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Predictive Objects

Automated Embedded AI Asset Intelligence

Jean-Michel Cambot
Founder & Chief Evangelist

Microsoft
Industry 4.0 Day

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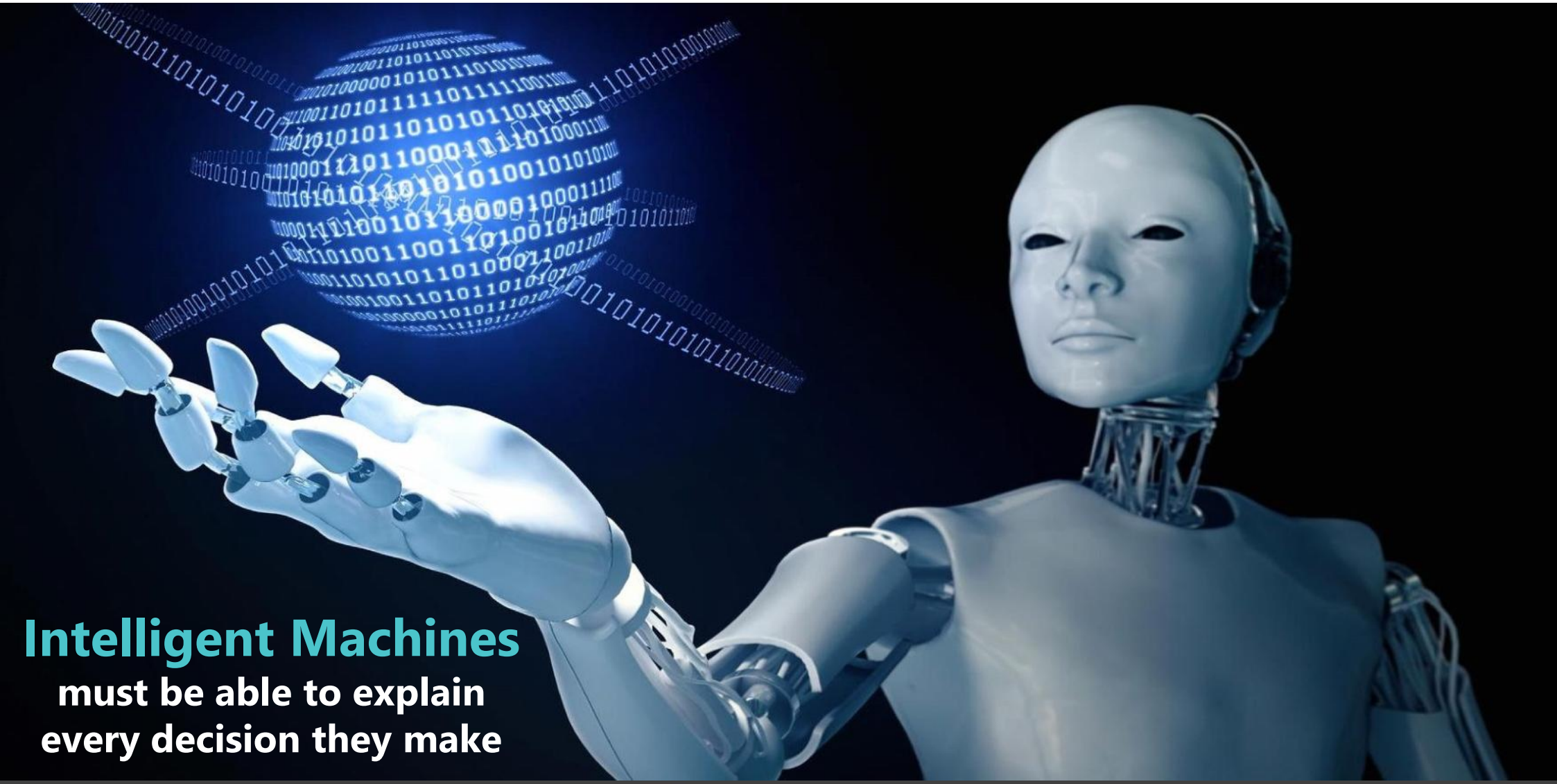

Intelligent Machines

must be able to explain every decision they make

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Predictive Objects

Disruptive SaaS platform to help customers leverage AI
Dramatically improves the efficiency & performance of Assets

Automation

Edge/Fog computing

Asset intelligence

The next level in the evolution of AI

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Industrial IoT Challenges

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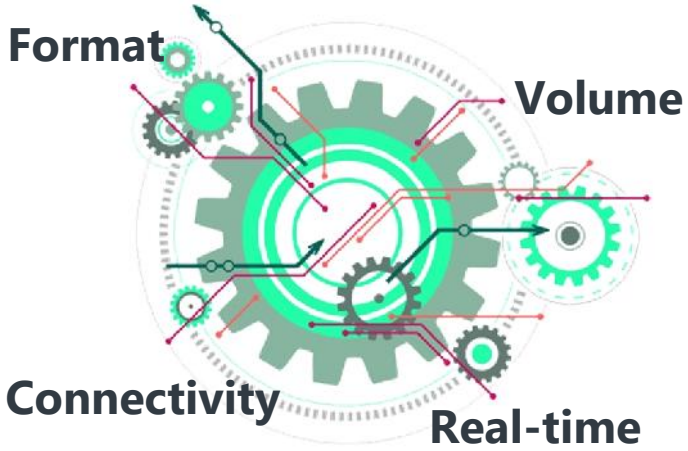
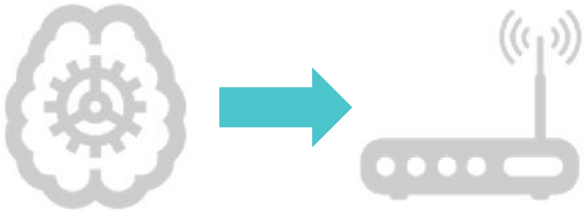
The challenges

INDUSTRIAL DATA

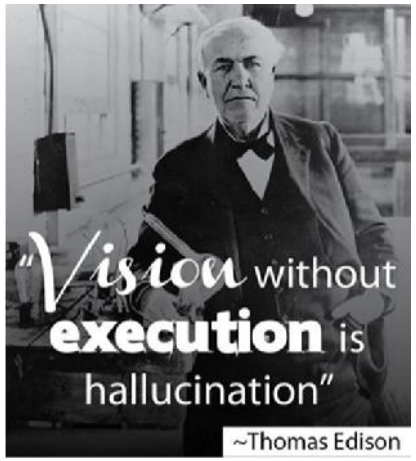


AI EVOLUTION



AI is moving at the edge/ inside the objects

AI AUTOMATION



Building AI predictive models is very empirical

Deployment of AI isn't industrial

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The challenges

INDUSTRIAL DATA

AI EVOLUTION

AI AUTOMATION

Solution

IoT Platform

Features engineering

PATENTED

EMBEDDED AI

PATENTED

Meta Active Machine Learning

Seamless deployment & monitoring

PATENTED

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BUSINESS INTELLIGENCE

DECISION TOOLS

PREDICTIVE INTELLIGENCE

PREDICTIVE & PRESCRIPTIVE MAINTENANCE

ASSET INTELLIGENCE

INTELLIGENCE OF USAGE

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Deployment modes… in 1 click

Private Cloud

Public Cloud

IoT Platform

At the edge of the network

Inside the objects

Tellmeplus Platform

Predictive Objects Models

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What makes Predictive Objects unique ?

AUTOMATING MACHINE LEARNING

FEATURE ENGINEERING

EMBEDDING PREDICTIVE MODEL

EDGE COMPUTING

ASSET VIEW

ACTIONABLE PREDICTION

LIFECYCLE MODEL MANAGEMENT

BUSINESS USERS ORIENTED PLATFORM

SAVE TIME

INCREASE PERFORMANCE

SAVE MONEY

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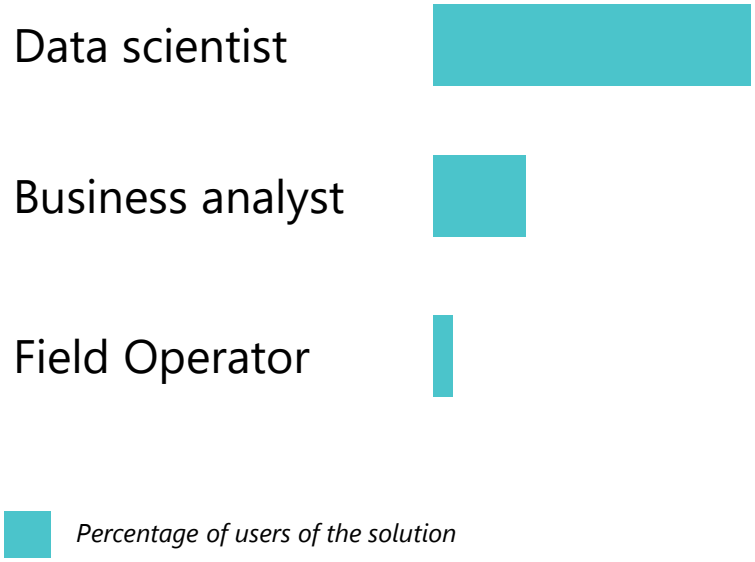
Business users oriented platform

Pure Data Science Platform



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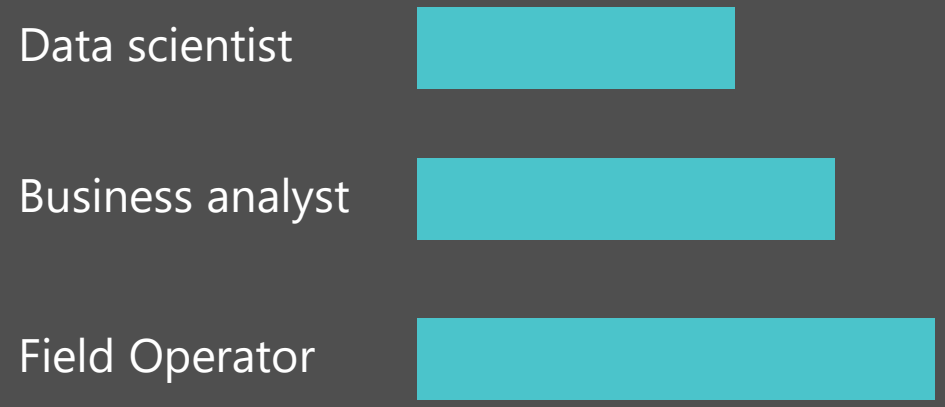

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PUT THE INTELLIGENCE
WHERE DECISIONS NEED TO BE MADE

Embedded
PREDICTIVE OBJECTS
everywhere

IoT Platforms

Space Defense & Military

Transportation

Smart Vehicles
Aeronautic
Drones

Energy

Wind turbines
Solar, Oil & Gas

Manufacturing 4.0

Process Quality
Prescriptive maintenance

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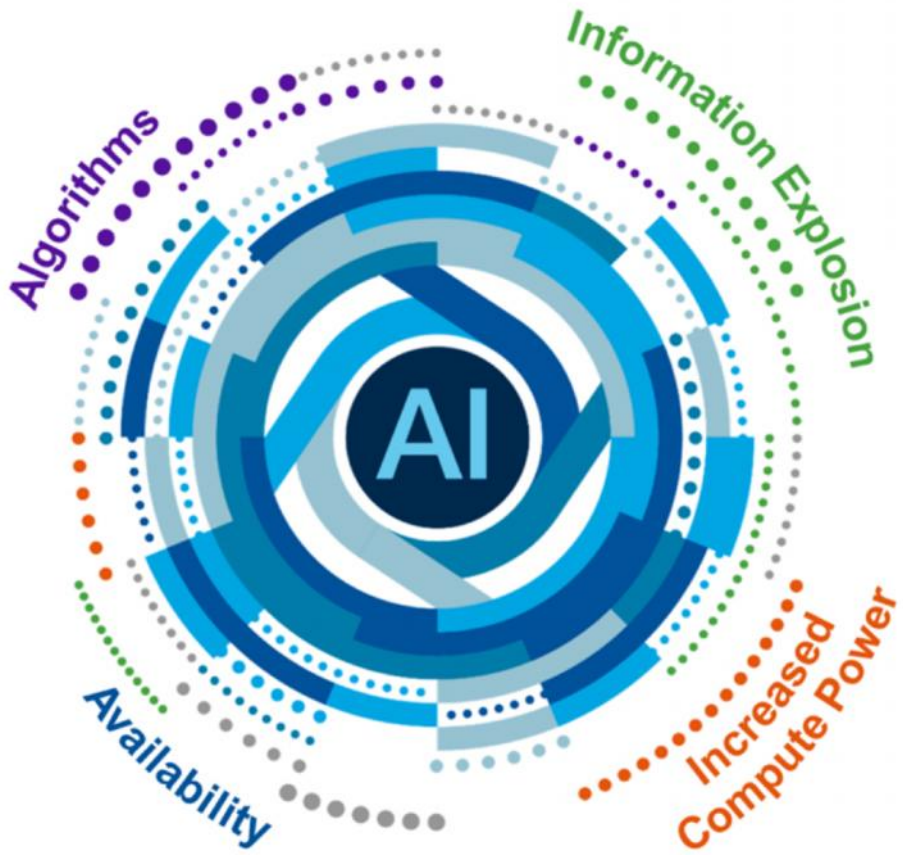
Predictive Objects



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Asset intelligence
is the next step
in the evolution of AI

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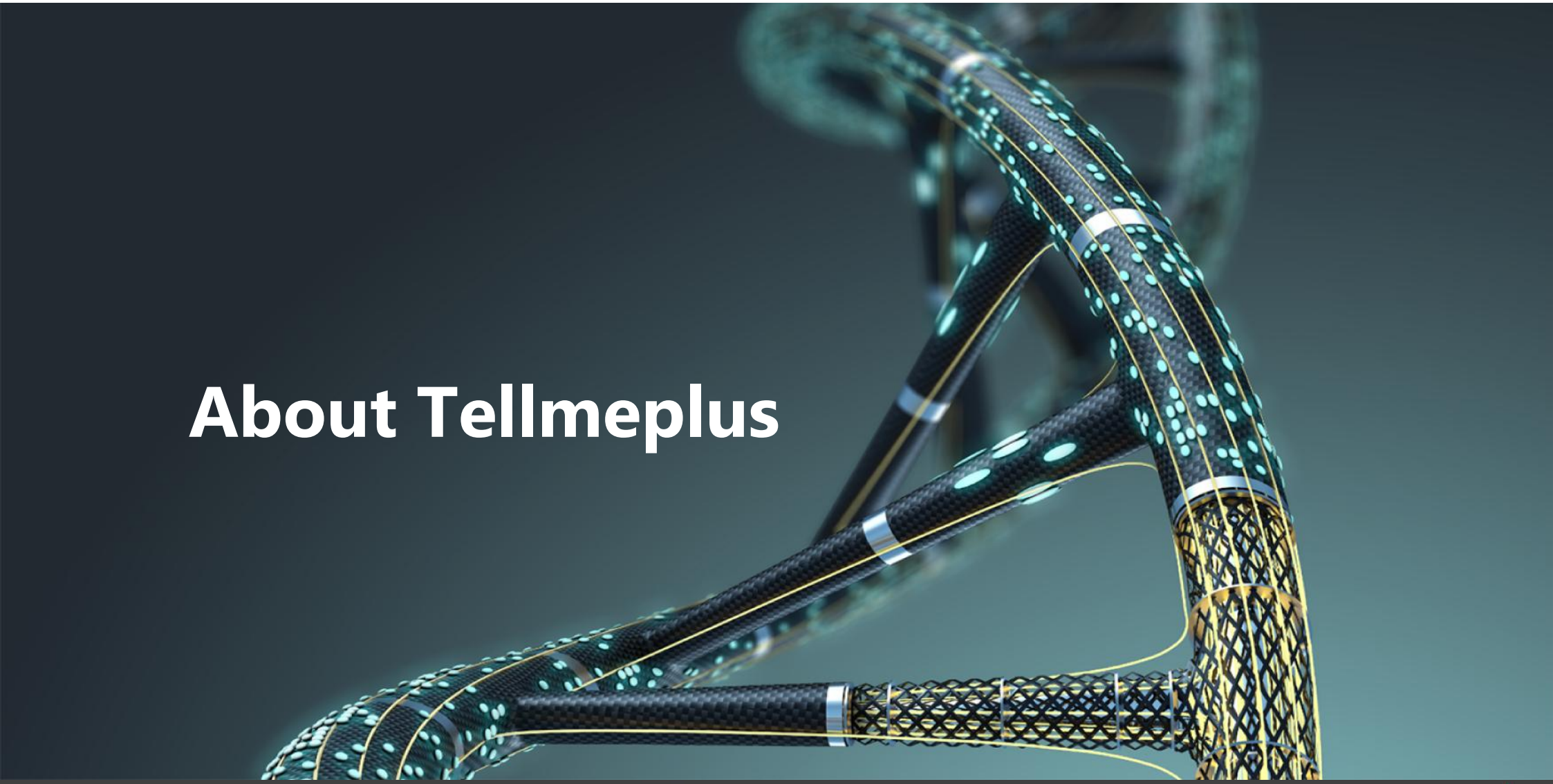
About Tellmeplus



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Predictive Objects

Jean-Michel Cambot
Founder & Chief Strategy

Inventor
$6,8B

Business Objects

Sold to SAP

Benoit Gourdon
CEO

Co-Founder
$600M

neolane

Sold to Adobe

GE Digital Alliance Partner · Google Cloud Platform · cisco · Microsoft Accelerator · AWS · sopra · Atos · Roland Berger · SIERRA WIRELESS · NEOTION

AUTOMATED EMBEDDED AI
ASSET INTELLIGENCE

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Predictive Objects

2011: creation
Founder
JM Cambot

2016:
4,2M€ raised
Benoit Gourdon
CEO

Software vendor

Predictive Analytics

4 Patents

Meta Active Machine Learning
Embedded Predictive Objects
PO in IIoT platforms

30

Paris & Montpellier,
Boston, Munich

R&D
mathematicians
from CNRS & INRIA

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Technology Partners

Tellmeplus is part of the **Microsoft AI Factory**

Tellmeplus is accelerated by **Microsoft ScaleUp Berlin**

Microsoft Accelerator

Inria
INVENTEURS DU MONDE NUMÉRIQUE

Tellmeplus is Strategic Partner **Google Cloud IoT Core**

Google Cloud Platform

Tellmeplus is accelerated by and Business Partner **Cisco**

Edge Computing
Fog Computing

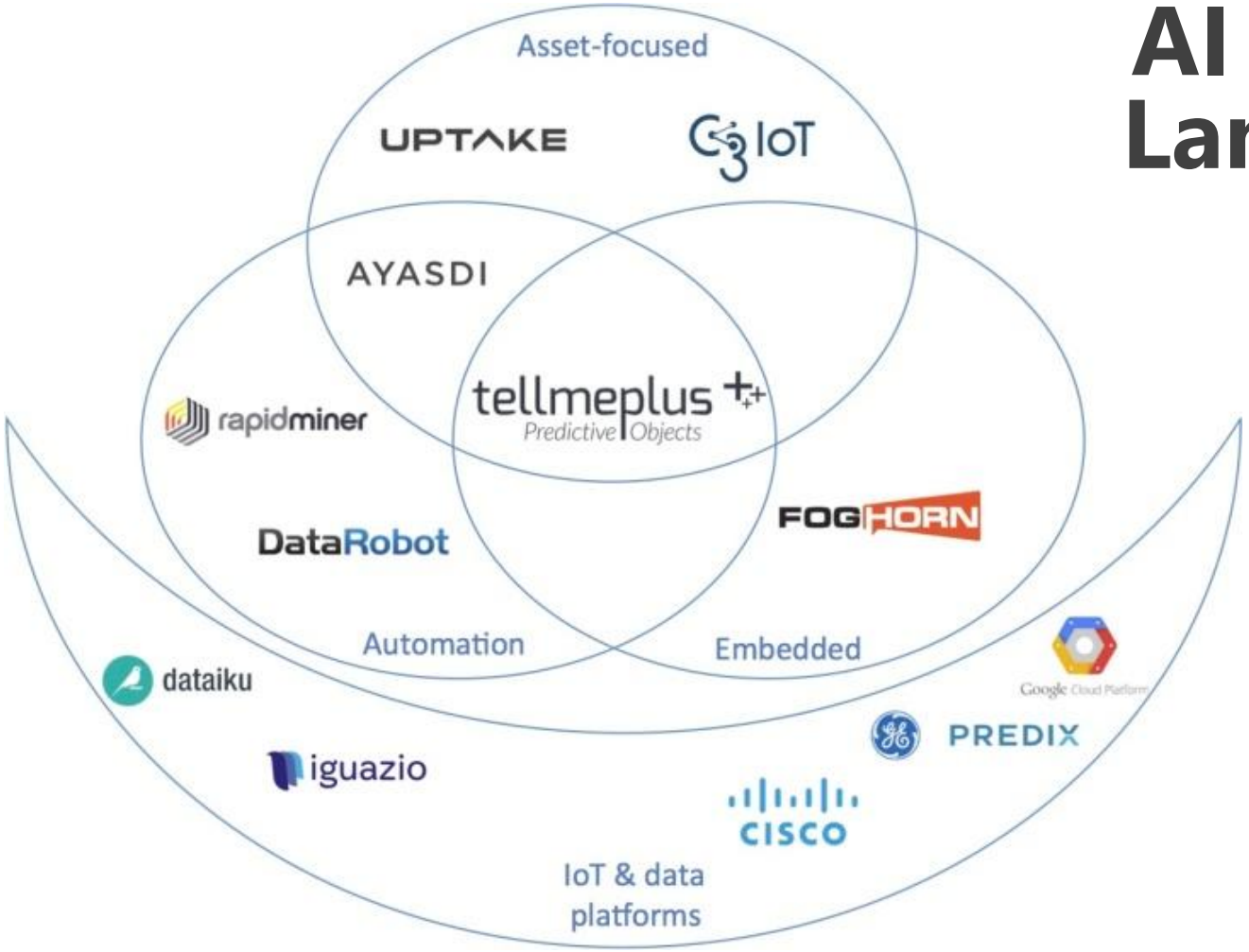
Tellmeplus is about to be certified on **Siemens Mindsphere**

SIEMENS

Tellmeplus is Certified on **GE Predix** and part of **GE Digital Alliance**

GE Digital Alliance Partner

AI for IIoT Landscape



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AI Technology

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DOCKER

MICRO SERVICES

STREAM

GO

AUTOMATED

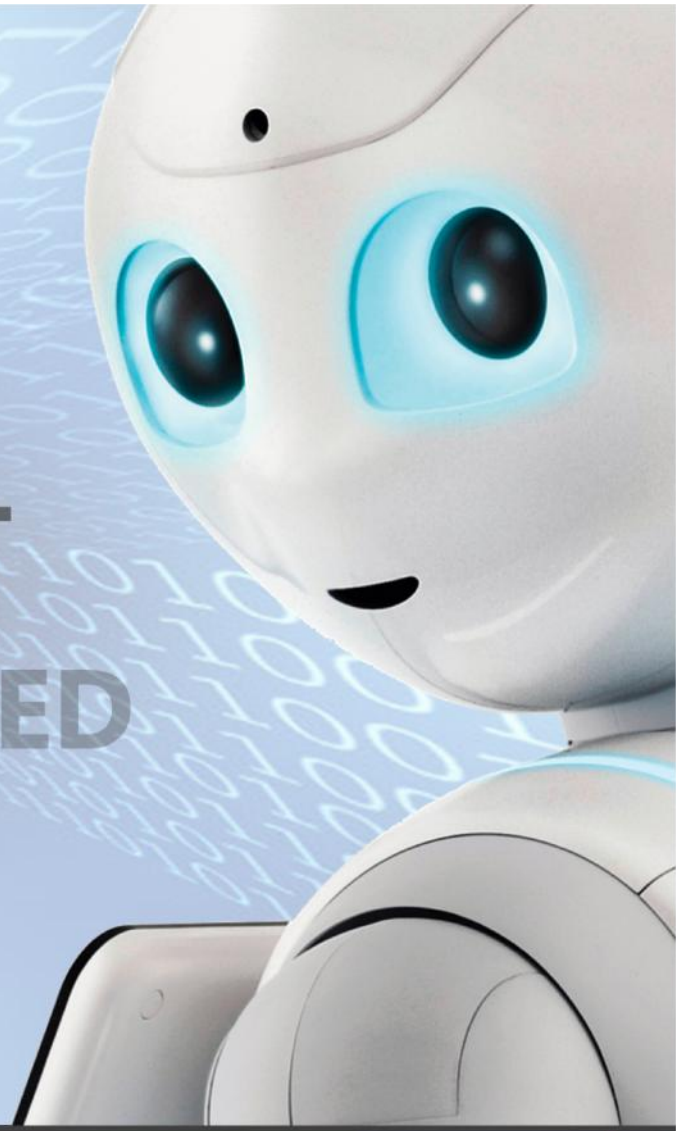
MQTT

UBIQUITY

EMBEDDED

TIMELINE SIMULATION

SYMBOLIC AI



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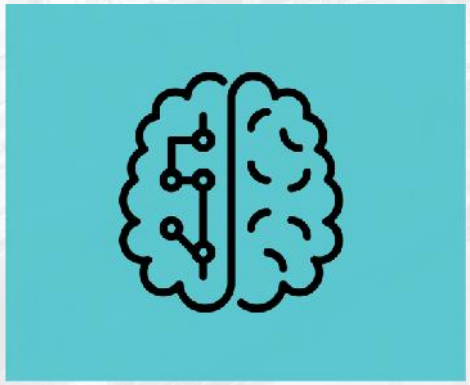
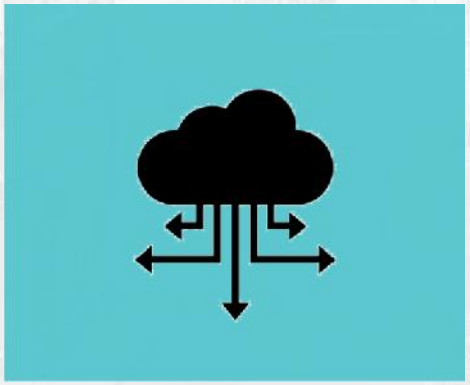
Automating Predictive Analytics

Predictive Objects improves the outcome of business and industrial processes through actionable asset intelligence.

Data Acquisition



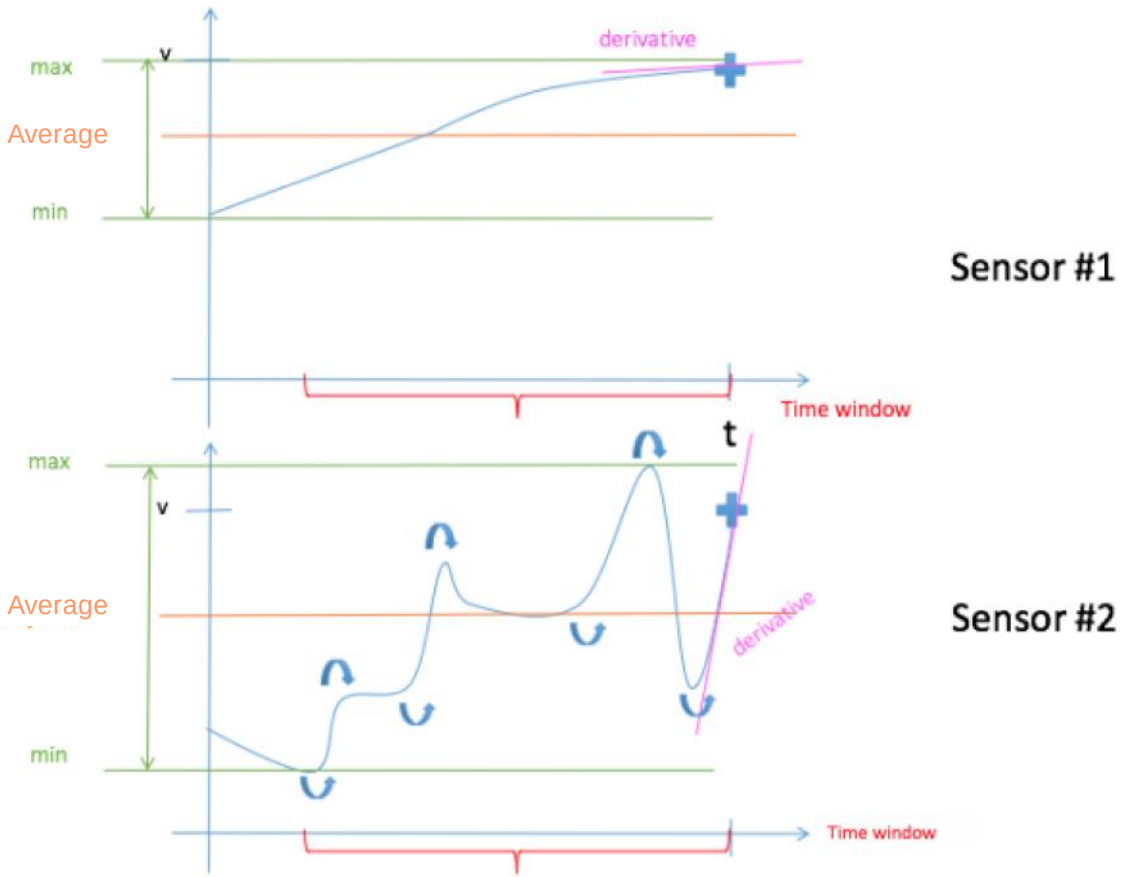
Modeling

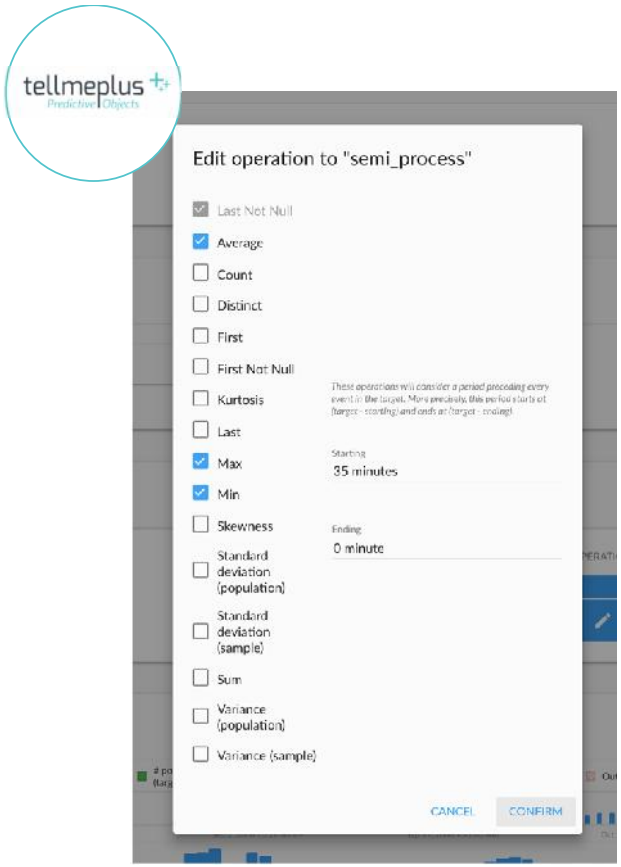


Deployment & update

Asset & processes Performance Monitoring

Feature Engineering : Automated sequence mining





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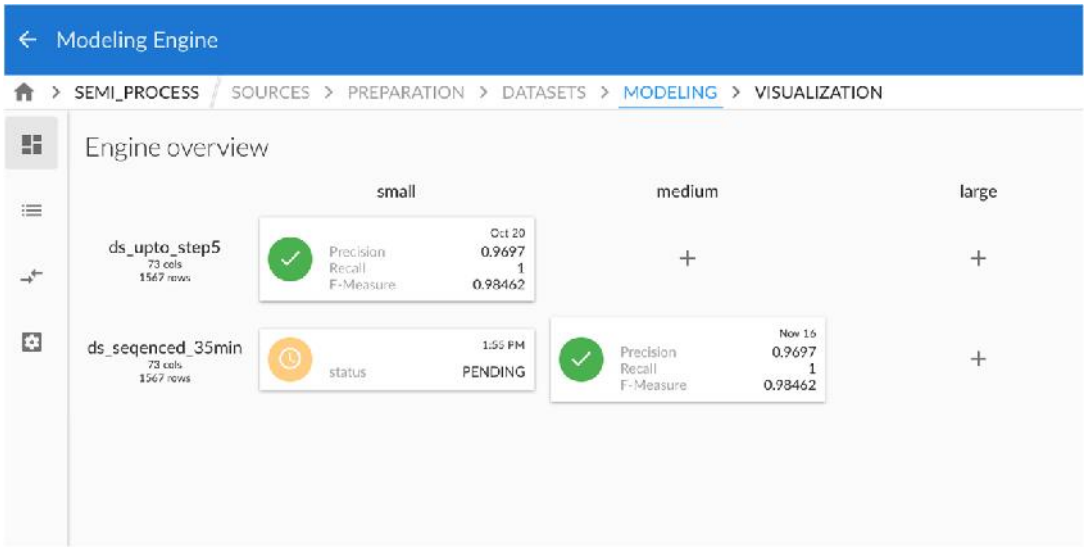
Feature Engineering

- **Column aggregation & calculation**
- **Meta Active Machine Learning**
  - Gather metadata from built datasets and models
  - Learn from generated metadata



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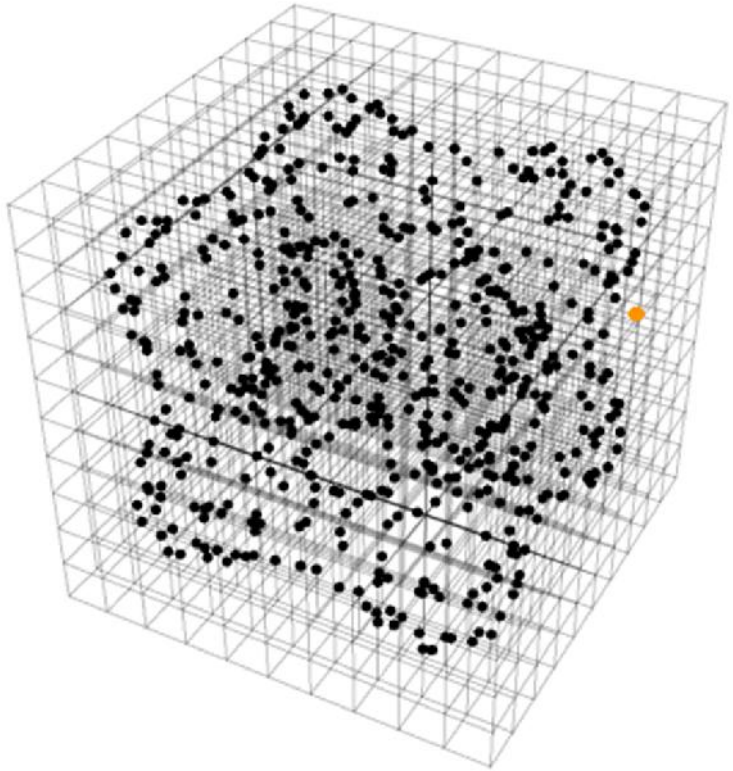
Analysis/Modeling Issues

Modeling is a 3 dimensions exploration:

- Which parts of my dataset should I use?
- Which algorithm?
- What set of parameters should I use for the selected algorithm?

Walking through the cube is time consuming

& you may never reach your goal…



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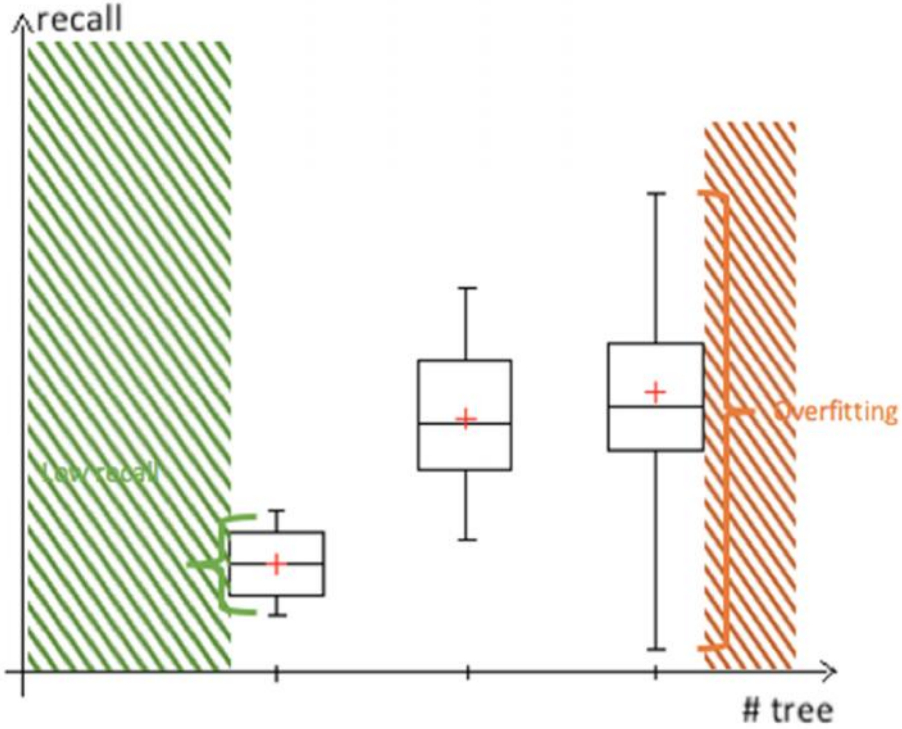
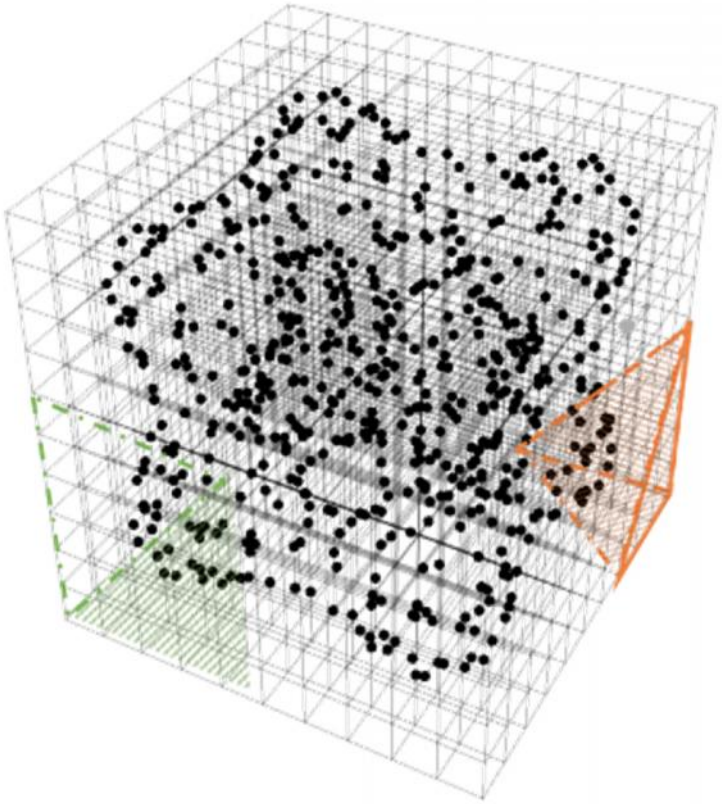
Pruning the Search Space





Meta Active Machine Learning engine will drive you through the cube
Give you the optimal model for prediction accuracy

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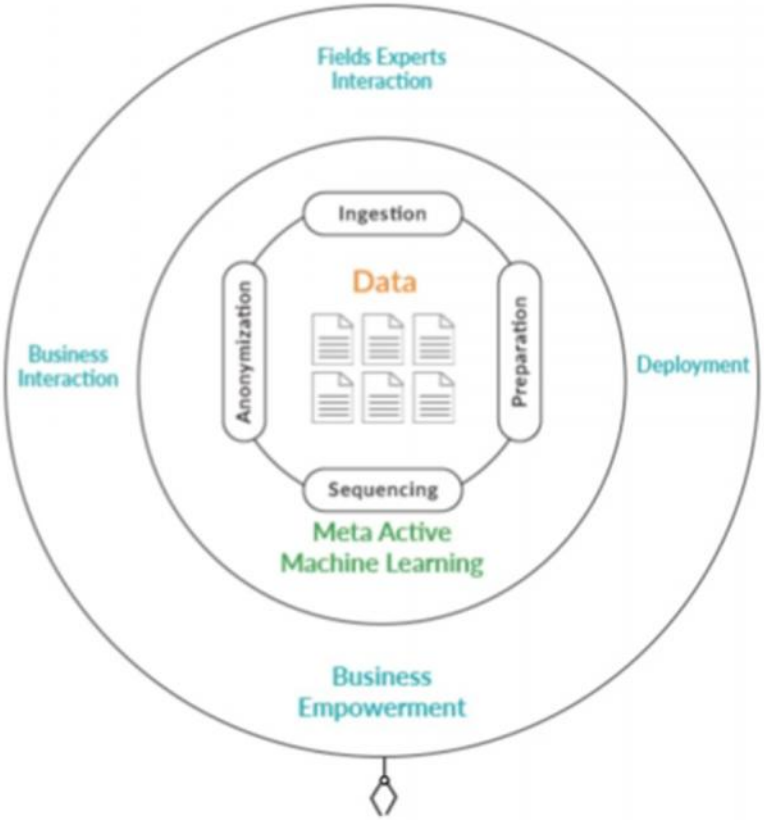
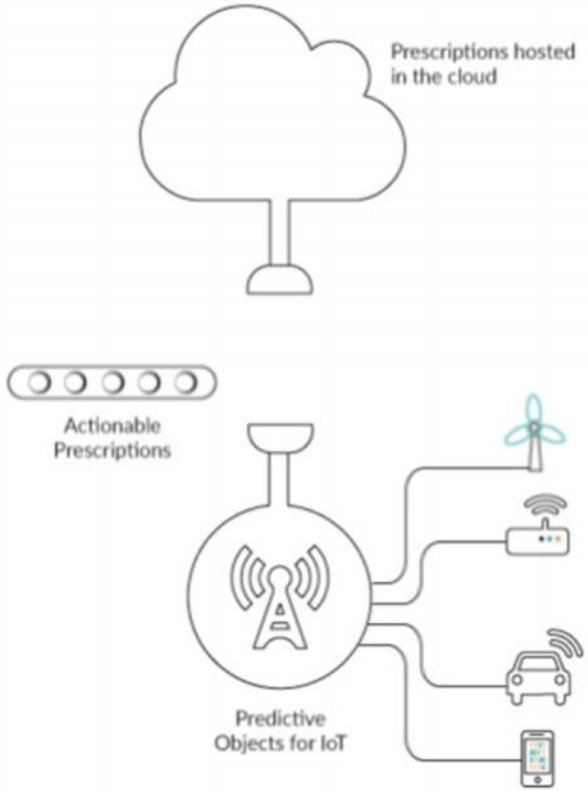
Predictive Objects – Meta Active Machine Learning®

Predictive Objects





AUTOMATED EMBEDDED AI
ASSET INTELLIGENCE

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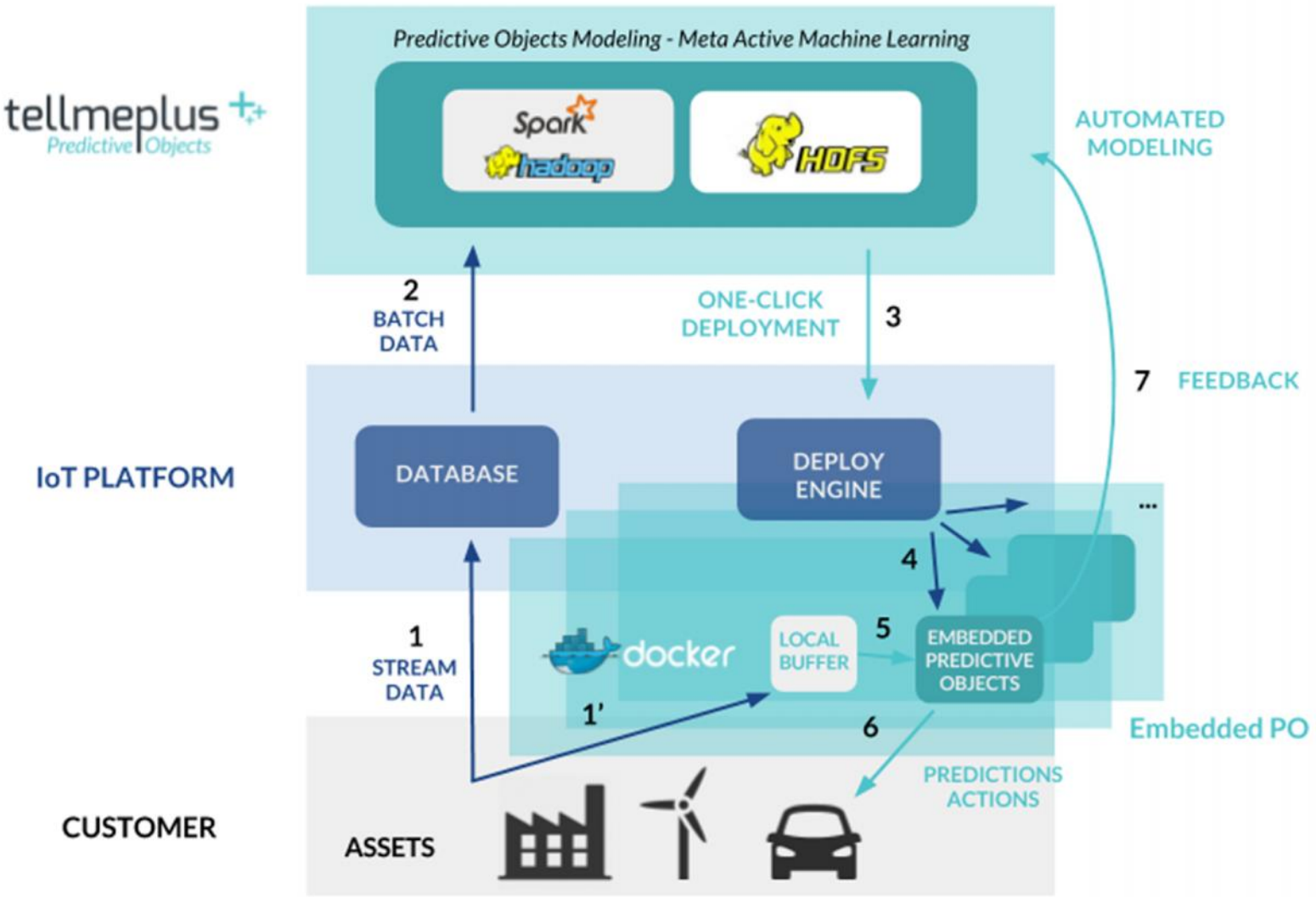

Seamless integration of Predictive Objects into IIoT Platforms

- AUTOMATIC CREATION
- 1 CLIC PUBLISHING
- EMBEDDED AI into ASSETS
- CONSTANT LEARNING
- UBIQUITOUS INTELLIGENCE

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Explore Prod. Ready Models

Models Prod. Ready

preds_upto_step7-small May 17
Conf. : small
DS : preds_upto_step7

preds_upto_step5-small May 17
Conf. : small
DS : preds_upto_step5

Best Model
Threshold 0.5

f-measure	precision	recall
1	1	1

MATRIX LIFT ROC

	Predicted positive	Predicted negative
Actual positive	11	0
Actual negative	0	350

Accuracy: 1

EXPLORE

Enter the pushed date

PUSH THIS MODEL

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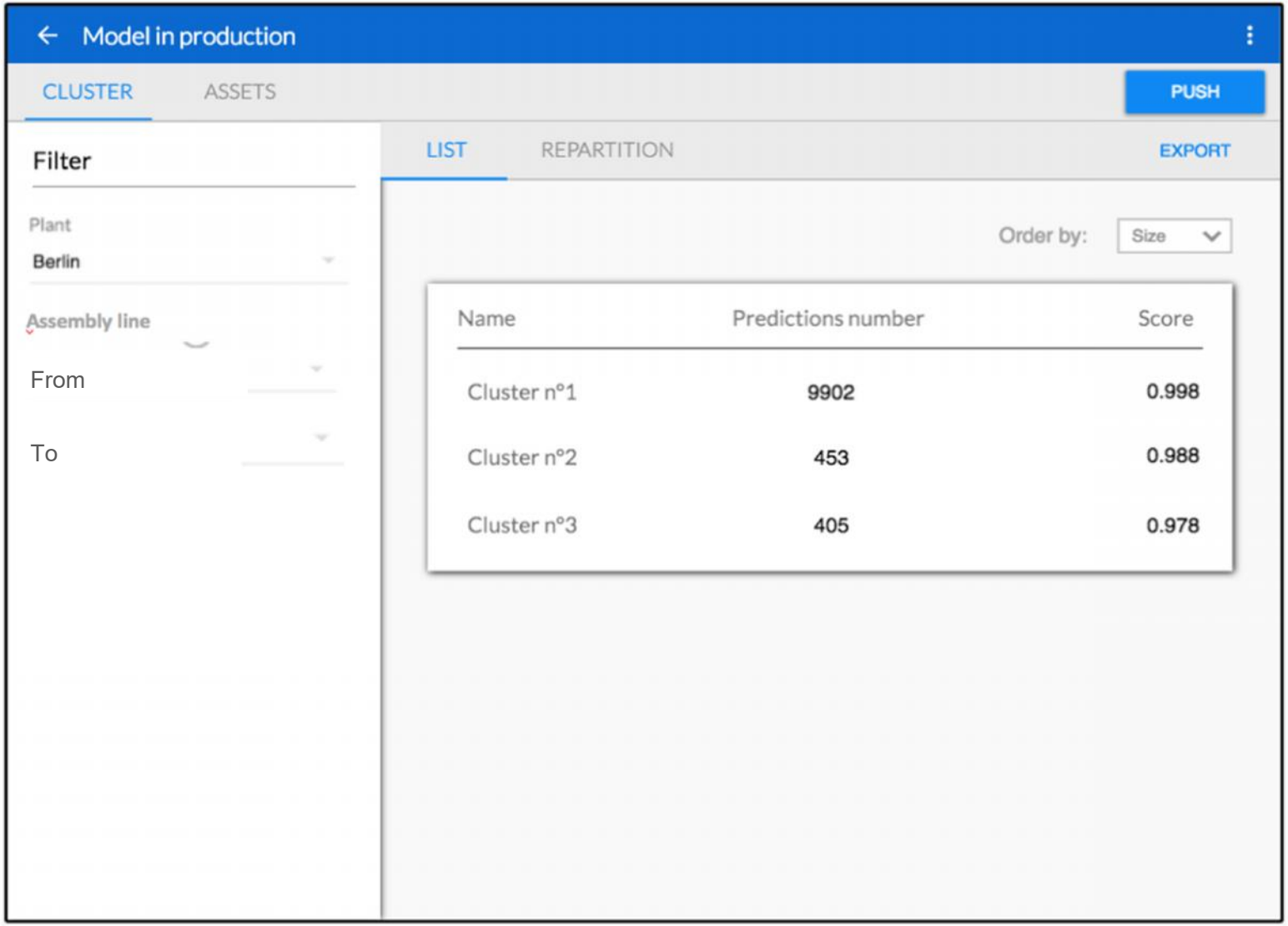

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Use Cases

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Industrial Internet

Use Cases

PROCESS MANAGEMENT

PRESCRIPTIVE MAINTENANCE

EMBEDDED INTELLIGENCE

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Examples of customers

AERONAUTICS

- Commercial Aircraft Predict "non conformity" on aircraft Assembly Lines

MANUFACTURING

- Problem Classification for mid power equipment

AUTOMOTIVE

- Embedded Prescriptive Maintenance for intelligent vehicles

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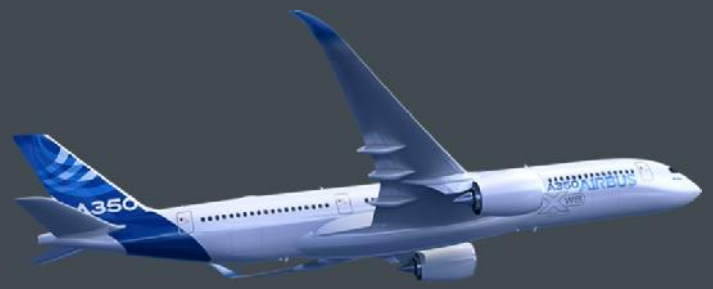
Industrial Internet

AERONAUTICS



- **Commercial Aircraft Predict "non conformity" on aircraft Assembly Lines**

Examples of customers

Supply Chain

Business case

- Assembly line from pieces to a ready to fly aircraft
- Process divided into many work orders
- Data collection by customer
- Data cleaning & management

Goals

- Prediction of non conformity for work orders later in the process
- Explanation of predicted failure to fix the problem & remove part asap

Result

- **Predictive Objects was fed by clean data**
- **Modeling with P.O Platform & a Cloud**
- **Very high prediction precision**
- **High ROI**

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Industrial Internet

MANUFACTURING

- **Problem classification for mid power equipment**

Examples of customers

Problem Classification

Business case

- Large industrial equipment (mid power) with black box
- Failure = real problem for final customer
- When this happens, manufacturer calls 1 expert (2 in the world…) to come onsite to retrieve data captured before failure
- Takes from 1 week to 1 month to the expert to explain the failure (>50 possible causes)

Goals

- Explain failure in a shorter time (blind test)
- Create a report to accelerate the expert's analysis

Result

- **Predictive Objects found the reasons for the failures in 1s**
- **Very high accuracy**

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Industrial Internet

AUTOMOTIVE

- **Embedded Prescriptive Maintenance for intelligent vehicles**

Examples of customers

Prescriptive Maintenance

Business case

- Xee manufactures a device plugged to the CAN and ODB buses
- Live Capture of all electric signals from the car
- Use of exogenous data (weather, driver's behaviors…)

Objective

- Predict a battery failure live (while driving)
- Organize maintenance operations directly with the garage
- Then expand the business case to other possible failures

Result

- Live prediction of battery failure (results may be improved by using a larger dataset, more cars and more information)
- Automatic alert to be transmitted to the garage, then SMS sent to the driver: « Your battery is gonna fail in 8 days, please come and visit us on Tuesday so that we change it »…

Industrial Internet

MANUFACTURING

- **Demand Forecast**
  1000s of SKUs, international footprint

Examples of customers

Supply Chain

Business case

- Key manufacturer of specialty chemicals
- Direct & indirect sales channels, global footprint
- Demand forecast critical for production/stock adjustment
- Demand forecast legacy tool requires corrections by sales + inaccuracy

Goals

- Improve regional demand forecast accuracy +15%
- Integrate exogenous data (specific events, raw material prices & exchange rates, geopolitical data, PMI indices,…)

Result

- **Current results accuracy 15% above legacy forecast**
- **System in production**

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Case Study

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Predictive analysis on Work Orders

WORK ORDER

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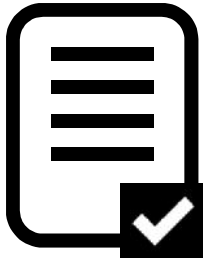
Predictive analysis on Work Orders

Stream 1 - Inspection time reduction

Conform WO

Output



List of predicted conform WO

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Predictive analysis on Work Orders

Stream 1 – Results comparison

August – October 2017

	282k work orders	40% predicted OK	99.6% accurate
FAL TOULOUSE	120k	33%	99.5%
BROUGHTON	82k	75%	99.8%
SAINT NAZAIRE	79k	16%	99.0%

CREATE VALUE

Anticipate confirmity with high accuracy

Reduce inspection time

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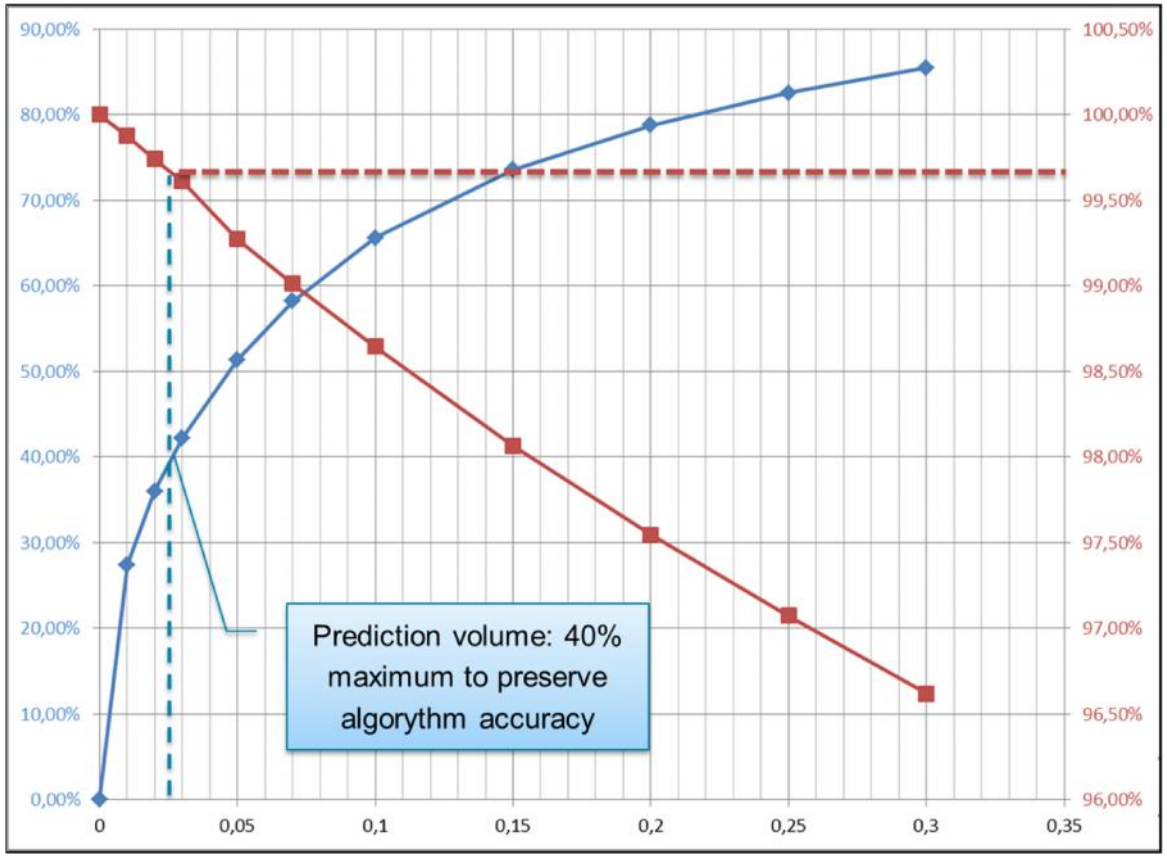
Predictive analysis on Work Orders

Stream 1 – Results comparison



Business decision
compromise between
Volume & Precision

More WO predicted
→ Less Precision

Volume of WO
predicted as conform
VS
Algorithm precision

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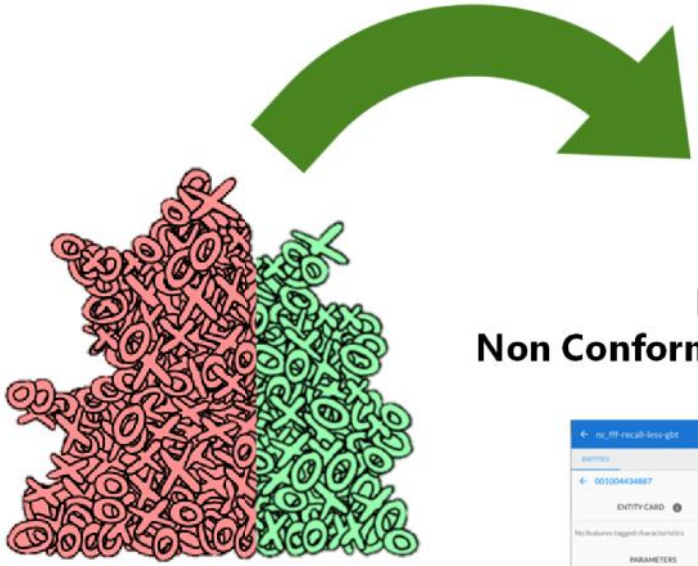
Predictive analysis on Work Orders

Stream 2 – Feature Importance Analysis



For each Work Order
Non Conformity feature importance check list

High risk of NC

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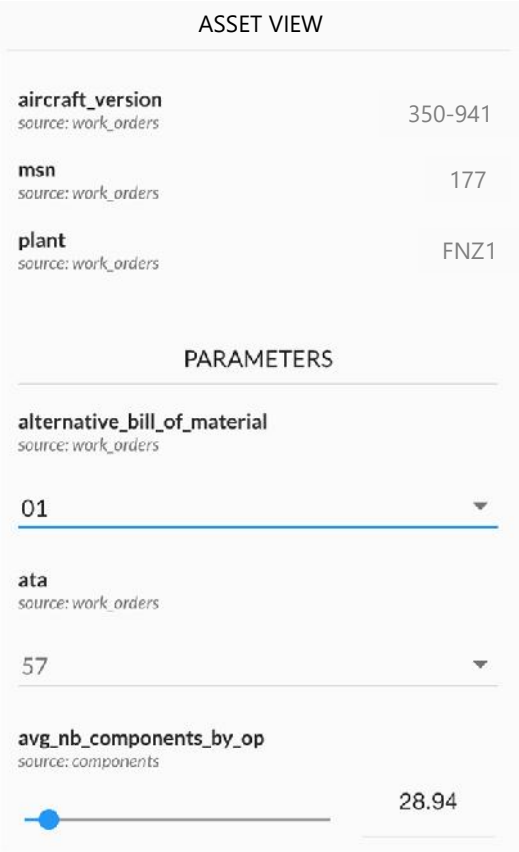
Predictive analysis on Work Orders

Stream 2 – Explicability of the Predictions

WO 1004612896
Launch Date 2017-05-11

NC risk = **0.91**

Sum of processing time	**< 35**
Average number of employees	**< 1**
Avg nb. of components by	**> 10**



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Predictive analysis on Work Orders

Stream 2 – Explicability of the Predictions

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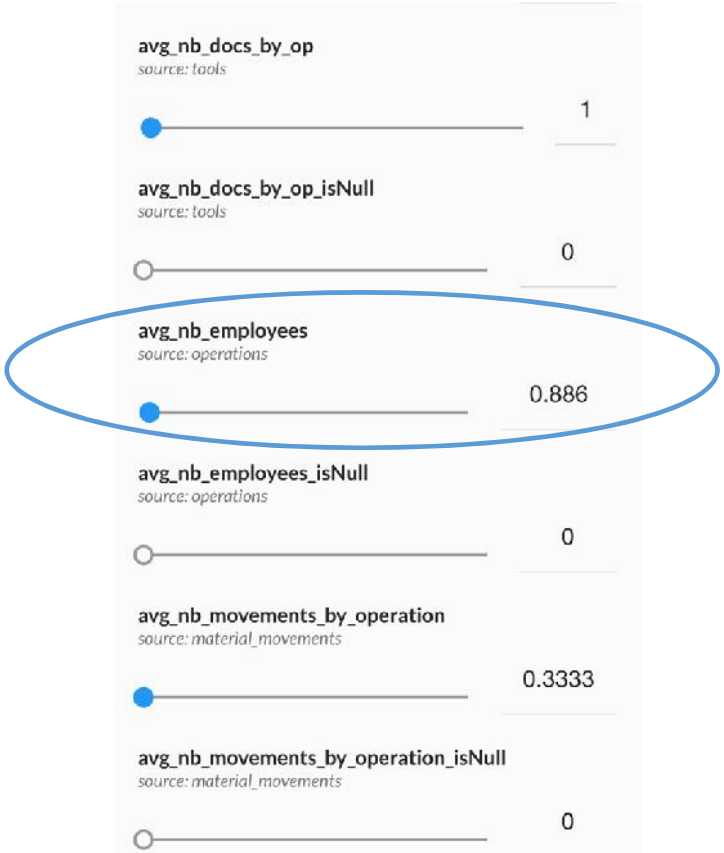

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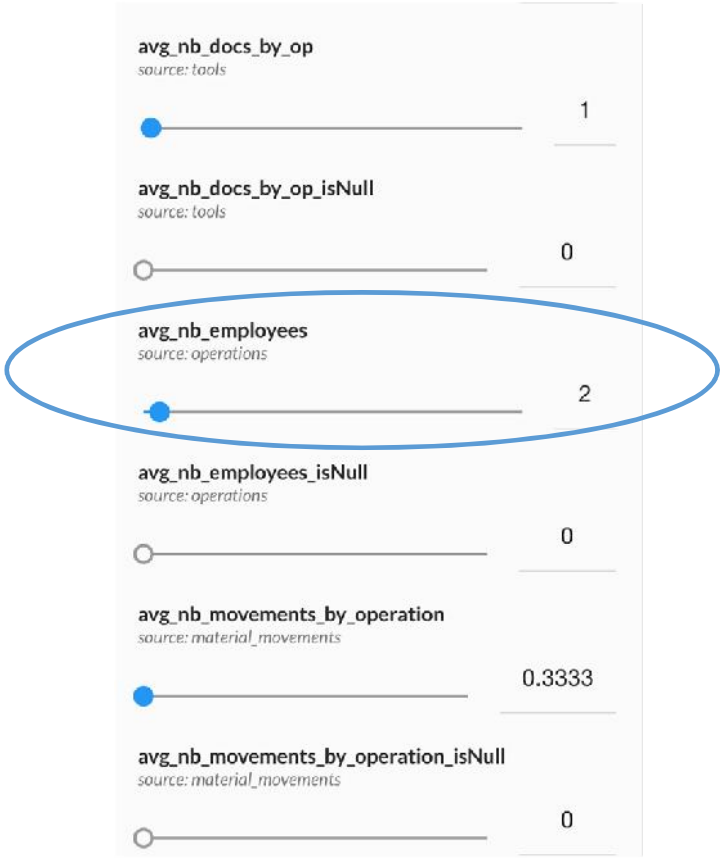
Predictive analysis on Work Orders

Stream 2 – Explicability of the Predictions

WO 1004612896
Launch Date 2017-05-11

NC risk = **0.86**

Sum of processing time	< 35
Average number of employees	< 1
Avg nb. of components by	> 10



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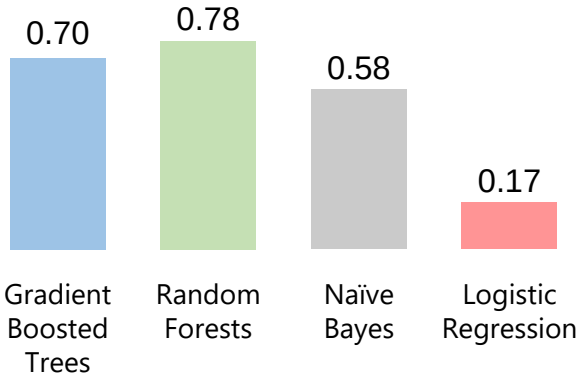
Predictive analysis on Work Orders

Stream 2 – Explicability of the Predictions

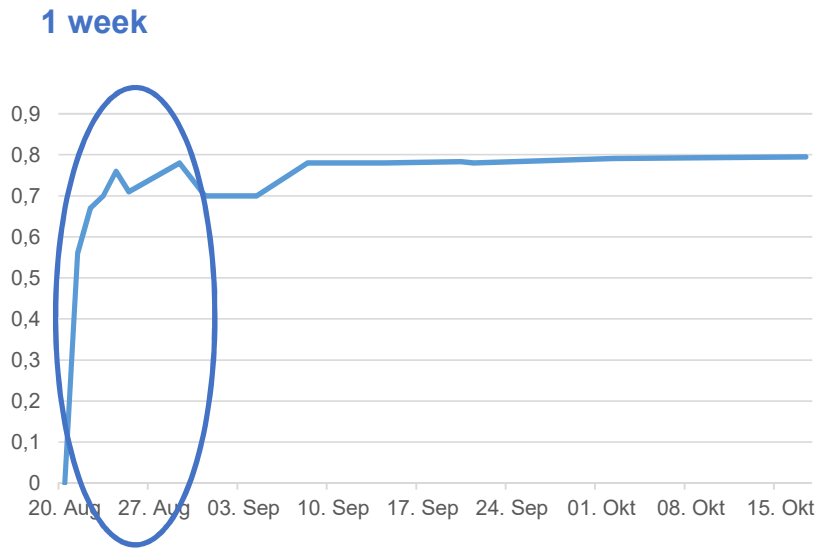
~ 50Go
1,7M Work Orders

Work Order data

~ 500 ML Model



Best score by class of ML model



Evolution of the score

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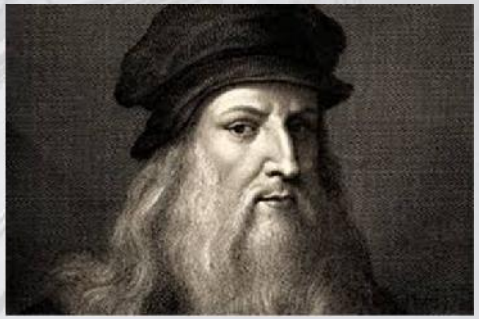
« Simplicity is the ultimate sophistication »

Leonard de Vinci



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Predictive Objects

Jean-Michel Cambot

STATION F

TIME FOR QUESTIONS

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