ITSA 2023 - ANOMALY DETECTION VIA ML - POTENTIAL FOR IT SECURITY

Computacenter

Splunk Data Scientist: Moussa El-Zaarah on date: 11th of October 2023

YOUR DATA SCIENCE CONSULTANT TODAY

MY JOURNEY TO COMPUTACENTER

- **Studies: Theoretical Physics:**
  Statistical Physics & Nonlinear Dynamics
  (= Stochastic Processes & Chaos theory)

- WS 2018:
  Big Data & Data Science
  Enthusiast/Evangelist

CoE: Data Science Lead 2021
Newcomer of the year 2020
Future Talent program 2019

Physics 2018

Humboldt-Universität zu Berlin

DESY

PHYSIK.BEGREIFEN
Schülerlabor in Zeuthen

Further Education:
Bioinformatics & Biostatistics

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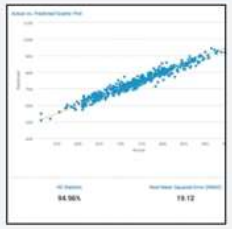
MACHINE LEARNING METHODS IN SPLUNK WITH SHOWCASES

INCLUDES ALSO HYPOTHESIS-TESTING (NOT SHOWN)

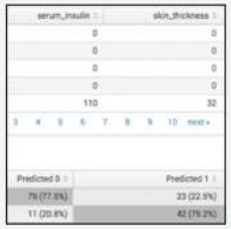


Predict Numeric Fields

Predict the value of a numeric field using a weighted combination of the values of other fields in that event. A common use of these predictions is to identify anomalies: predictions that differ significantly from the actual value may be considered anomalous.

Examples

- Predict Server Power Consumption
- Predict VPN Usage
- Predict Median House Value
- Predict Power Plant Energy Output
- Predict Future Logins
- Predict Future VPN Usage (sinusoidal time)
- Predict Future VPN Usage (categorical time)



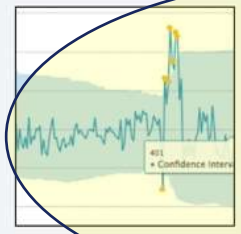
Answer binary Questions or Multiple Choice

Predict Categorical Fields

Predict the value of a categorical field using the values of other fields in that event. A common use of these predictions is to identify anomalies: predictions that differ significantly from the actual value may be considered anomalous.

Examples

- Predict Hard Drive Failure
- Predict the Presence of Malware
- Predict Telecom Customer Churn
- Predict the Presence of Diabetes
- Predict Vehicle Make and Model
- Predict External Anomalies



Detect Numeric Outliers

Find values that differ significantly from previous values.

Examples

- Detect Outliers in Server Response Time
- Detect Outliers in Number of Logins (vs Predicted Value)
- Detect Outliers in Supermarket Purchases
- Detect Outliers in Power Plant Humidity
- Detect Cyclical Outliers in Call Center Data
- Detect Cyclical Outliers in Logins

Probability Aspects

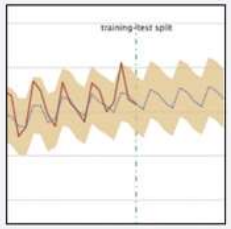
Detect Categorical Outliers

Find events that contain unusual combinations of values.

Examples

- Detect Outliers in Disk Failures
- Detect Outliers in Bitcoin Transactions
- Detect Outliers in Supermarket Purchases
- Detect Outliers in Mortgage Contracts
- Detect Outliers in Diabetes Patient Records
- Detect Outliers in Mobile Phone Activity

Probability Aspects

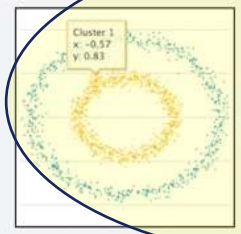


Forecast Time Series

Forecast future values given past values of a metric (numeric time series).

Examples

- Forecast Internet Traffic
- Forecast the Number of Employee Logins
- Forecast Monthly Sales
- Forecast the Number of Bluetooth Devices
- Forecast Exchange Rate TWI using ARIMA



Cluster Numeric Events

Partition events with multiple numeric fields into clusters.

Examples

- Cluster Hard Drives by SMART Metrics
- Cluster Behavior by App Usage
- Cluster Neighborhoods by Properties
- Cluster Vehicles by Onboard Metrics
- Cluster Power Plant Operating Regimes
- Cluster Business Anomalies to Reduce Noise

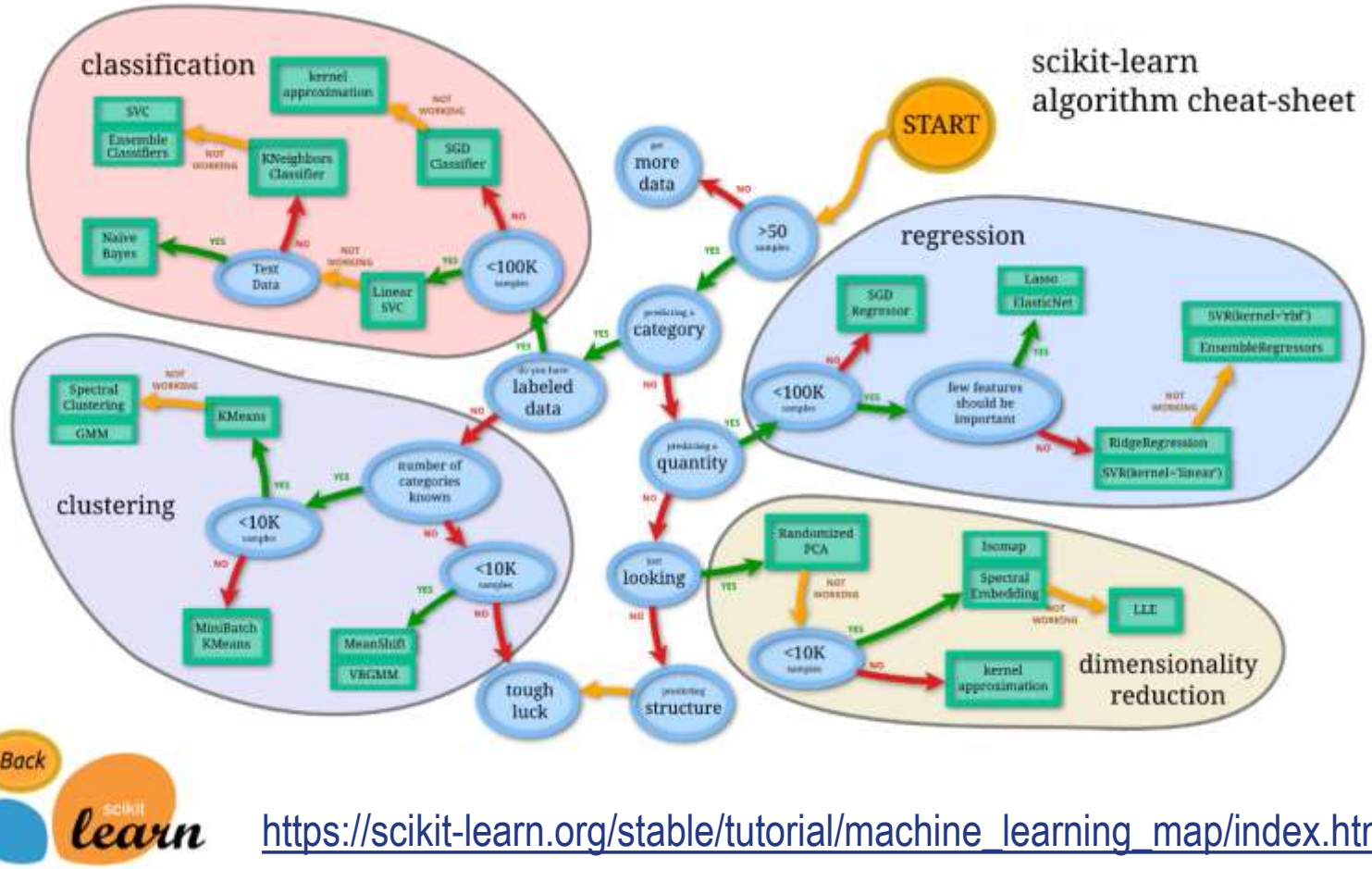
Automatically Group Data

MACHINE LEARNING TOOLKIT

splunk> Platform for Operational Intelligence

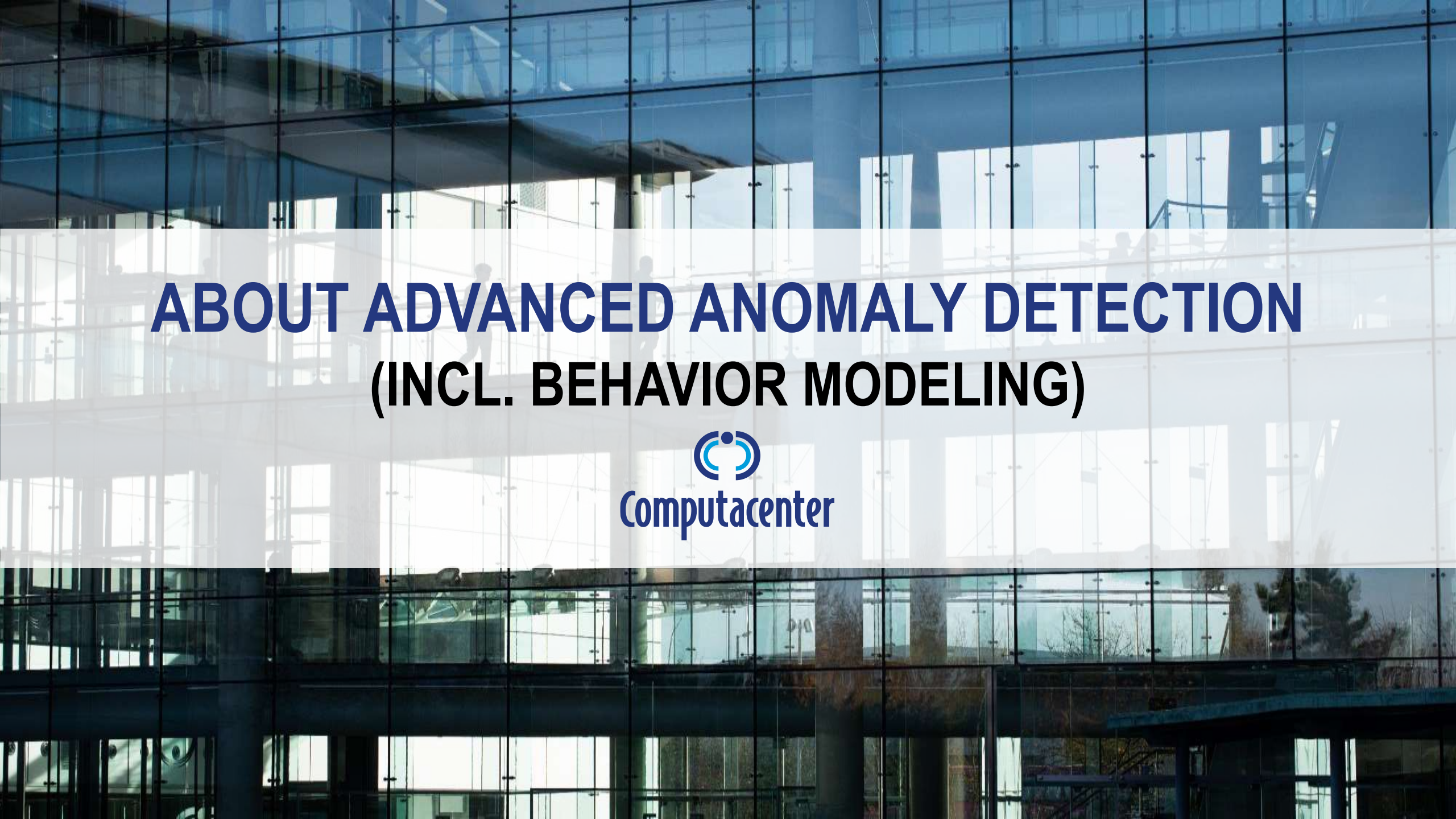
WHAT ALGORITHM TO CHOOSE FROM ML-LIBRARIES?

WE WILL HELP YOU NAVIGATE THROUGH THE DATA SCIENCE JUNGLE



https://scikit-learn.org/stable/tutorial/machine_learning_map/index.html#

Needs (at least) one data scientist to navigate towards customer goal!



ABOUT ADVANCED ANOMALY DETECTION

(INCL. BEHAVIOR MODELING)

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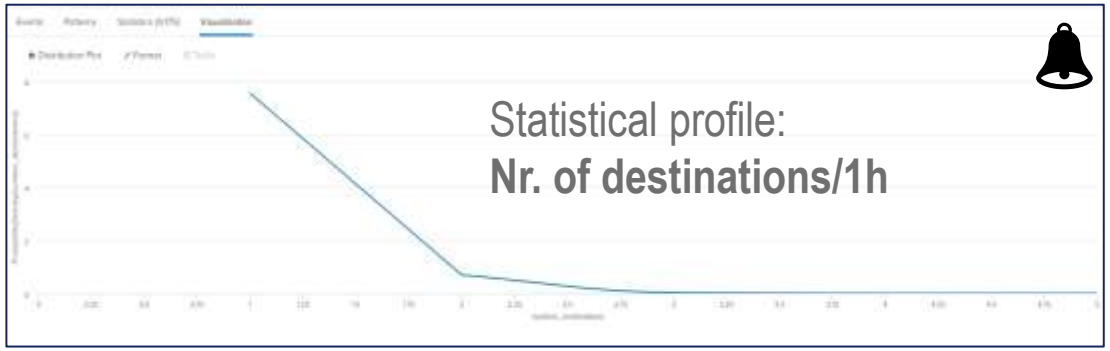
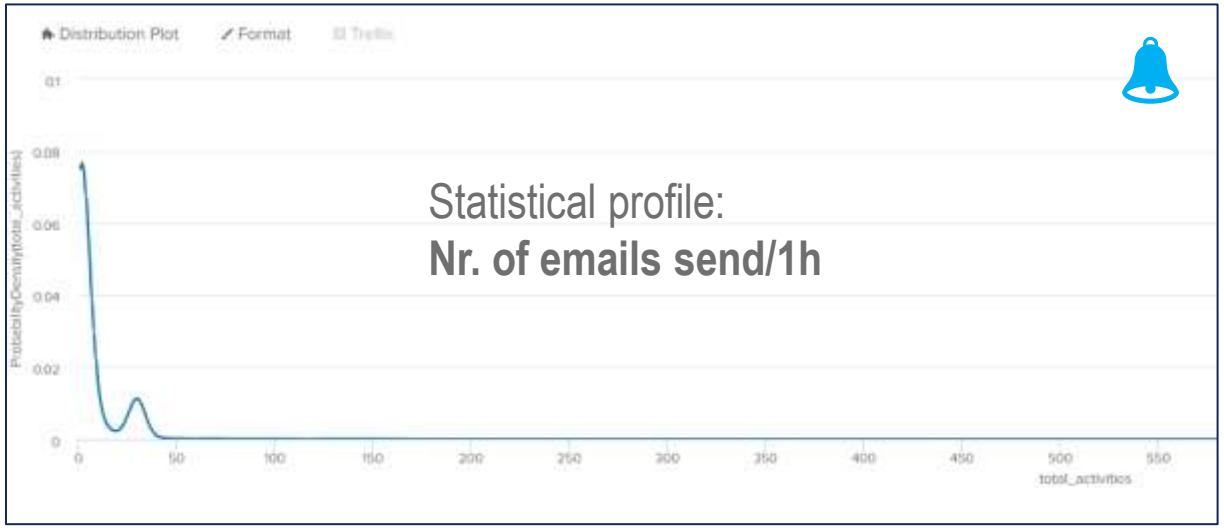
MULTIVARIATE BEHAVIOR BASELINES: EMAIL TRAFFIC BEHAVIOR

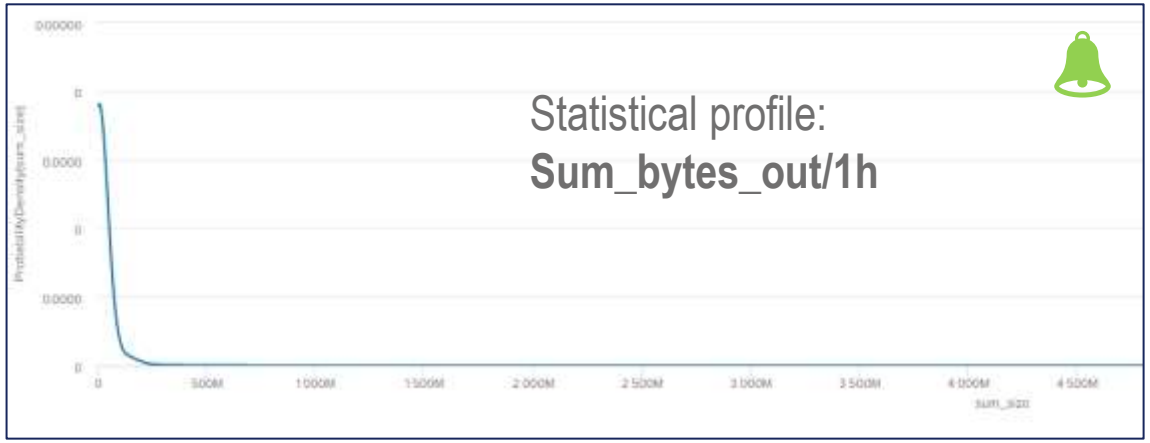
RANDOM DISTRIBUTION → AUTOMATED STATS MODEL VIA GAUSSIAN_KDE



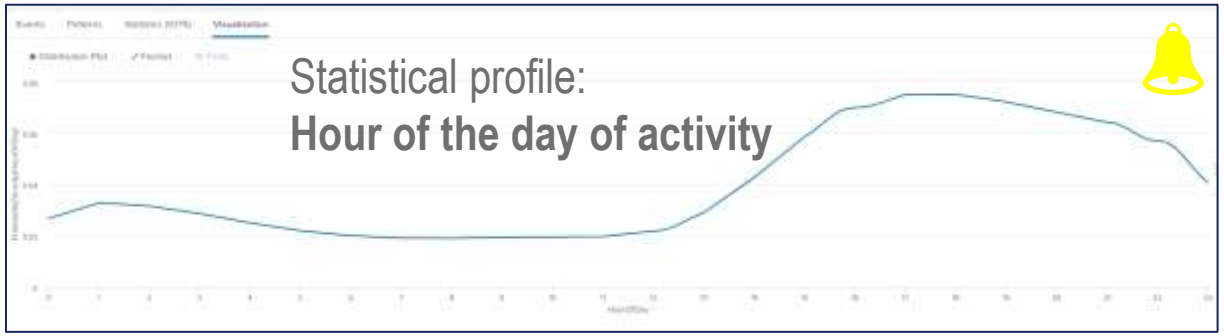
Statistical profile:
Nr. of destinations/1h



Statistical profile:
Nr. of emails send/1h



Statistical profile:
Sum_bytes_out/1h



Statistical profile:
Hour of the day of activity

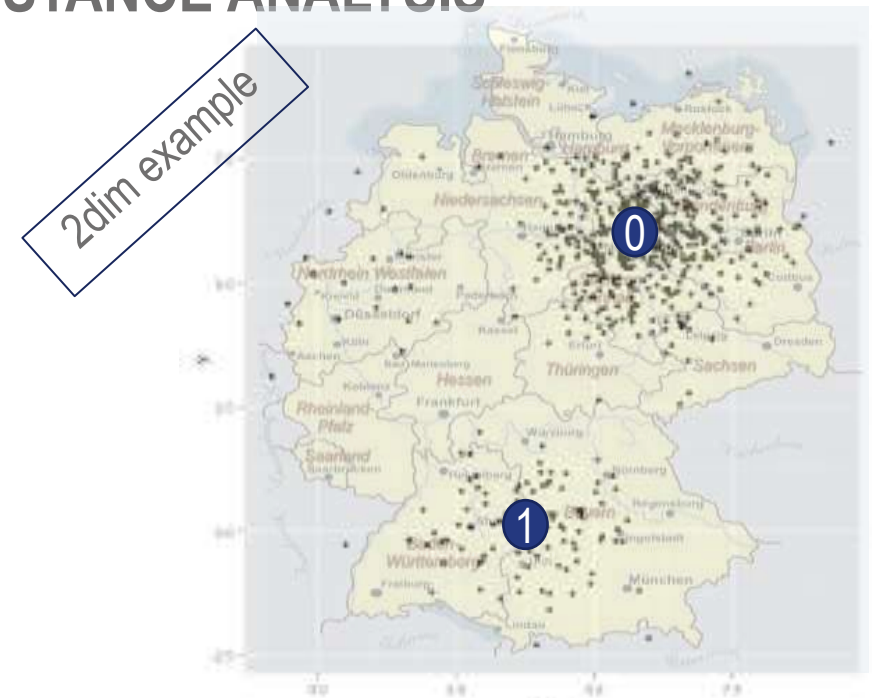
Multivariate alert triggers if statistical anomaly for the combination of aspects exist!

UNSUPERVISED ML: GEOGRAPHICALLY IMPROPABLE ACCESS

REAL SPACE CLUSTER & DISTANCE ANALYSIS

PART I:

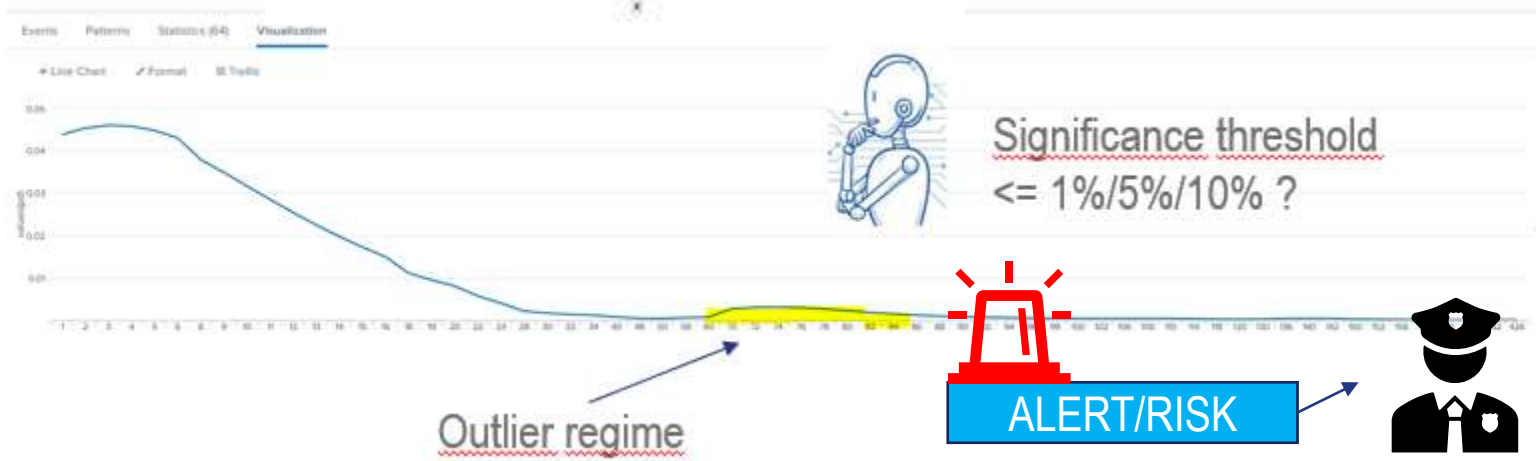
Specify nr. of clusters to find for KMeans -algorithm to find **within N numerical dimens./attributes**



- Use Cluster algorithms to **group your (un)labeled data** „spatially“ and detect centers.
- Each data point maps to a **login attempts ip-location** per identity/asset and gets assigned to a group

PART II:

Extract **cluster_distance statitsics model** and apply für new incoming measurements to find outliers or assign risk!



ANOMALIOUS GROUP MEMBERSHIP OVER TIME DETECTED

XMEANS DETECTS NR. OF CLUSTERS & SPECTRUM-CHANGES AUTOMATICALLY

PART I:

Use unsupervised learning via XMeans -algorithm to idenify hourly cluster membership **within N dimens./attributes**

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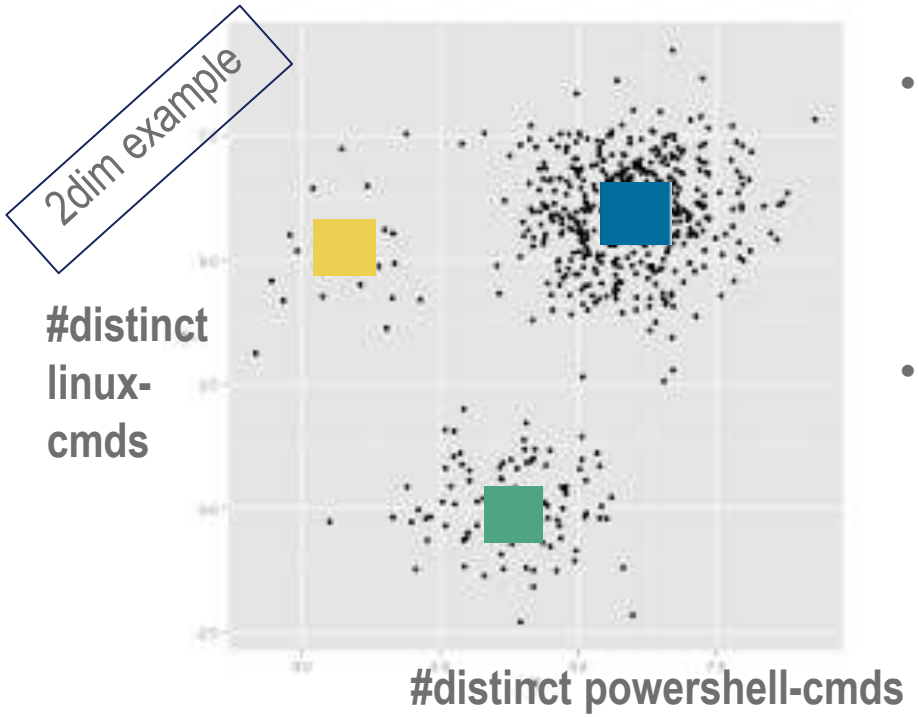
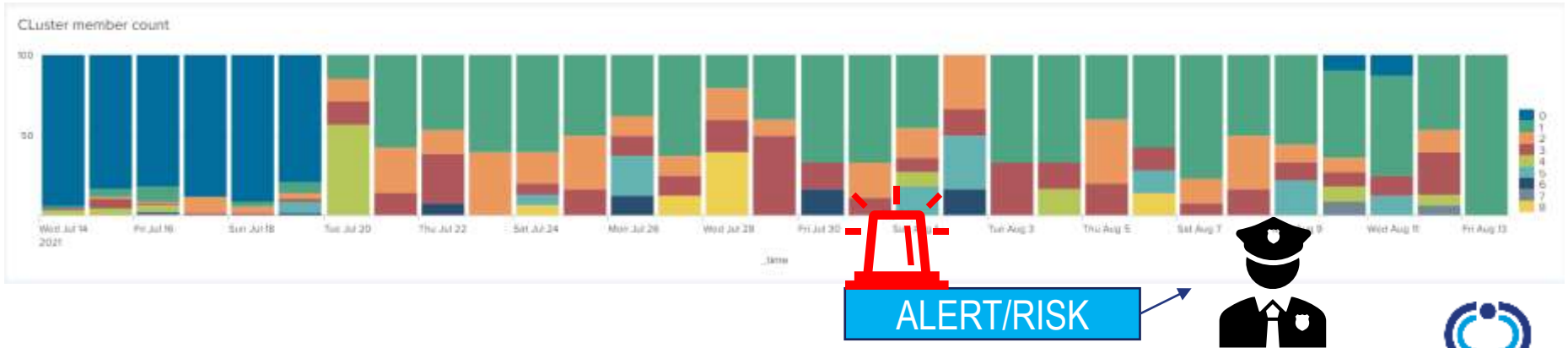


- Each **coordinate axis maps to the a behavior modeling attribute** (feature engineering).
- Each **data point describes an entities hourly behavior** & belongs to an (un)labeled data group (cluster)

PART II:

Monitor guessed cluster membership over the day and detect changes for alerting or assigning risk!



ML WORKBENCH VS OOTB SOLUTION OR BETTER HYBRID?

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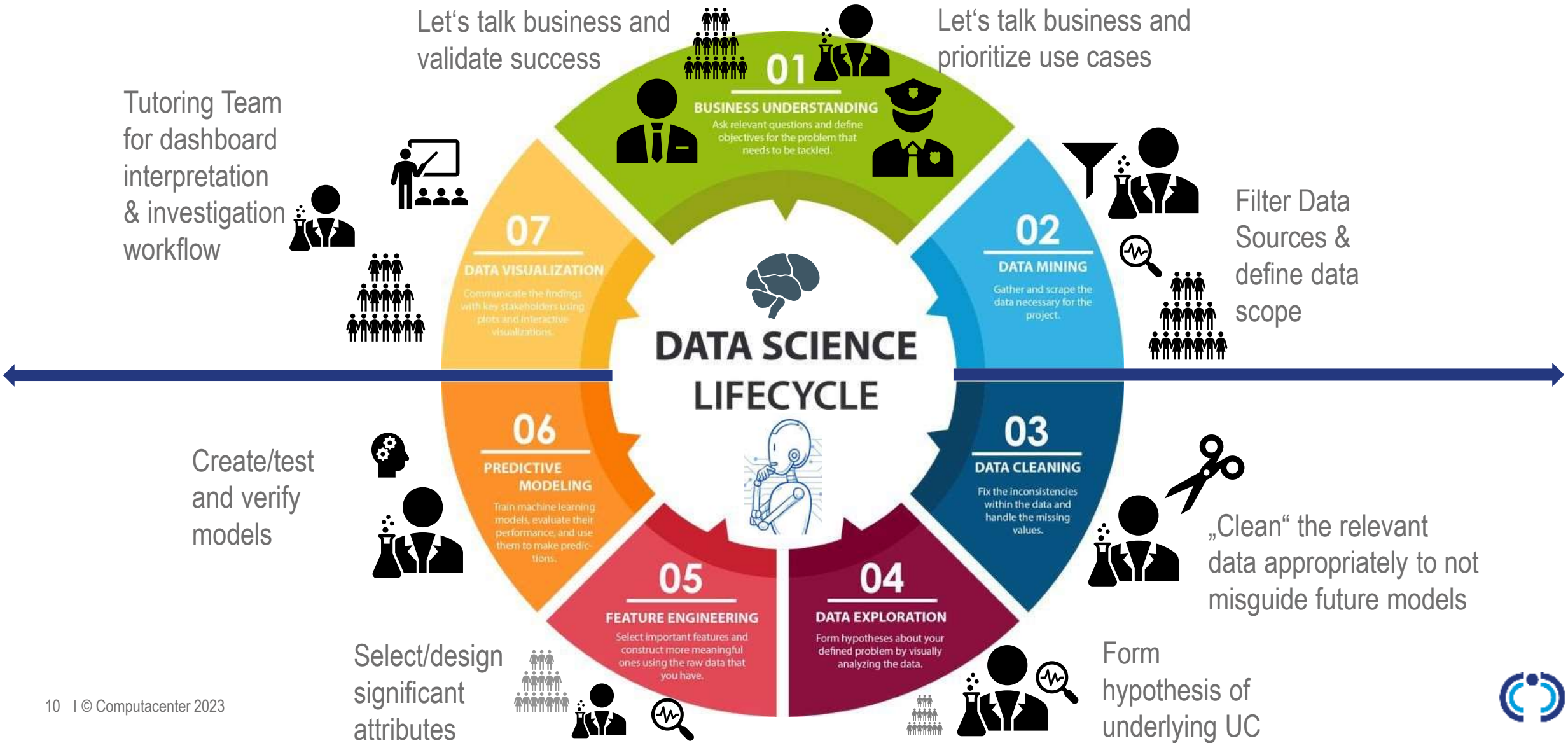
DATA SCIENCE LIFECYCLE PER USE CASE DEVELOPMENT

THIS IS AN ITERATIVE AND AGILE PROCESS TO GAIN A SUPPORTING ML/AI-AGENT



THANK YOU FOR YOUR ATTENTION!

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