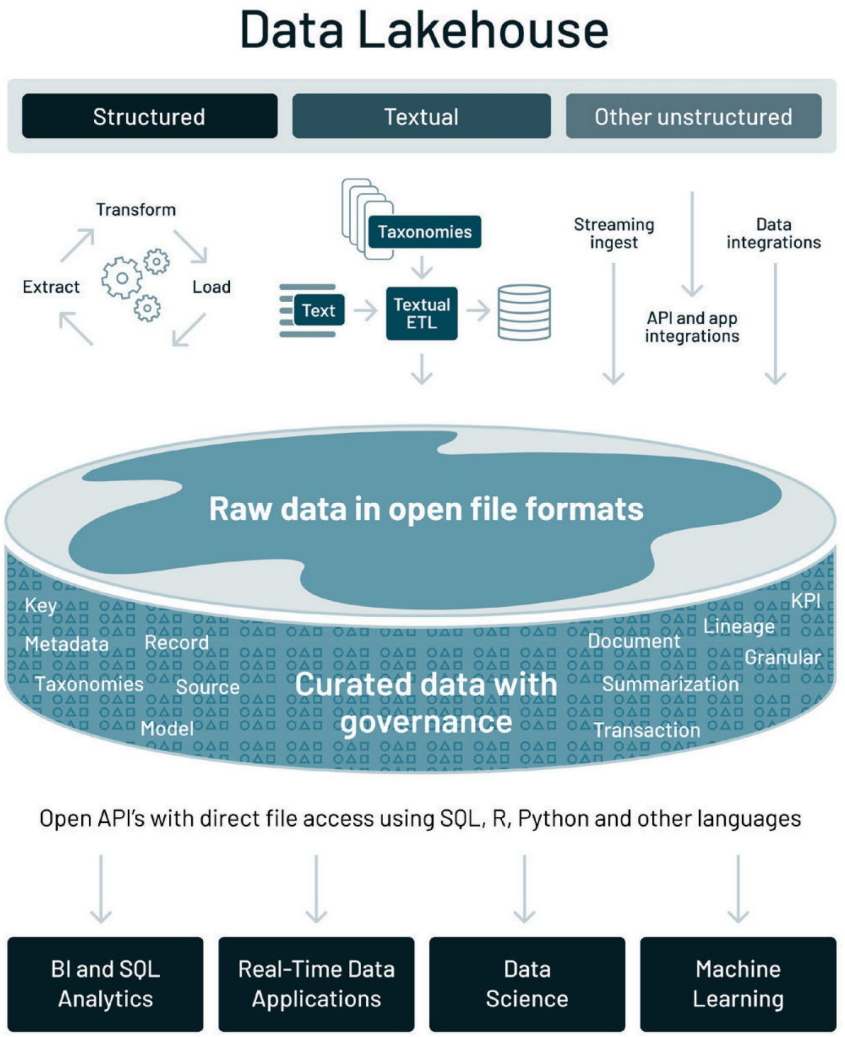
Comparison of Technologies



Comparison of Technologies



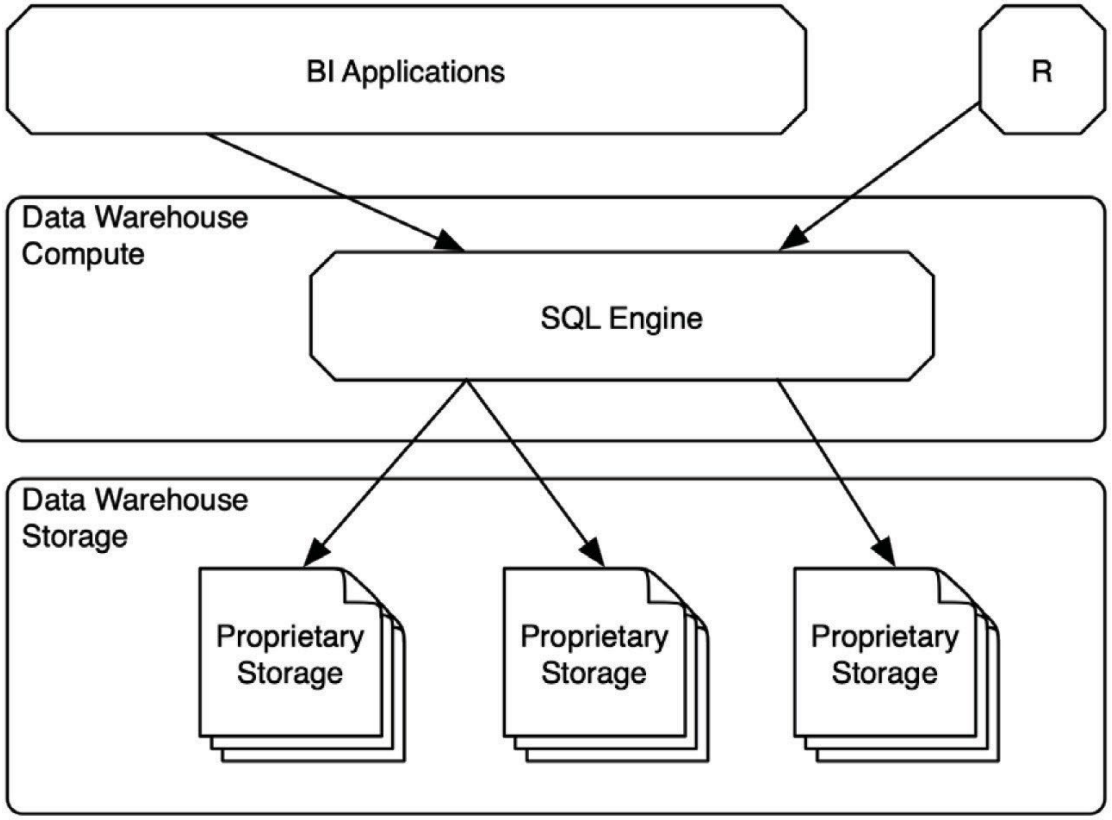
Comparison of Technologies

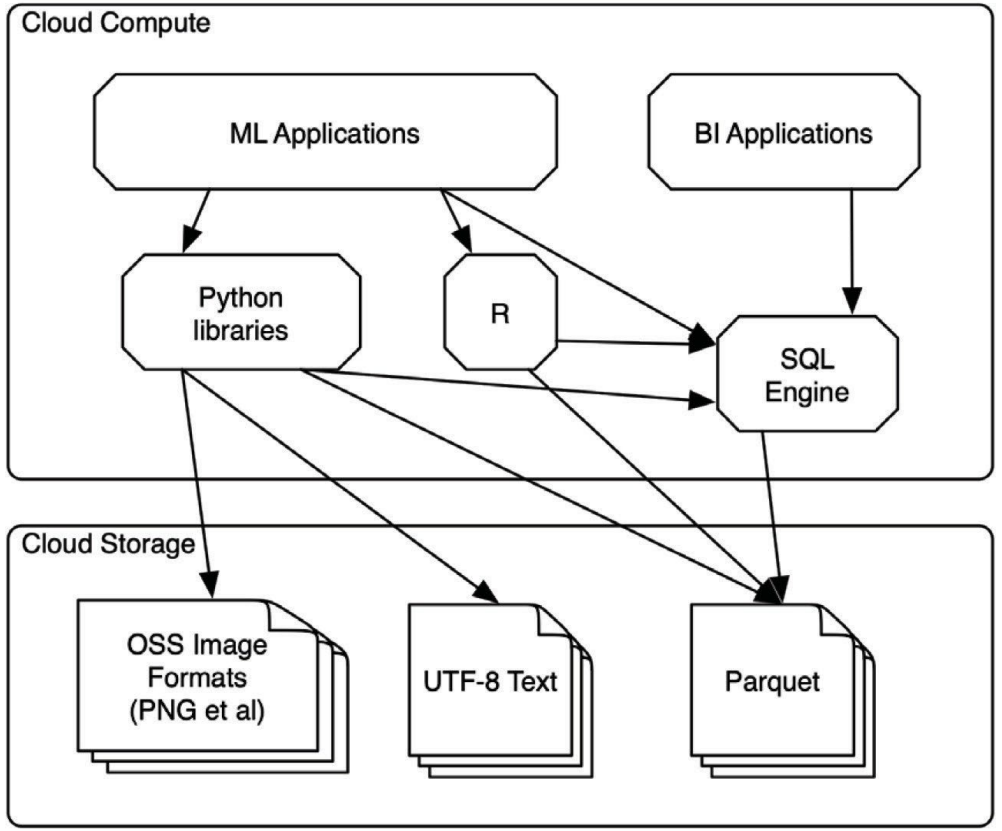


Comparison of Technologies

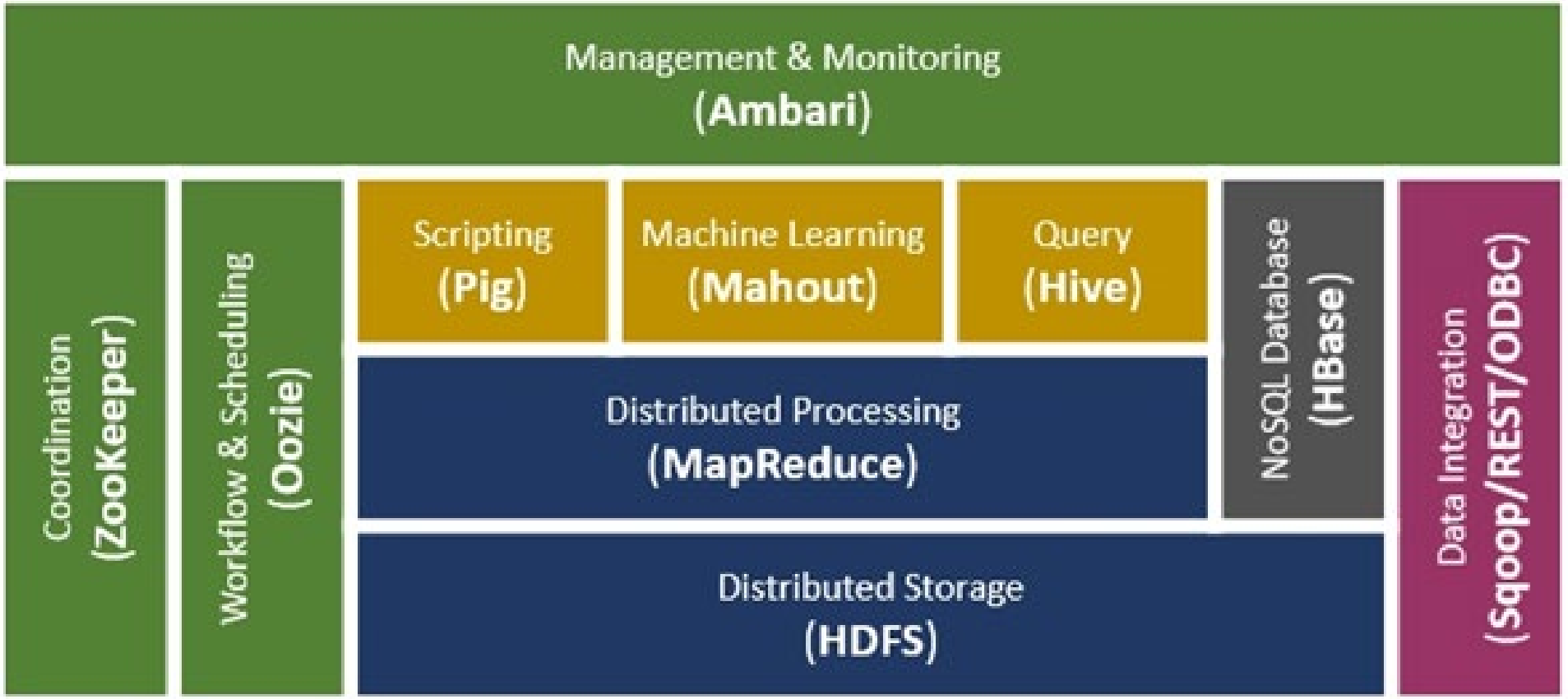
	Data warehouse	Data lake	Data lakehouse
Data format	Closed, proprietary format	Open format	Open format
Types of data	Structured data, with limited support for semi- structured data	All types: Structured data, semi-structured data, textual data, unstructured (raw) data	All types: Structured data, semi-structured data, textual data, unstructured (raw) data
Data access	SQL-only	Open APIs for direct access to files with SQL, R, Python, and other languages	Open APIs for direct access to files with SQL, R, Python, and other languages
Reliability	High quality, reliable data with ACID transactions	Low quality, data swamp	High quality, reliable data with ACID transactions
Governance/security	Fine-grained security and governance for row/columnar level for tables	Poor governance as security needs to be applied to files	Fine-grained security and governance for row/columnar level for tables
Performance	High	Low	High
Scalability	Scaling becomes exponentially more expensive	Scales to hold any amount of data at low cost, regardless of type	Scales to hold any amount of data at low cost, regardless of type
Use Case Support	Limited to BI, SQL applications, and decision support	Limited to machine learning	One data architecture for BI, SQL, and machine learning

Data Warehouse vs. Data Lakehouse

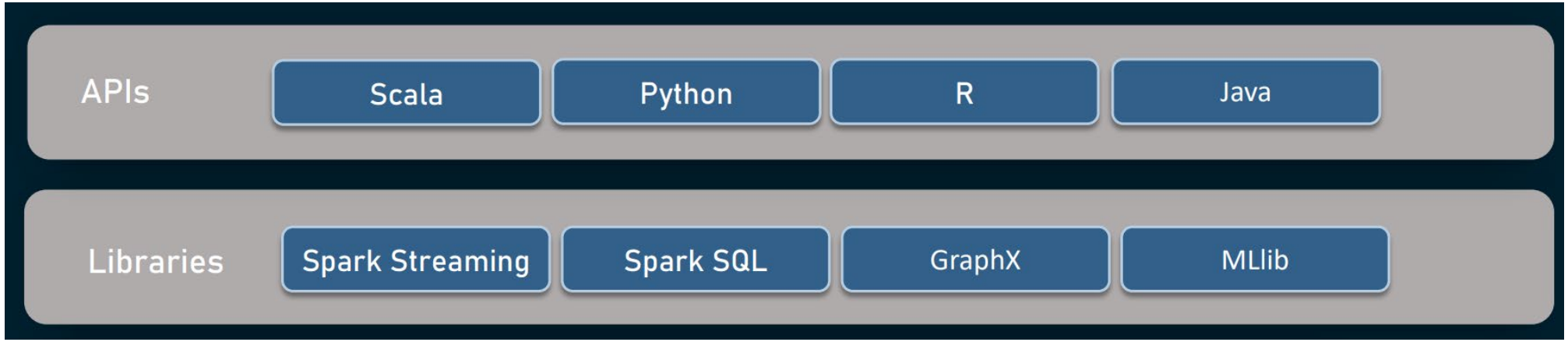




Hadoop Architecture (Pre-Spark)



Spark Architecture



SEPARATION OF COMPUTE AND STORAGE

NATIVE JVM WITH SCALA DIALECT

SPARKR AND PYSPARK THUNKY INTEGRATIONS

Azure Synapse vs. Databricks

AZURE DATABRICKS

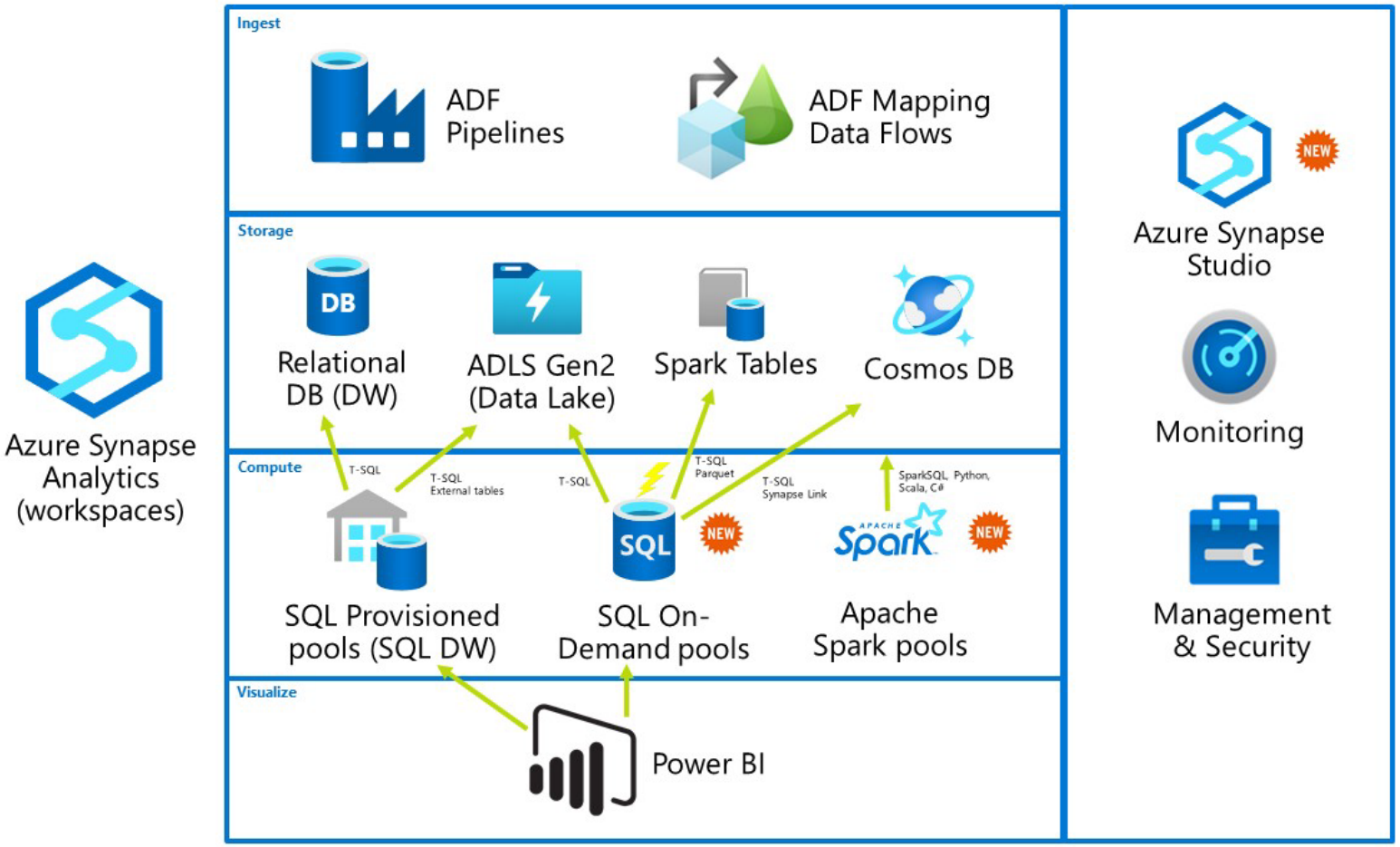
- Git Support
- Deeper Spark IP
- Cross-cloud support
- Single node support
- Maturer autoscale
- Tight MLFlow integration
- Tighter Delta Lake in Spark SQL
- Spark SQL Live Tables
- Component level Azure Data Factory integration
- Notebook as Dashboard

Hive Support
Java/Scala/Python
Spark Scaleout
GPU Support
SparkML Support

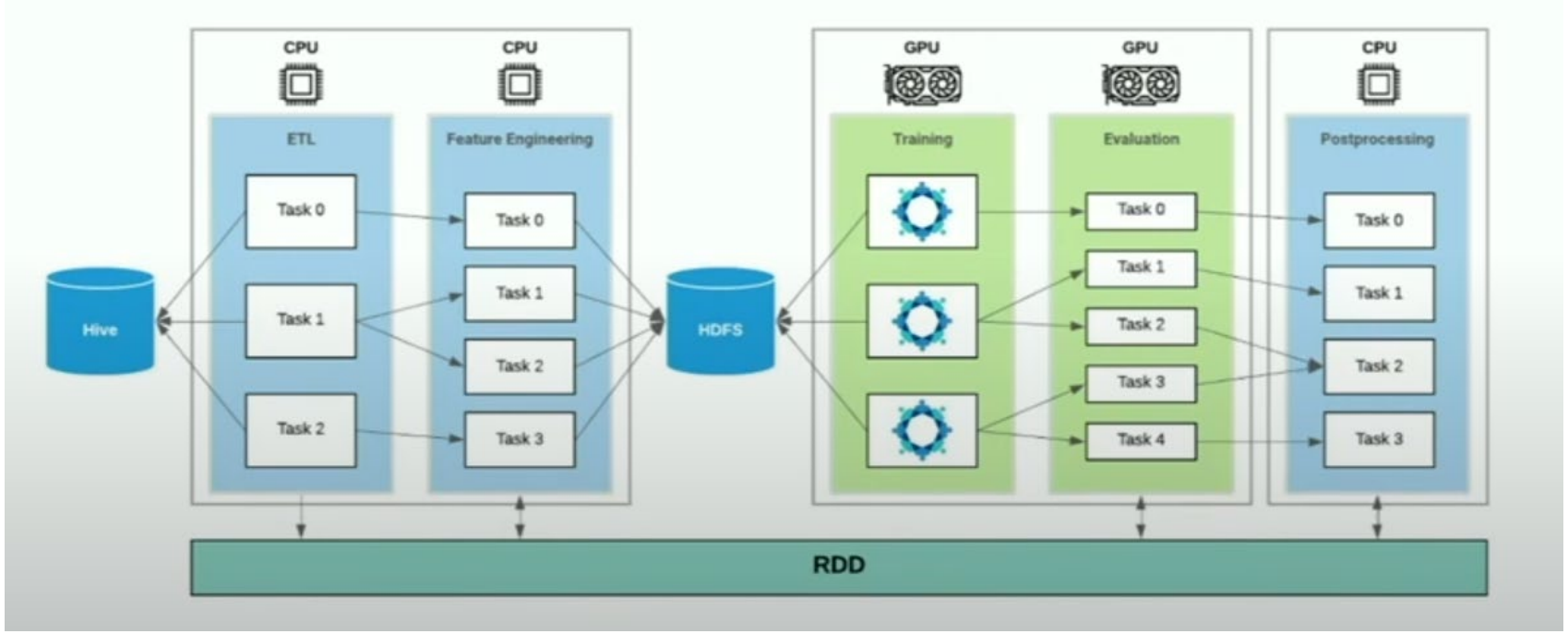
- SynapseML support
- Serverless or Dedicated SQL Pool
- Data warehousing
- Data Lake Tables
- Tighter Power BI integration
- .NET language support
- Big Data Scale Model Scoring with Zero Data Movement
- Transact-SQL compatibility
- Azure Purview Integration
- Azure Data Factory workspace integration

AZURE SYNAPSE

Azure Synapse Architecture



Azure Synapse Analytics – Deep Learning Benefits



- Scale-out
- Spark integration built-in
- Easier Azure DevOps & Azure Data Factory integration
- .NET language, Transact-SQL integration

https://www.youtube.com/watch?v=jbbnZIpCu-U

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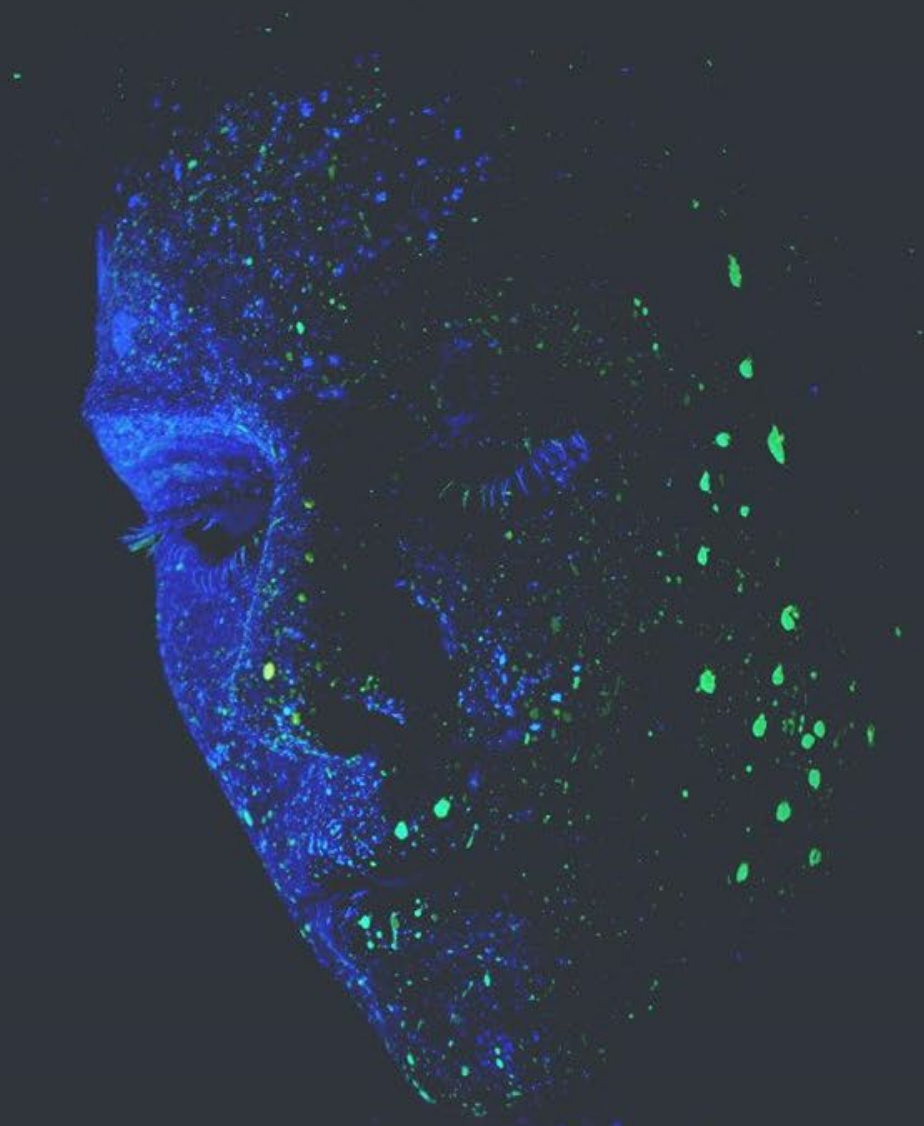
Demos:
Azure Synapse & Databricks



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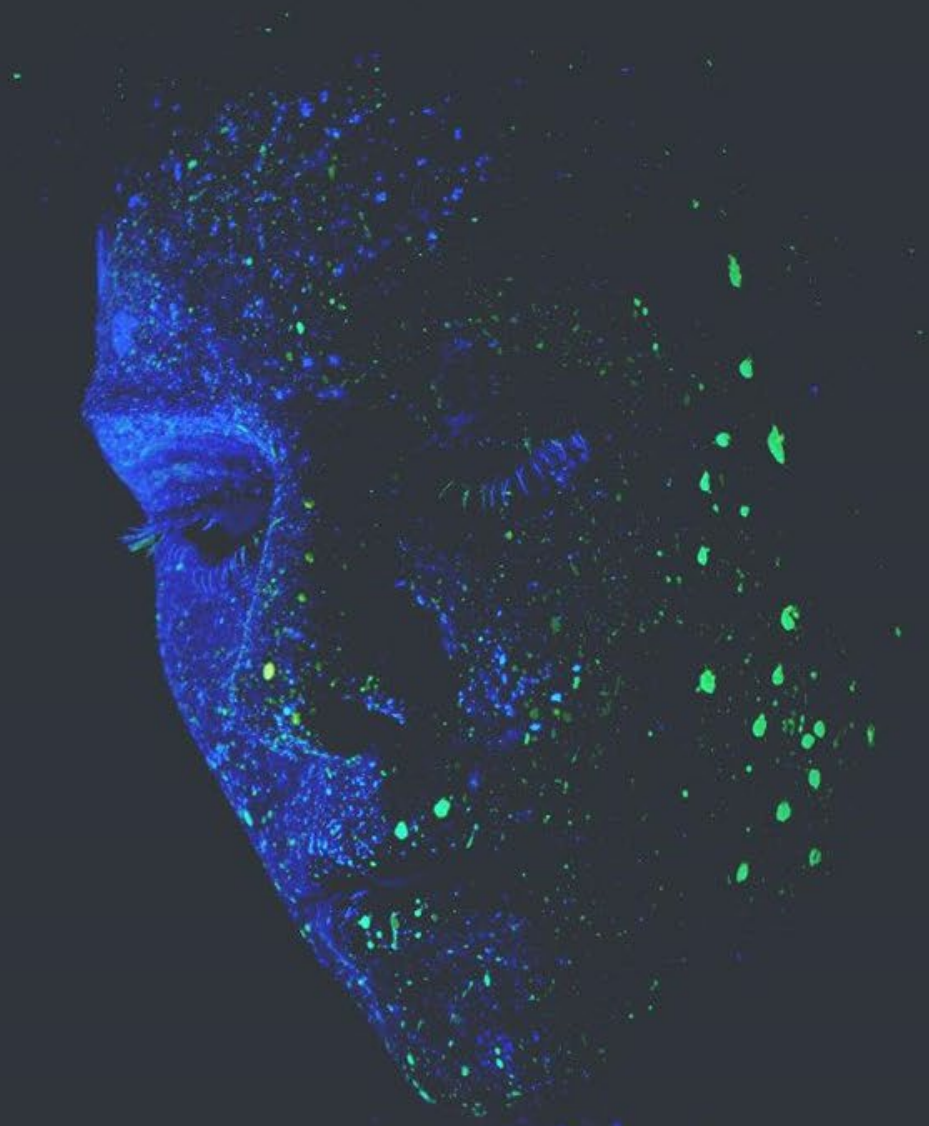
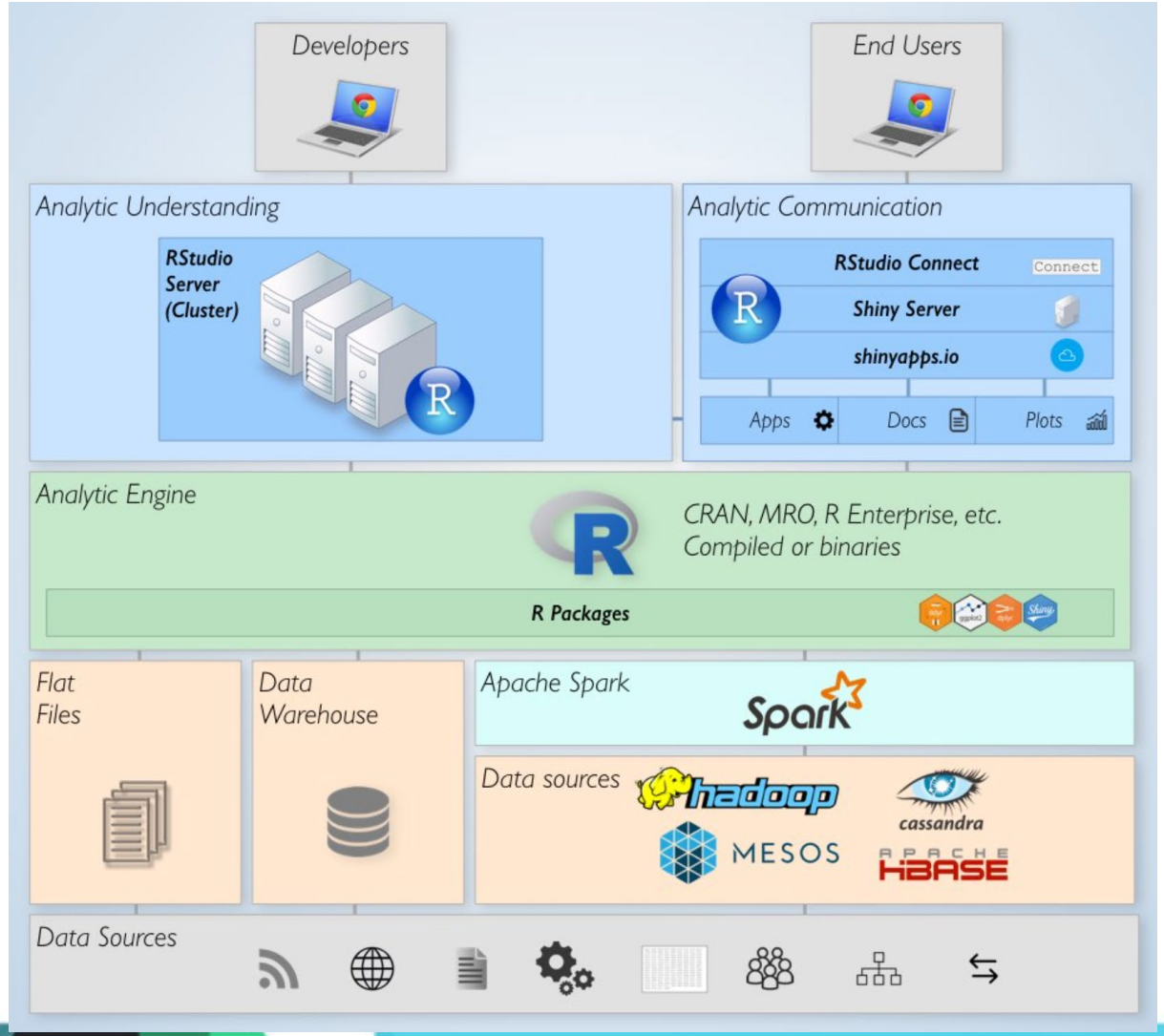
Spark & R Integration



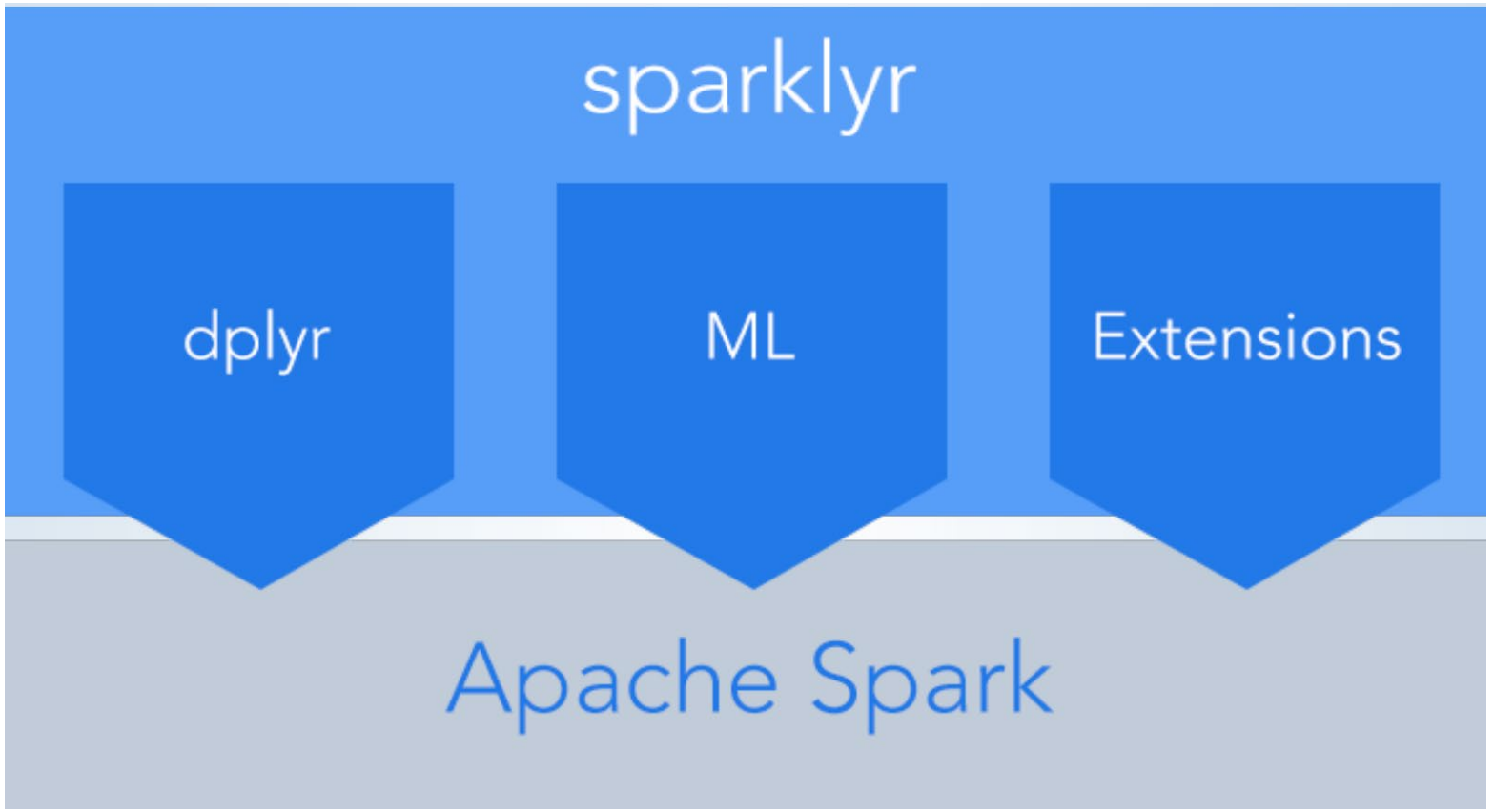
Spark & R Integration Architectural Overview



Two APIs: SparkR vs sparklyr

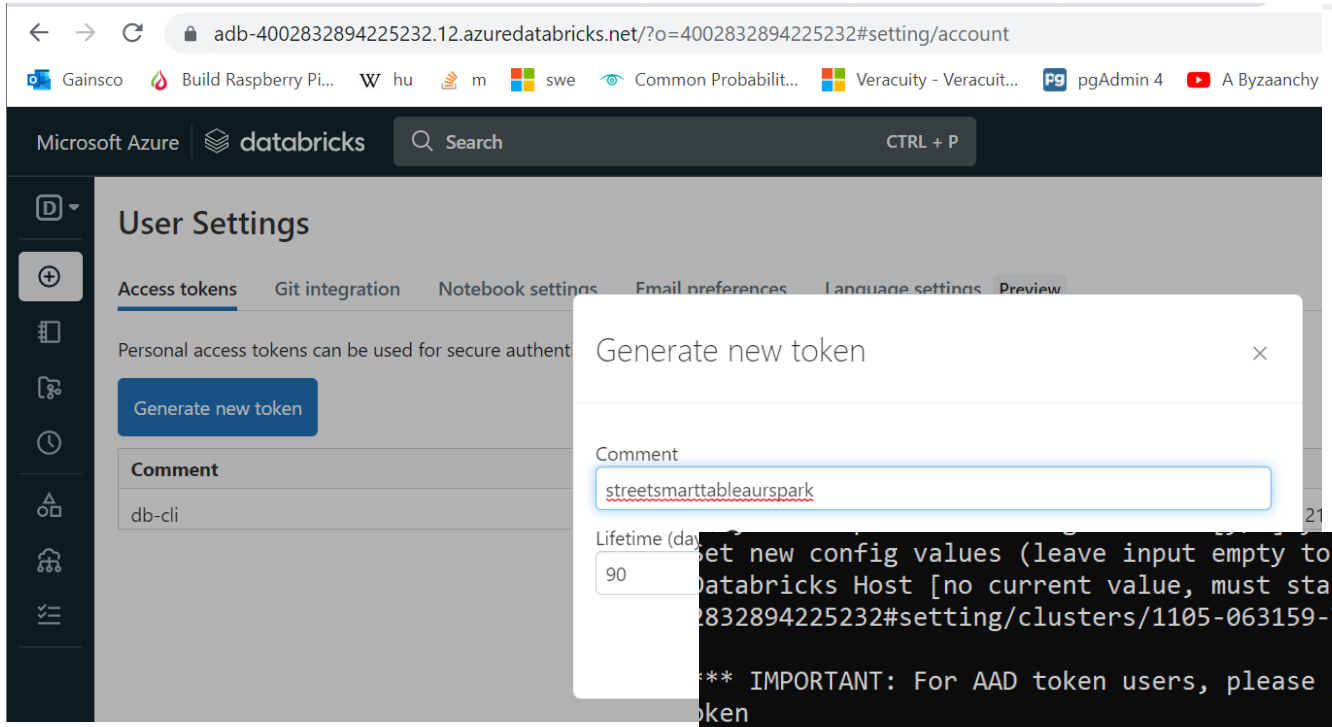
SparkR	sparklyr
has *SparkSession* concept	uses *spark_connect*
follows *R* syntax	benefits from *dplyr* syntax
masks some R functions	consistent naming convention
provides different dplyr syntax for functions	same dplyr functions
R to Spark DF: *as.DataFrame*	R to Spark DF: *copy_to*
for UDFs: *dapply*, *gapply*, *spark.apply*	for UDFs: *spark_apply*
ML models: *spark.** functions, i.e *spark.kmeans*	ML models: *ml_** functions, i.e. *ml_linear_regression*
ML transformations: special functions, i.e. *add_months*	ML transformations: *ft_** functions, i.e. *ft_string_indexer*
ML: no model validators nor evaluators	ML: model validators and evaluators
List of available functions	List of available functions

The winner and new champion…



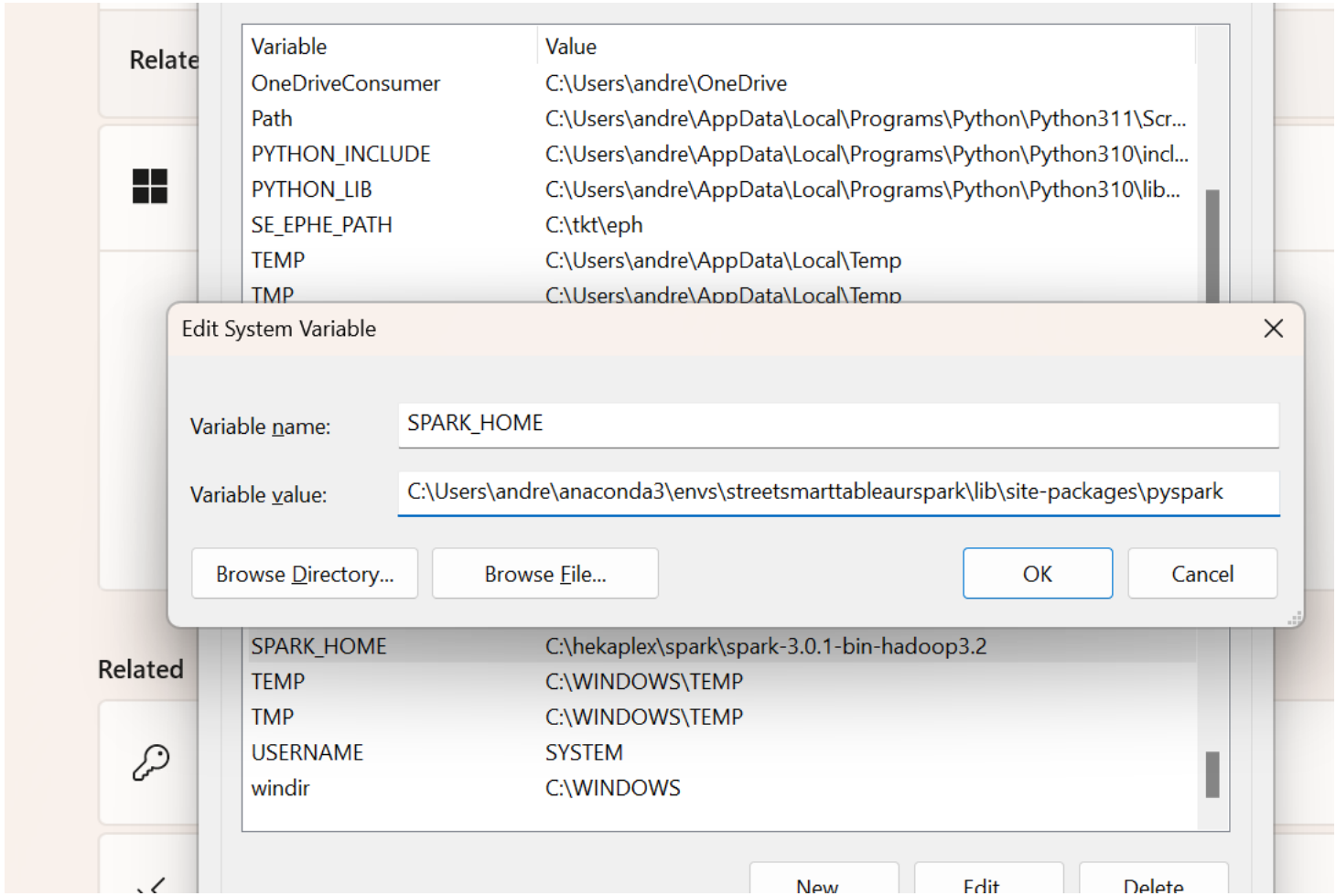
Advanced Analytics – Technical Debt

A Proportional Measure of Estimated Effort in the Entire Machine Learning Lifecycle

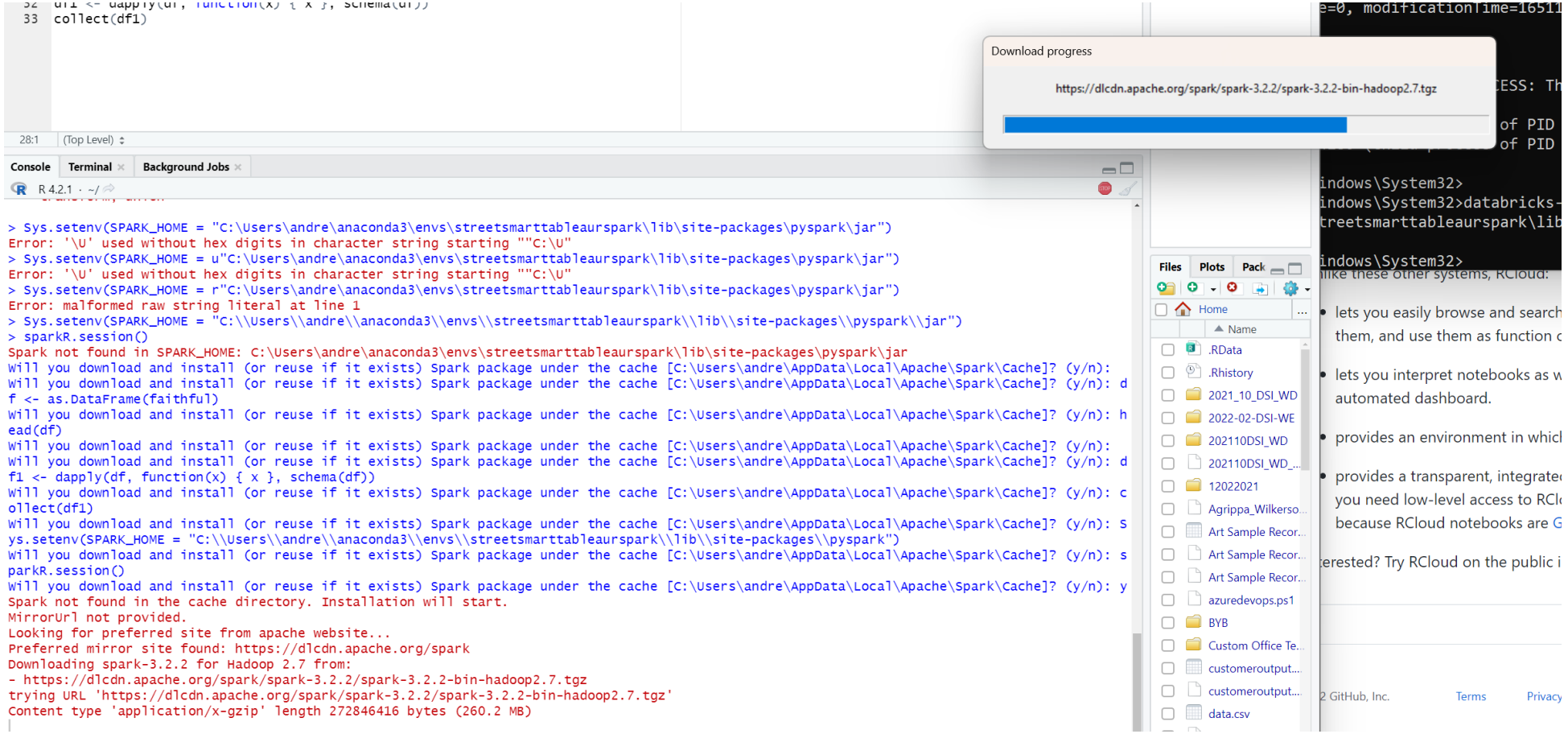



```
et new config values (leave input empty to accept default):
atabricks Host [no current value, must start with https://]: https://adb-4002832894225232.12.azuredatabricks.net/?o=400
832894225232#setting/clusters/1105-063159-7j9yi5hs

** IMPORTANT: For AAD token users, please leave this empty and set AAD token via spark conf, spark.databricks.service.t
ken

atabricks Token [no current value]: dapi764addac1cfb0498c99c860714c4b9e0-3

** IMPORTANT: please ensure that your cluster has:
- Databricks Runtime version of DBR 5.1+
- Python version same as your local Python (i.e., 2.7 or 3.5)
- the Spark conf `spark.databricks.service.server.enabled true` set

luster ID (e.g., 0921-001415-jelly628) [no current value]: 1105-063159-7j9yi5hs
rg ID (Azure-only, see ?o=orgId in URL) [0]: 4002832894225232
ort [15001]: 15001
```

...The Devil is in the Setup Details



…The Devil is in the Setup Details



…The Devil is in the Setup Details

```
(streetsmarttableaurspark) C:\Windows\System32>databricks-connect test
* PySpark is installed at C:\Users\andre\anaconda3\envs\streetsmarttableaurspark\lib\site-packages\pyspark
* Checking SPARK_HOME
* Checking java version
openjdk version "17.0.3" 2022-04-19 LTS
OpenJDK Runtime Environment Zulu17.34+19-CA (build 17.0.3+7-LTS)
OpenJDK 64-Bit Server VM Zulu17.34+19-CA (build 17.0.3+7-LTS, mixed mode, sharing)
WARNING: Java versions >8 are not supported by this SDK
* Skipping scala command test on Windows
* Testing python command
22/11/05 02:01:33 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java cl
asses where applicable
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
22/11/05 02:01:33 WARN MetricsSystem: Using default name SparkStatusTracker for source because neither spark.metrics.nam
espace nor spark.app.id is set.
View job details at https://adb-4002832894225232.12.azuredatabricks.net/?o=4002832894225232&o=4002832894225232#/setting/
clusters/1105-063159-7j9yi5hs/sparkUi
* Simple PySpark test passed
* Testing dbutils.fs
[FileInfo(path='dbfs:/FileStore/', name='FileStore/', size=0, modificationTime=1654628862000), FileInfo(path='dbfs:/data
bricks-datasets/', name='databricks-datasets/', size=0, modificationTime=0), FileInfo(path='dbfs:/databricks-results/',
name='databricks-results/', size=0, modificationTime=0), FileInfo(path='dbfs:/delta/', name='delta/', size=0, modificati
onTime=1653678776000), FileInfo(path='dbfs:/local_disk0/', name='local_disk0/', size=0, modificationTime=1665054121000),
 FileInfo(path='dbfs:/mnt/', name='mnt/', size=0, modificationTime=1651155365000), FileInfo(path='dbfs:/outputs/', name=
'outputs/', size=0, modificationTime=1654628727000), FileInfo(path='dbfs:/scripts/', name='scripts/', size=0, modificati
onTime=1654629190000), FileInfo(path='dbfs:/tmp/', name='tmp/', size=0, modificationTime=1664423920000), FileInfo(path='
dbfs:/user/', name='user/', size=0, modificationTime=1651155363000)]
* Simple dbutils test passed
* All tests passed.
```

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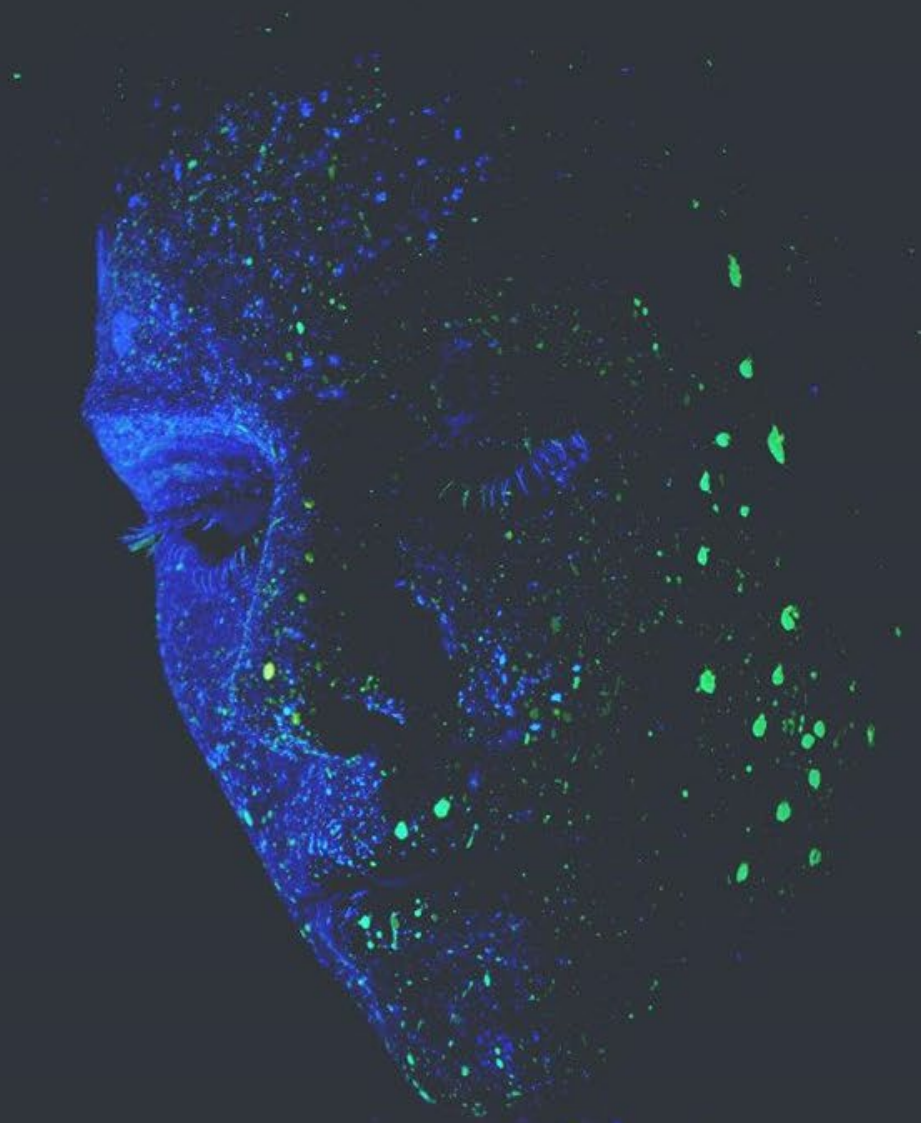
Demo:
Local R & Remote R Integration



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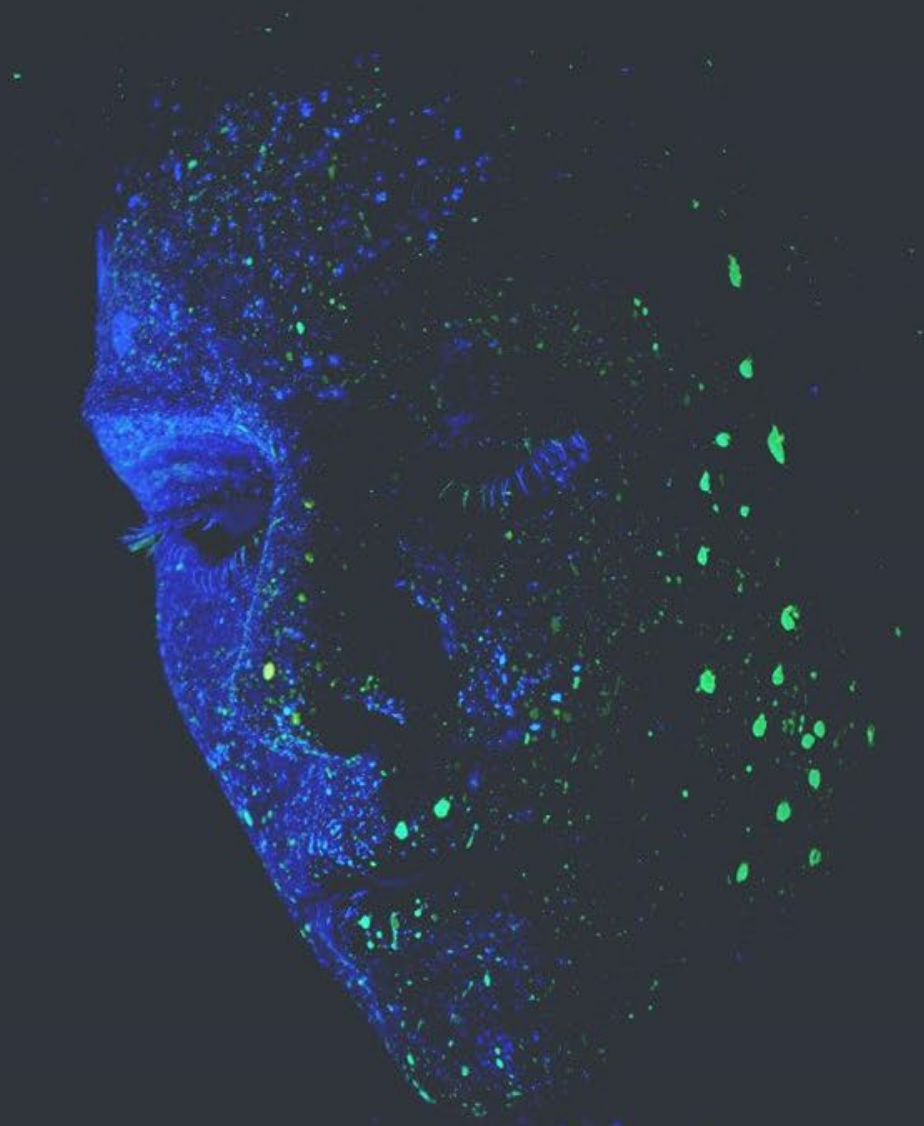
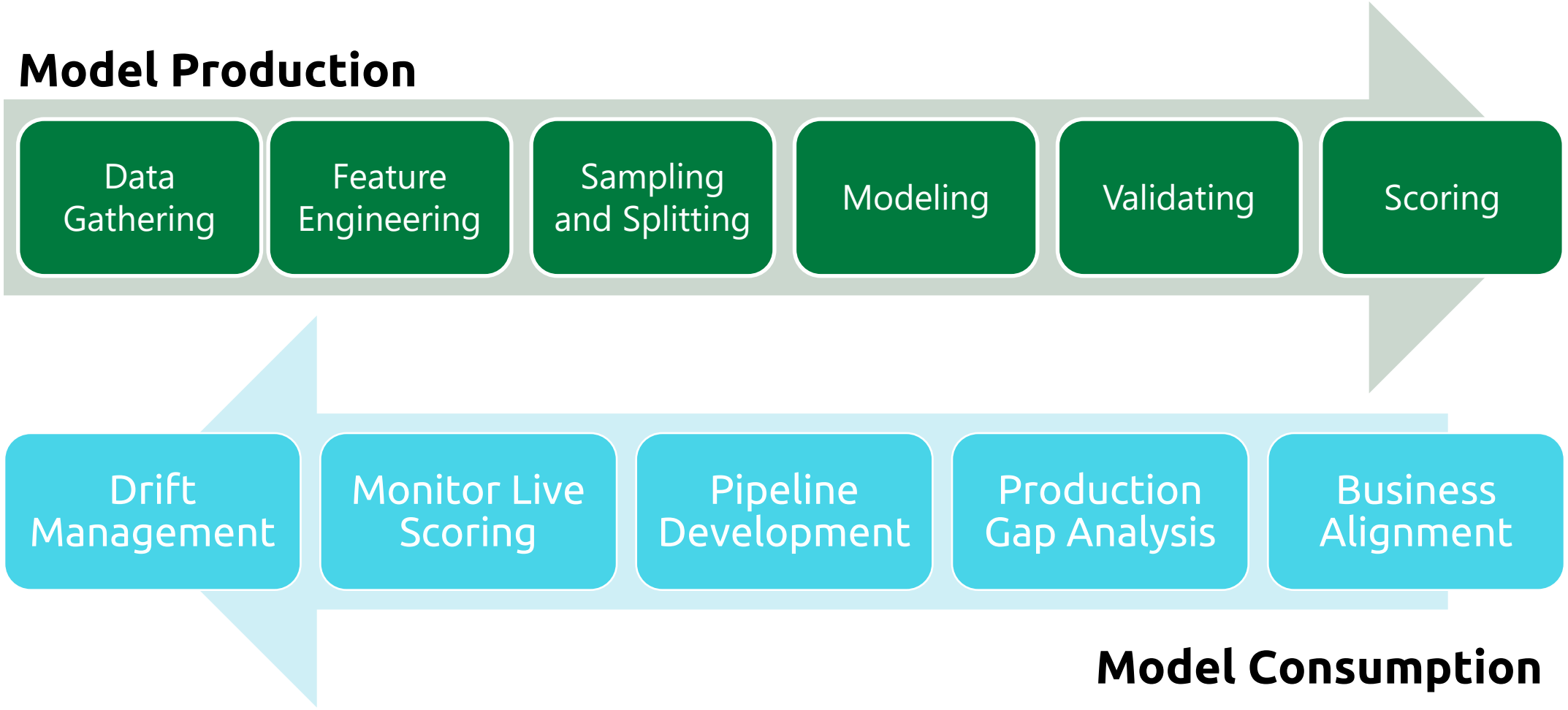
Street Smart Machine Learning

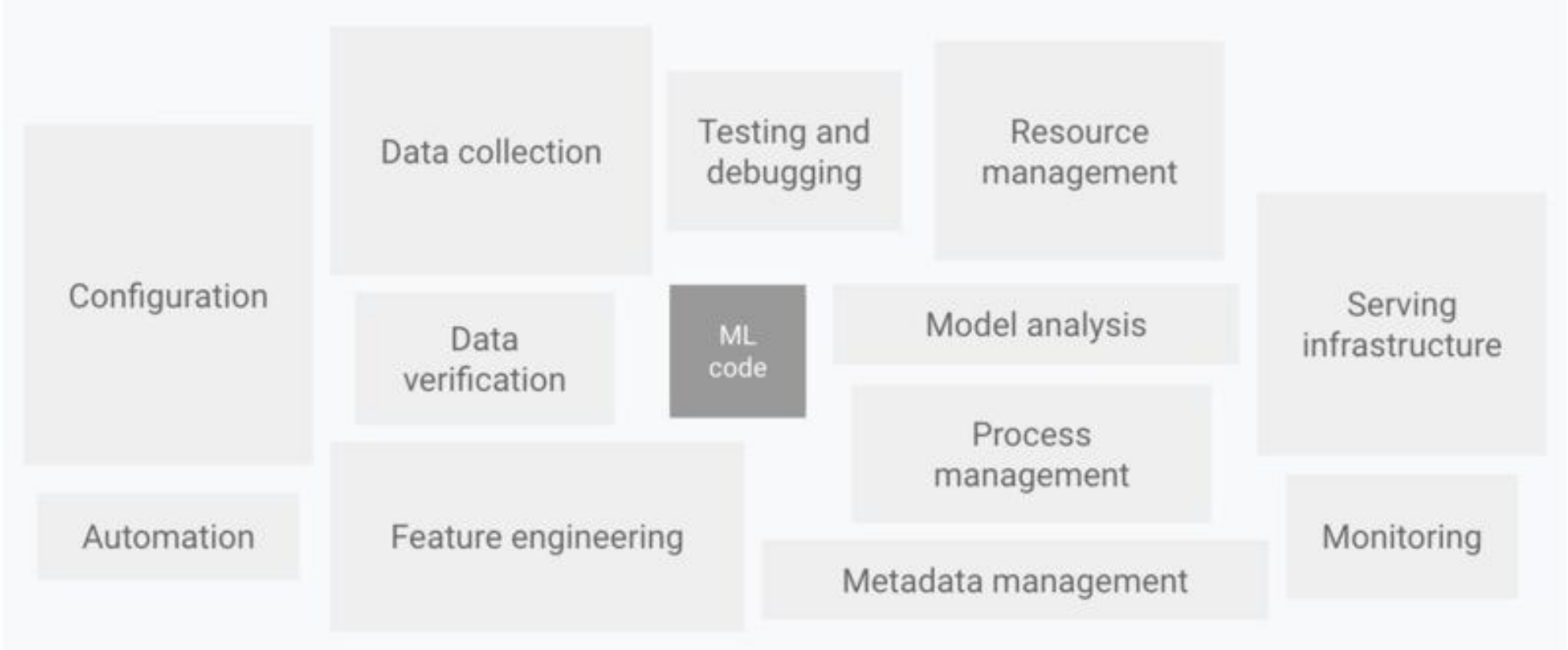


Machine Learning Process



Advanced Analytics – Technical Debt

A Proportional Measure of Estimated Effort in the Entire Machine Learning Lifecycle



Machine Learning Modeling Families

Estimation

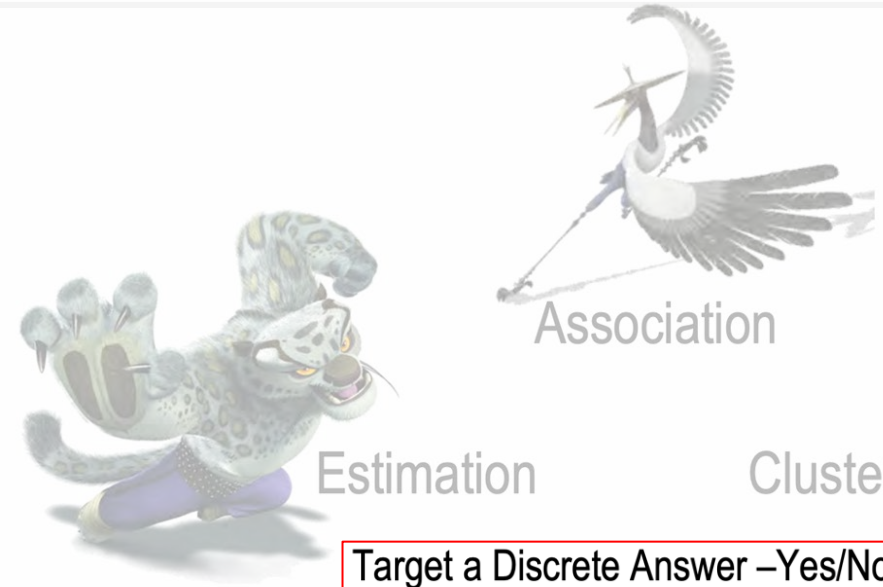
Association

Clustering

Classification

Forecasting

Machine Learning Modeling Families



Association

Estimation

Clustering

Target a Discrete Answer –Yes/No

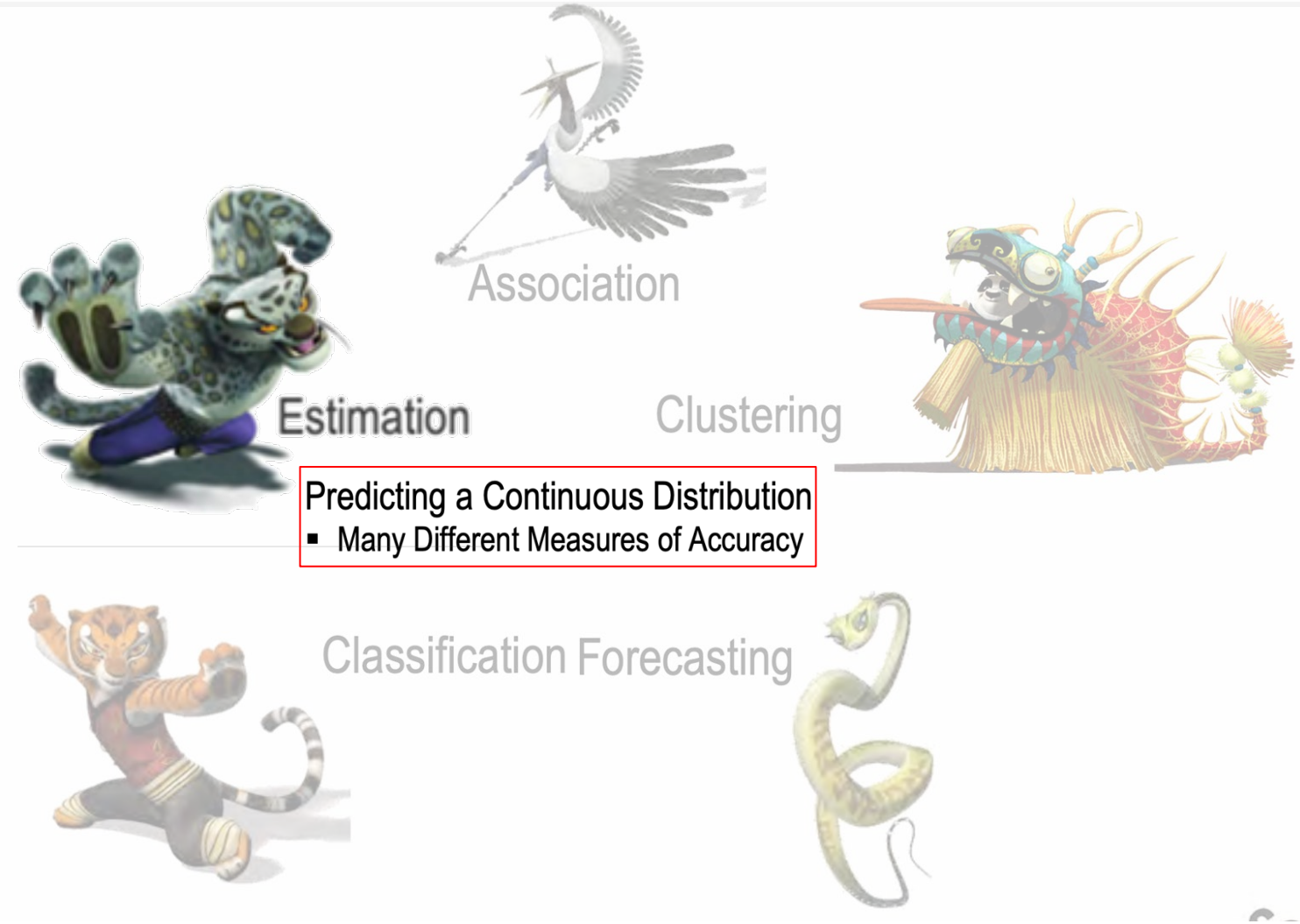
- Find All Columns Driving its Value
- Use model to score new records

Classification Forecasting

Machine Learning Modeling Families

- Hard and Soft Groupings
- Profiles of Subgroups
- Likenesses and Differences

Machine Learning Modeling Families

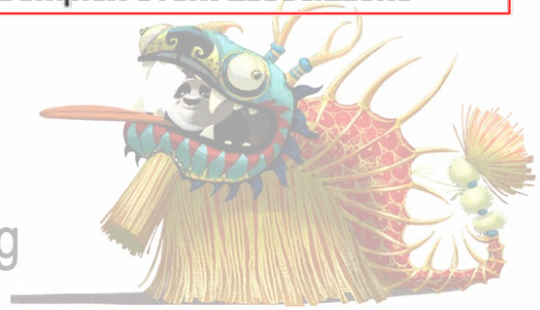


Machine Learning Modeling Families

Estimation

Association

- Collaborative Filtering
- Identify cross-sell
- Identify sequential, next-sale
- Make purchase recommendations
- Complex event associations

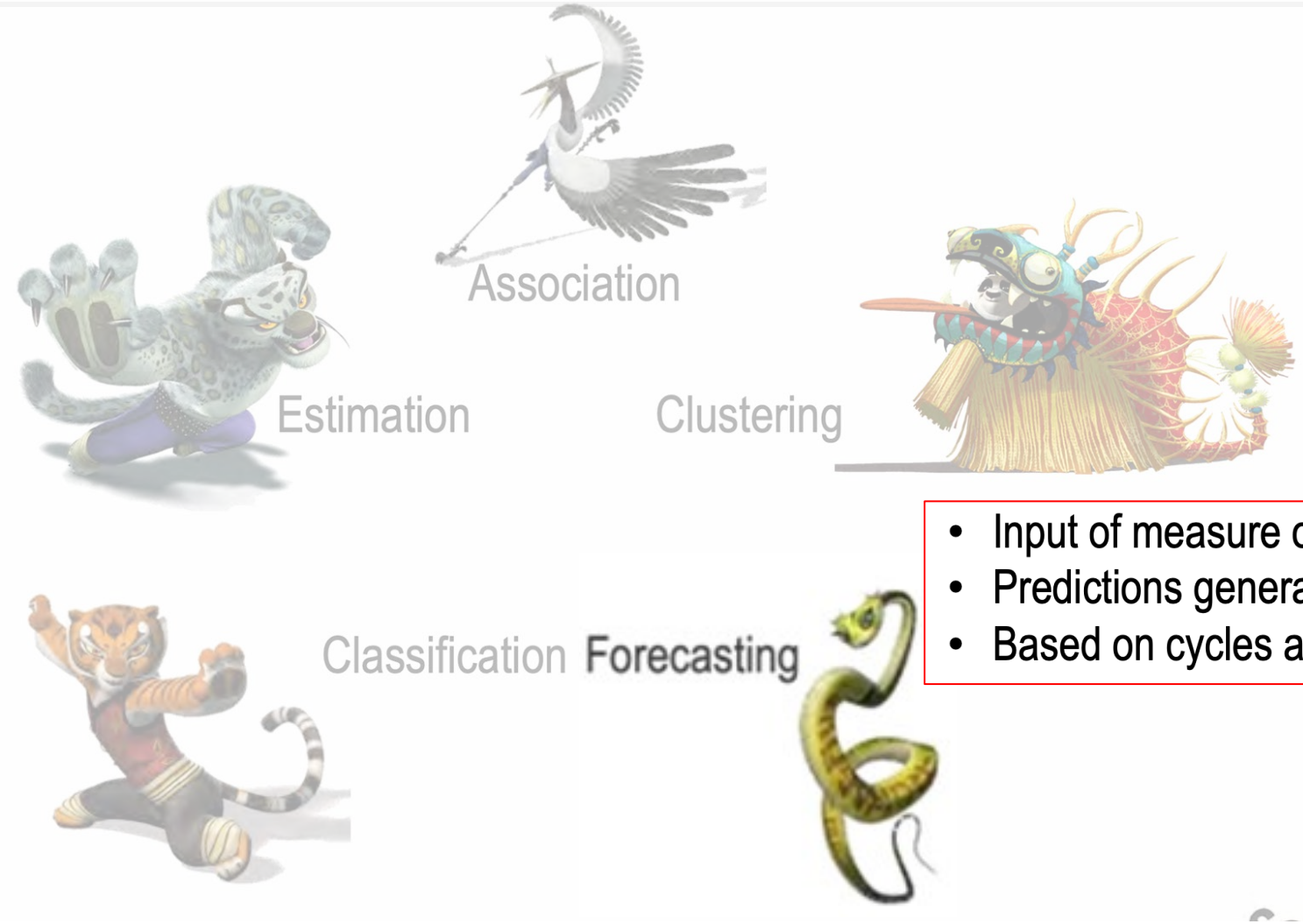


Clustering

Classification

Forecasting

Machine Learning Modeling Families



- Input of measure over time and related series
- Predictions generated for short term trends
- Based on cycles and events

Machine Learning Algorithm Complexity & Context

darch
deepnet
deepr
FCNN4R
h2o

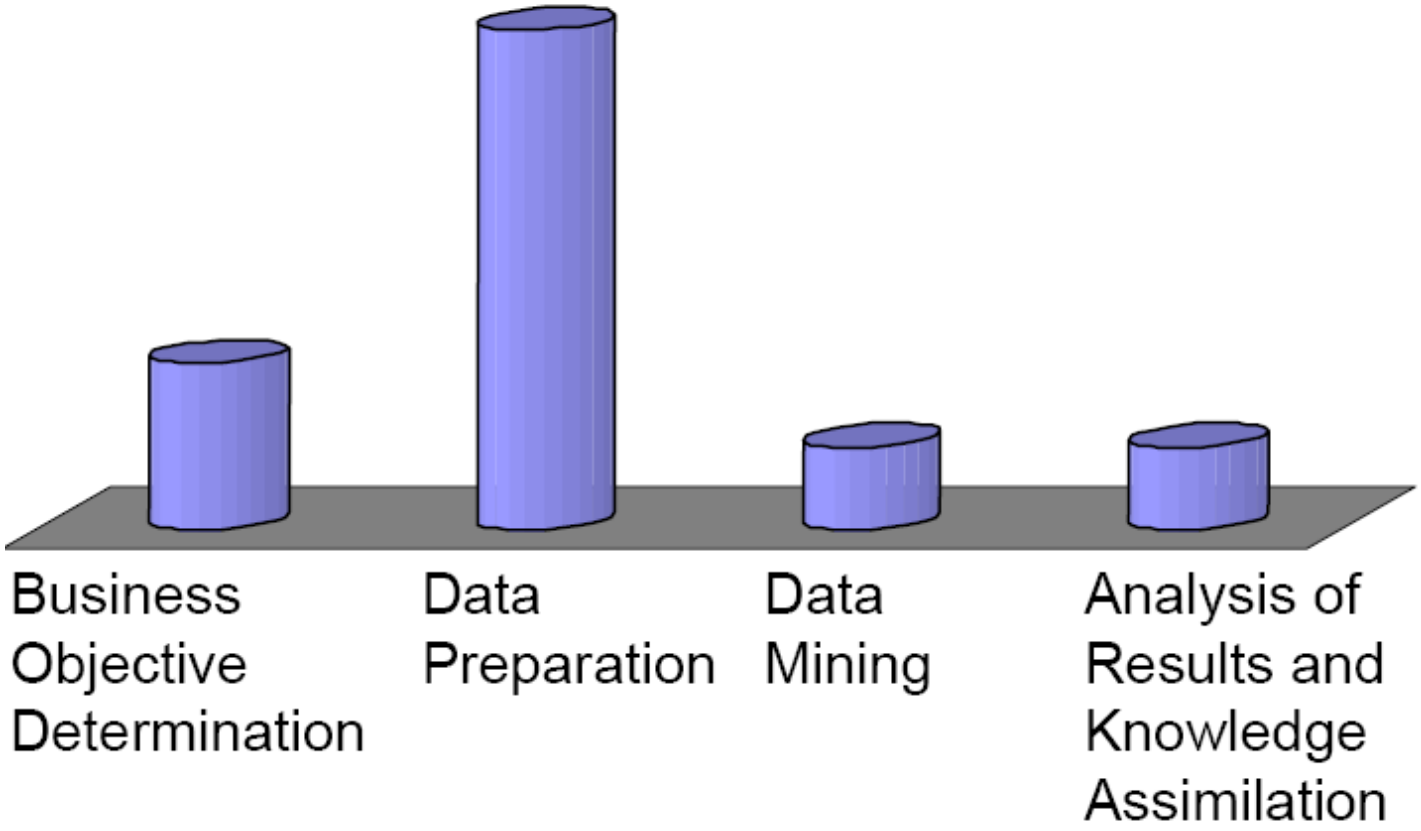
caret
e1071
rpart
xgboost
randomForest

forecast
lgm

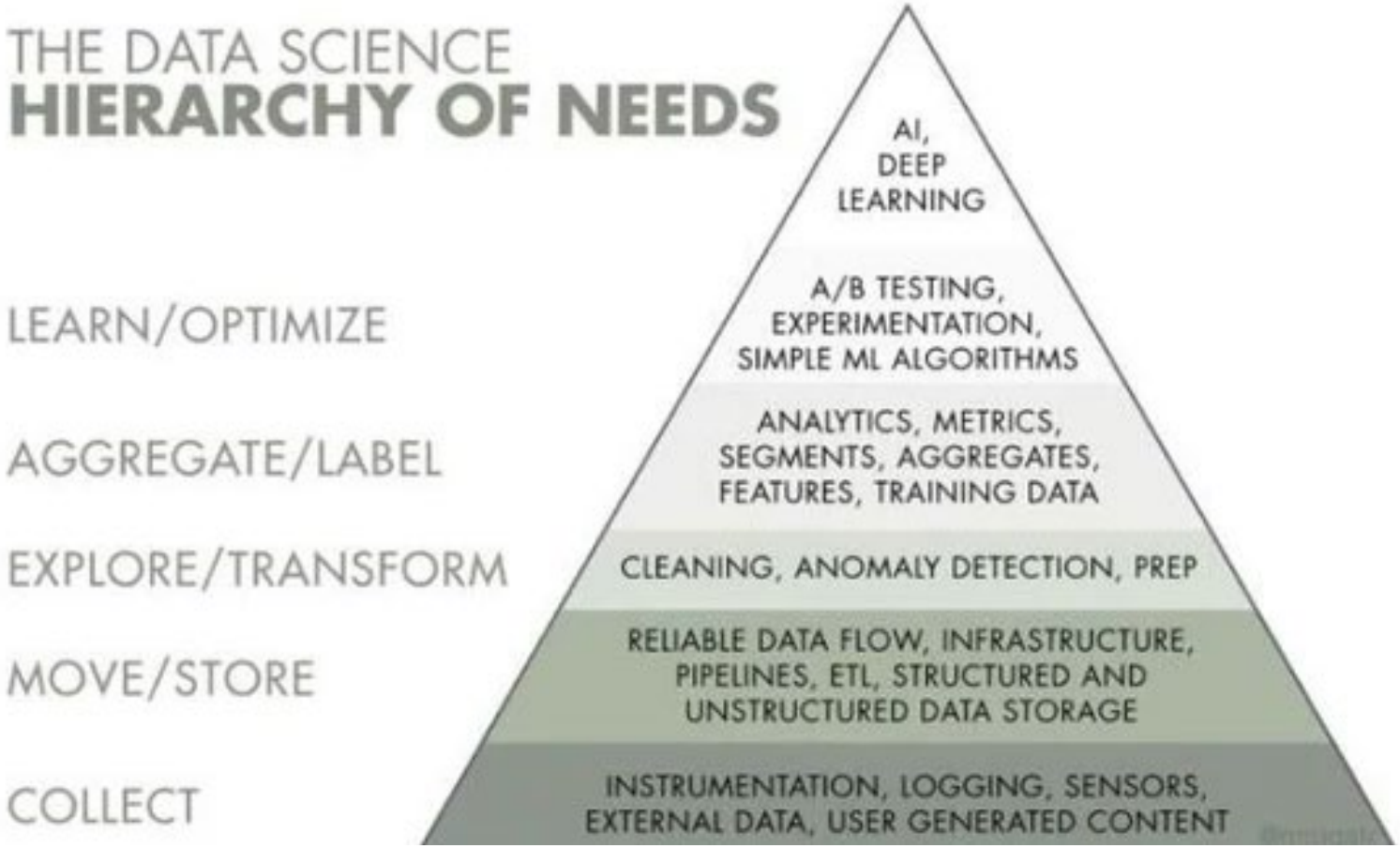
neuralnet
nnet
RSNNS

- LR, NN and other algorithms part of **hierarchical layers** of DL model
- **Transfer Learning** Learning models on same type of data

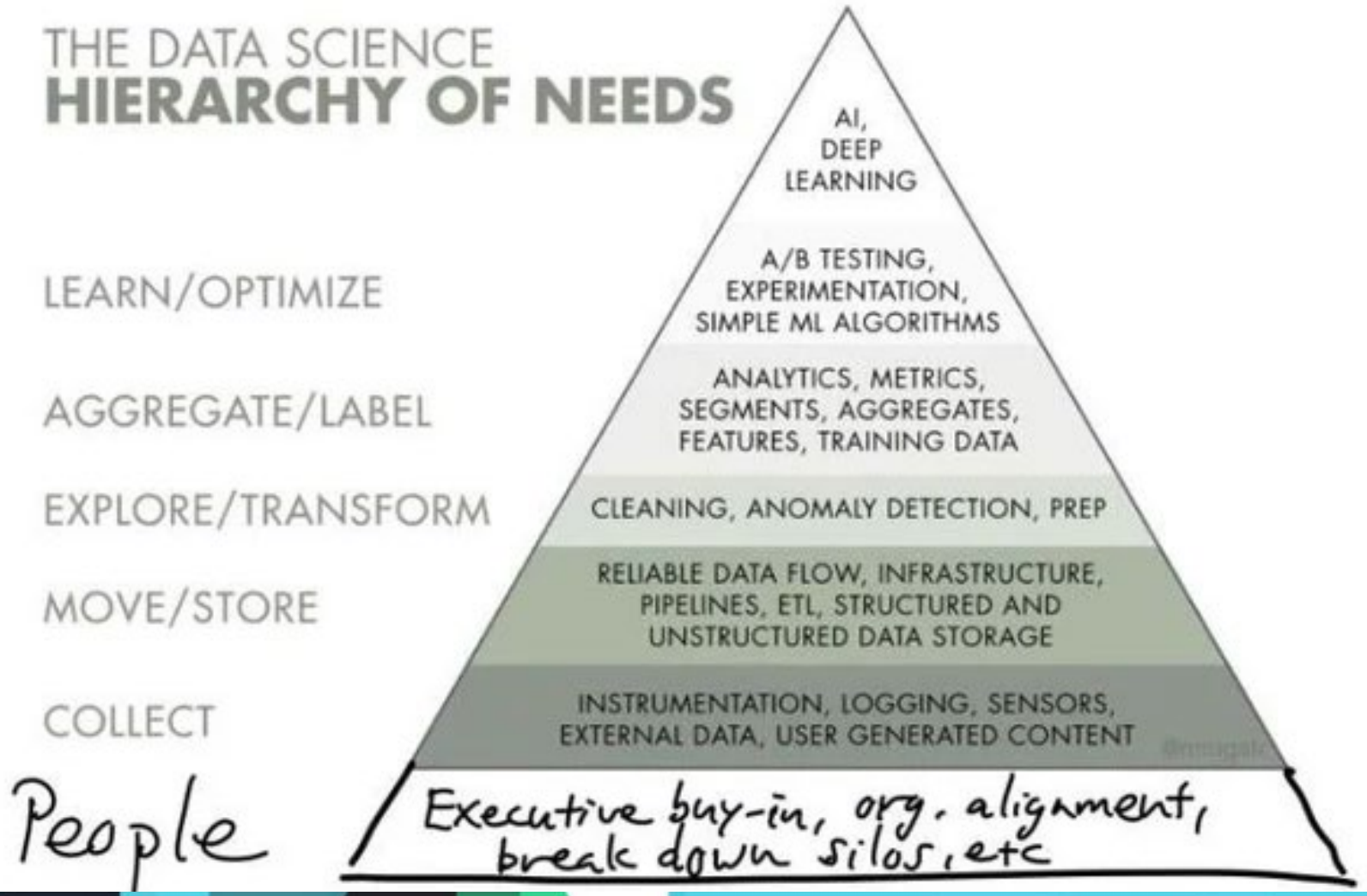
Advanced Analytics Task Breakout



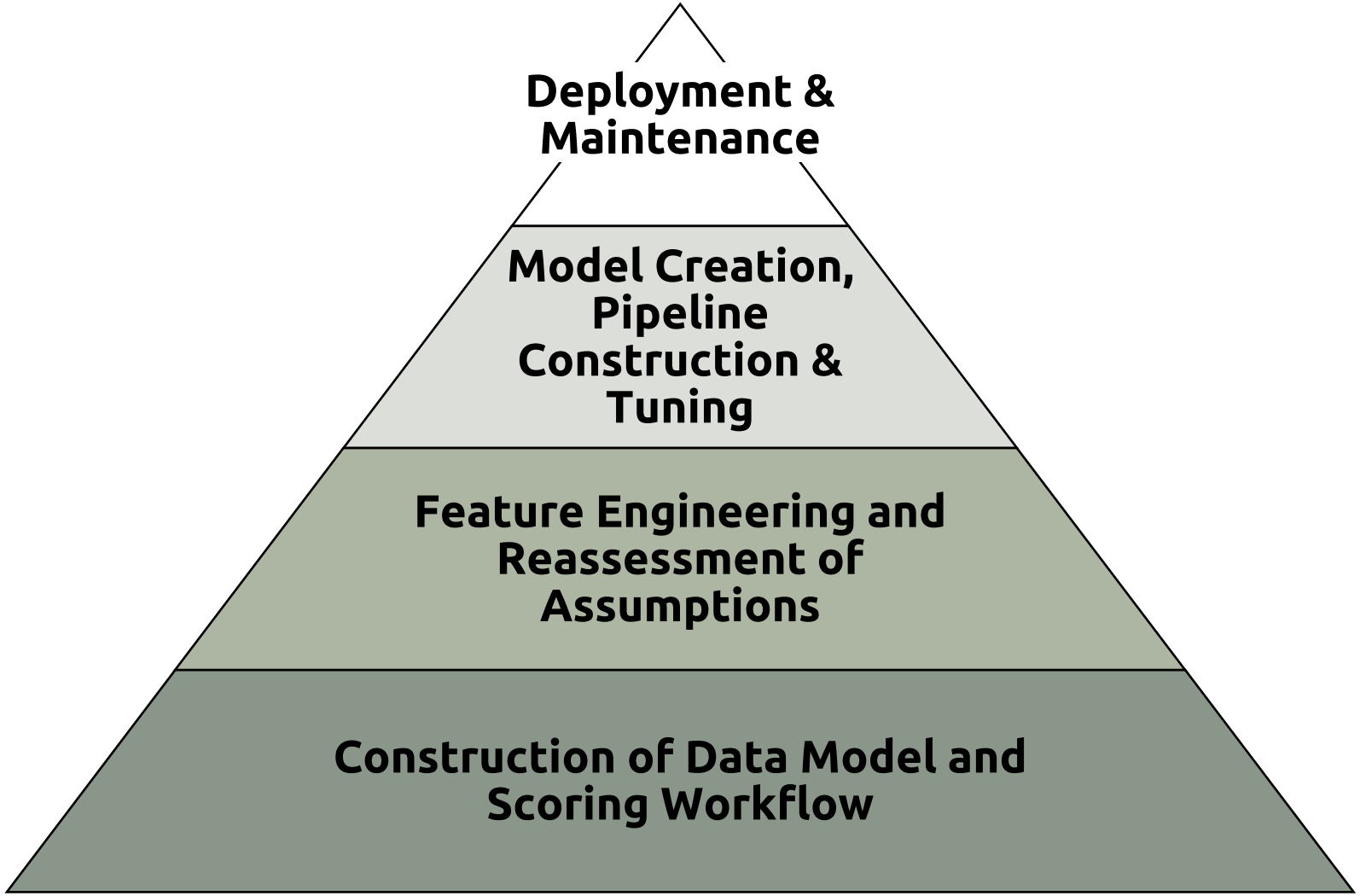
Experimental Design – On Paper



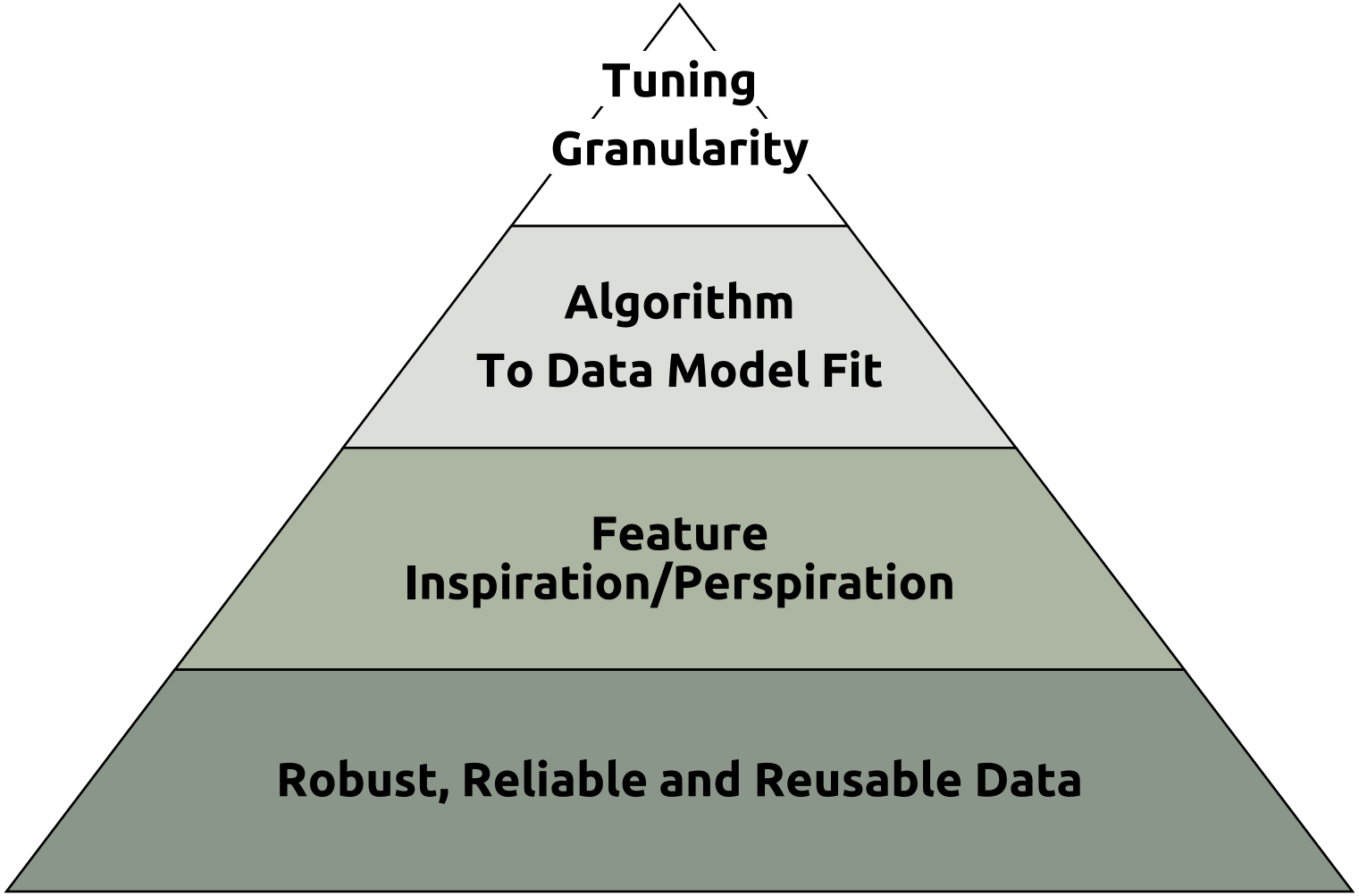
Experimental Design – In Real Life



Experimental Design – Effort By % of Labor



Experimental Design – Effort ROI



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Thank you!!!

Deck & Repo at
https://github.com/hekaplex/StreetSmartTableauRSpark

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