DNV GL Energy

Application of digital technology in Energy

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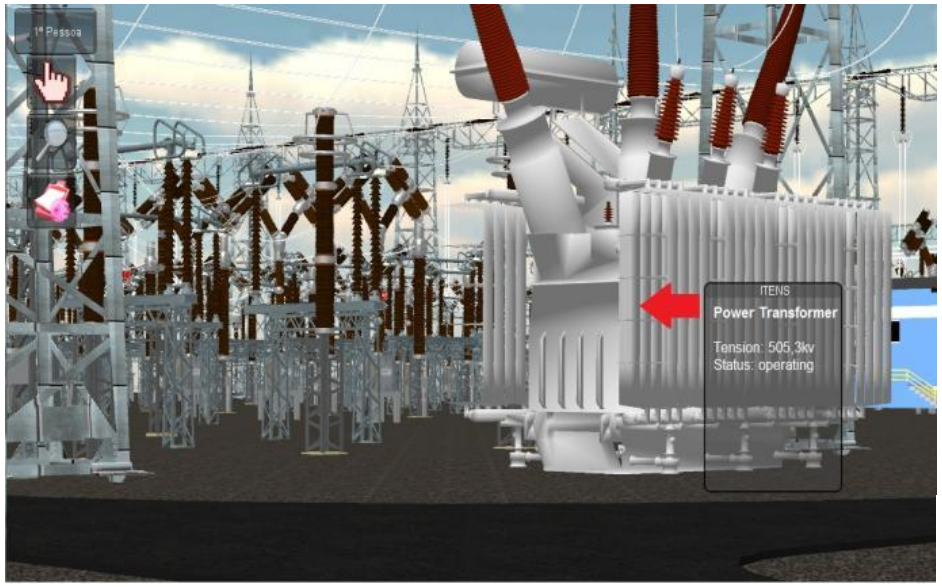
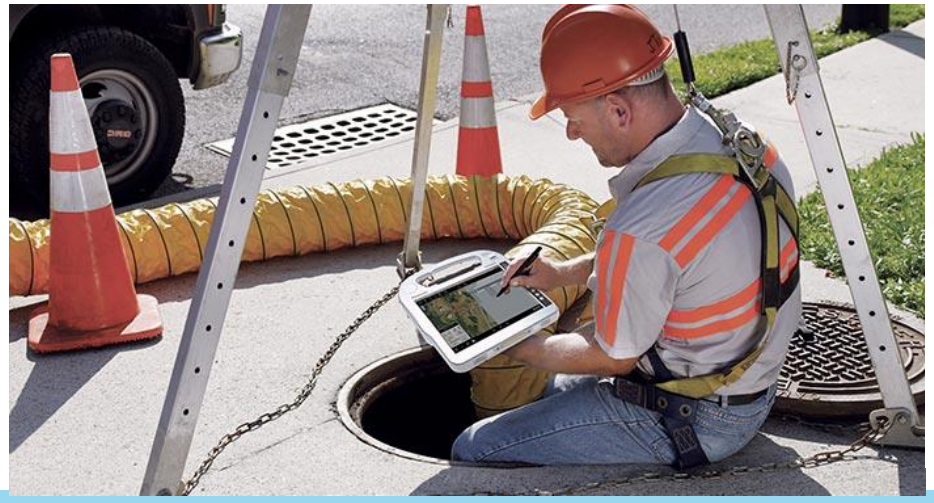
SAFER, SMARTER, GREENER

DIGITALIZATION IN ENERGY





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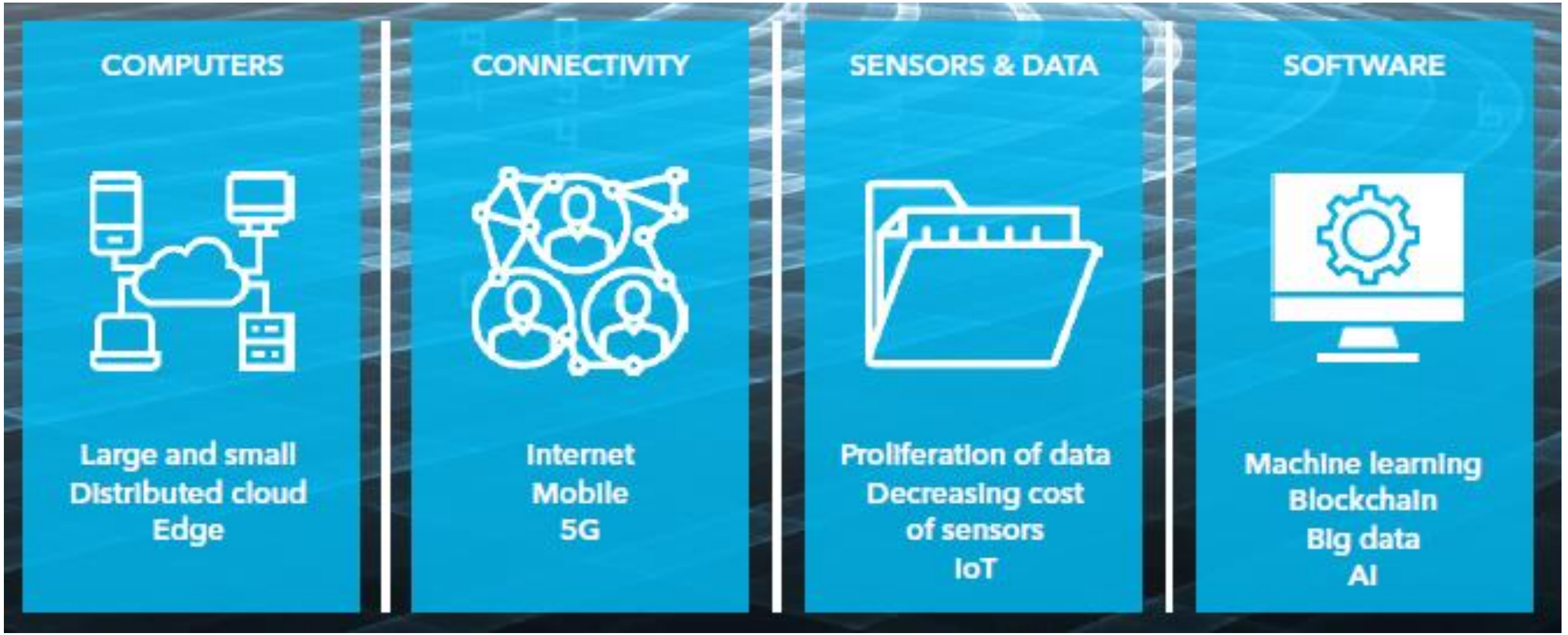
Digital Technologies



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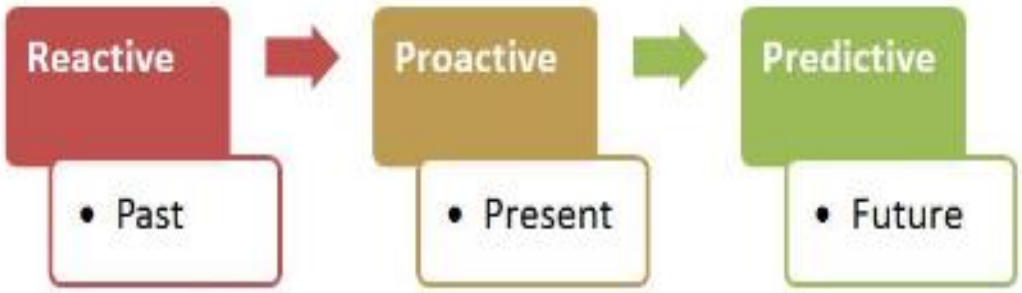
Digital Transformation in Energy

Digital transformation will change business models, create new revenue streams and value producing opportunities. Two waves:

1. **Smartgrid technology**
   Mostly about adding digital **hardware** in the grid (protection, automation, controllers, meters, sensors).
2. **Digitalisation in Energy**
   Is about *emerging digital* technologies like data analytics, AI, cloud, mobile and blockchain.
   This will add layers of **software** and applications on top of the Smartgrid, bringing scalability and enabling new business models to grid operators.

For grid operators this translates to:

- Moving from reactive to predictive
- Improved situational awareness and decision support
- Data driven system operation
- Predictive asset maintenance



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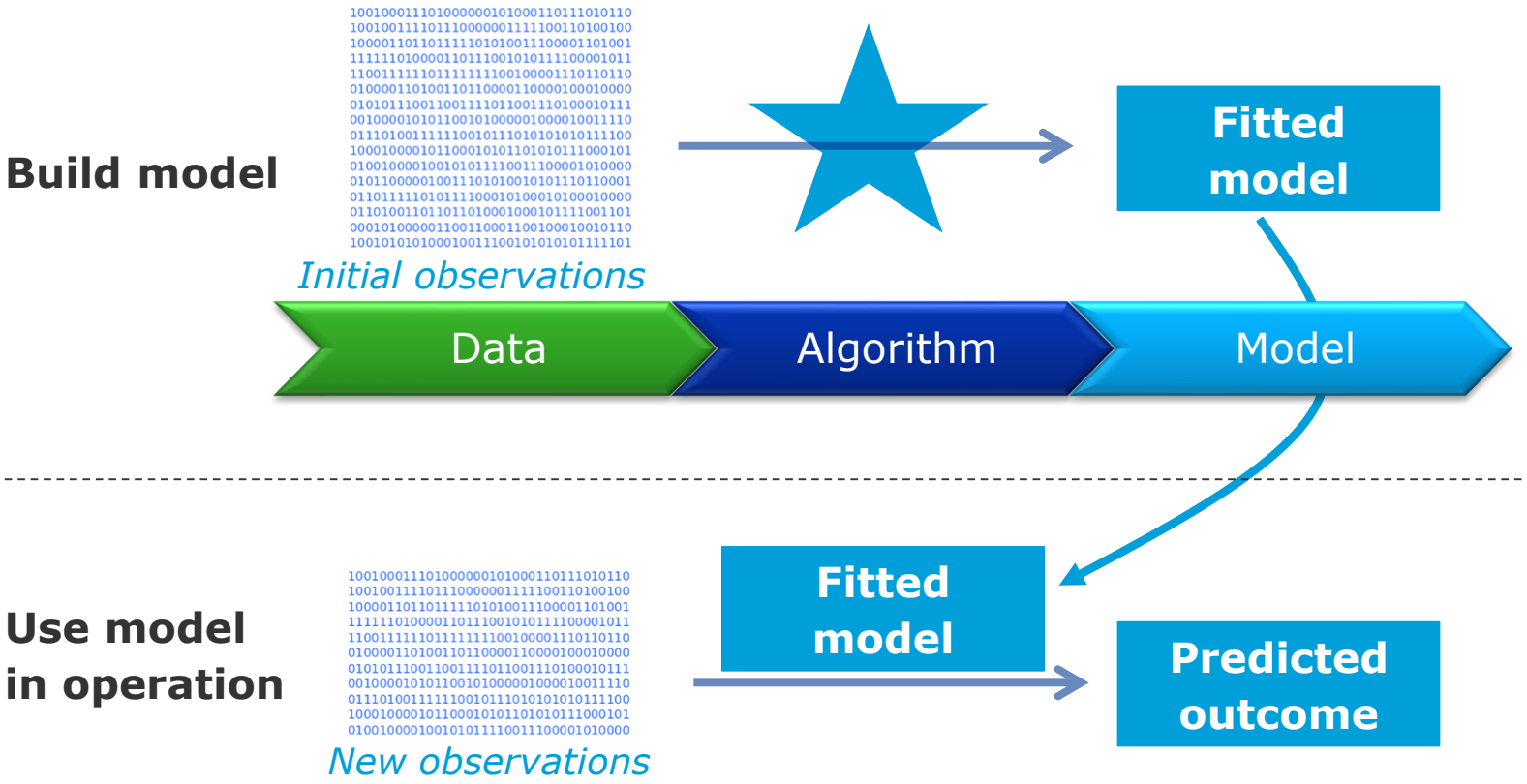
Machine learning in a nutshell:
Building predictive models from historical data, for use on new data

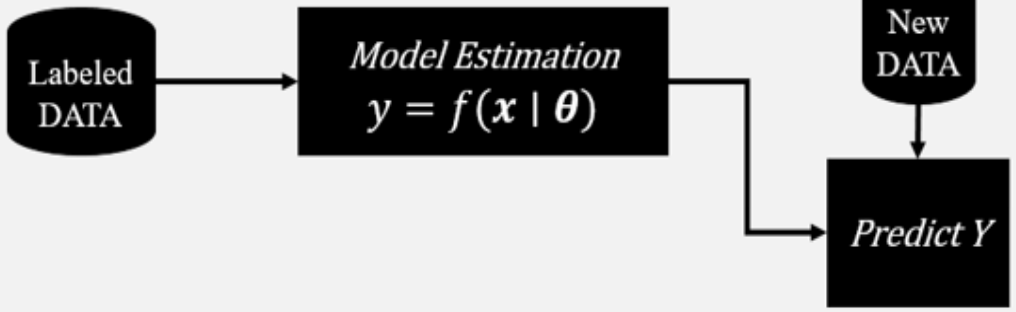


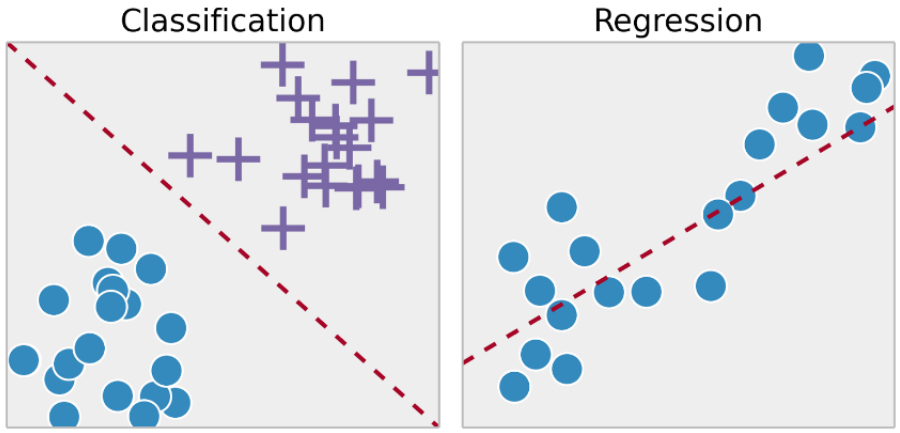
Machine Learning give computers the ability to "learn" with data
(i.e., progressively improve performance on a specific task), without being **explicitly programmed**

Supervised versus unsupervised machine learning

Supervised Learning

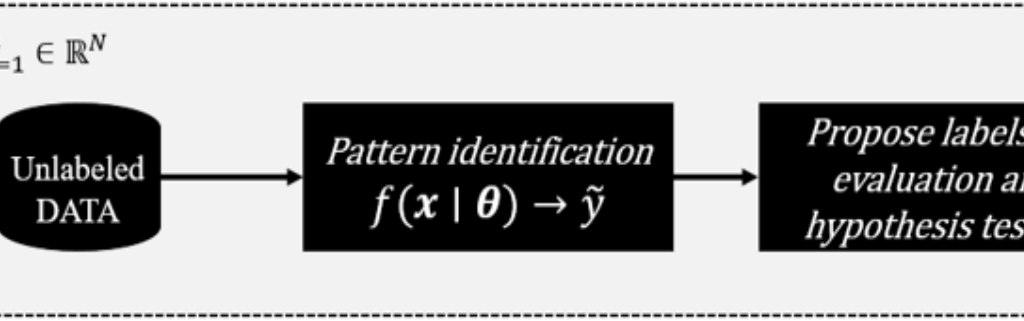
$\{x_i, y_i\}_{i=1}^{n} \in \mathbb{R}^N \times \mathbb{R}$

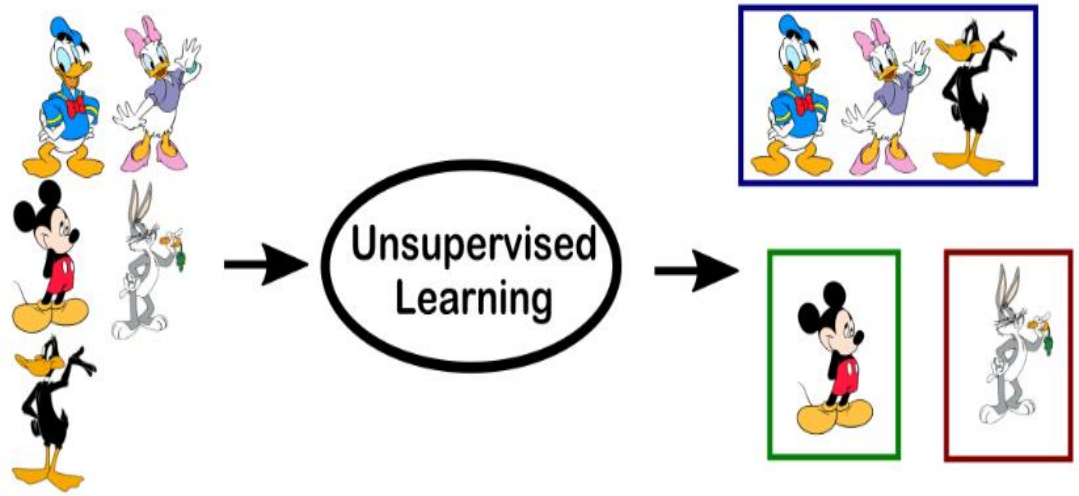




Unsupervised Learning

$\{x_i\}_{i=1}^{n} \in \mathbb{R}^N$





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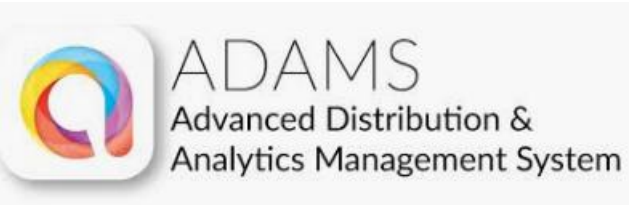
How can Data science and Machine learning solve the Challenges in Energy

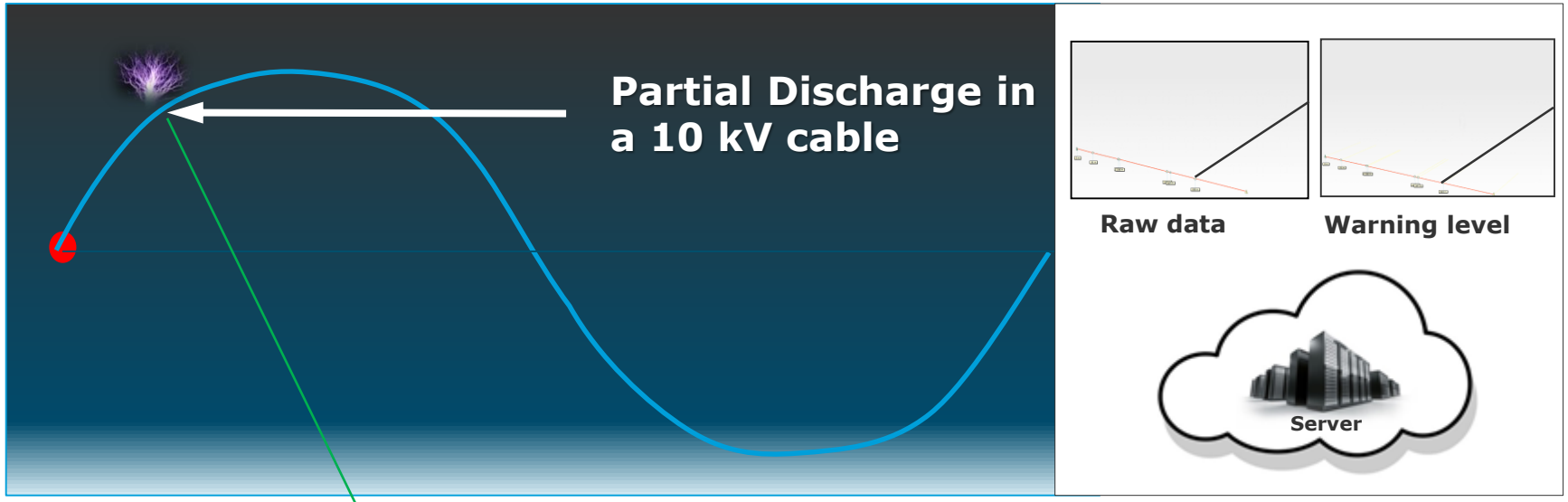
- **Outage management.**
  Utilities can use machine learning models to predict and identify outages, allowing for reduction of downtime, improved reliability and optimized resource and dispatch planning. Self-healing grids can automatically detect and address vulnerabilities, reducing the likelihood of outages.

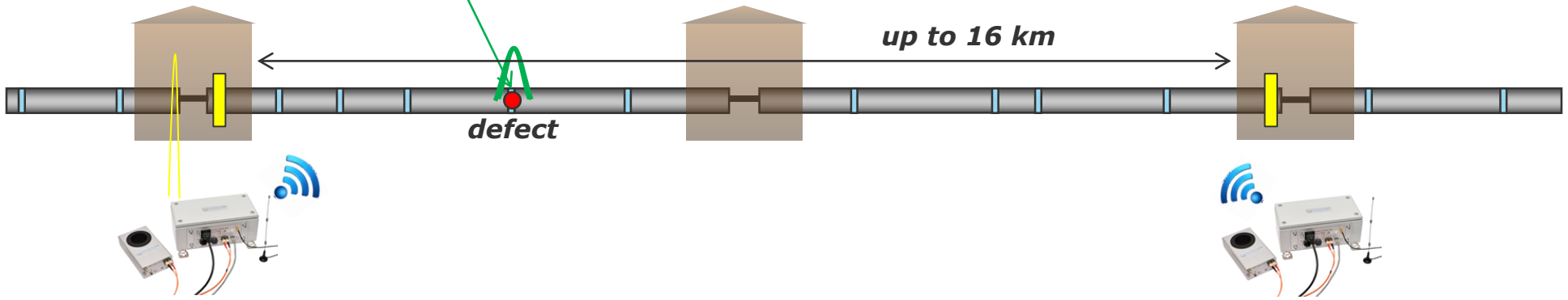
- **Optimized distributed resource management.**
  Machine Learning can enable enhanced distributed resource management that optimizes power flows through the grid to deliver more reliable energy and greater customer choice. Example: Smart charging for EV.



- **Data driven asset management**.
  Machine learning can predict the probability of asset failure, allowing enhanced asset management and a better understanding of asset conditions, remaining lifetime, replacement priorities and portfolio management.

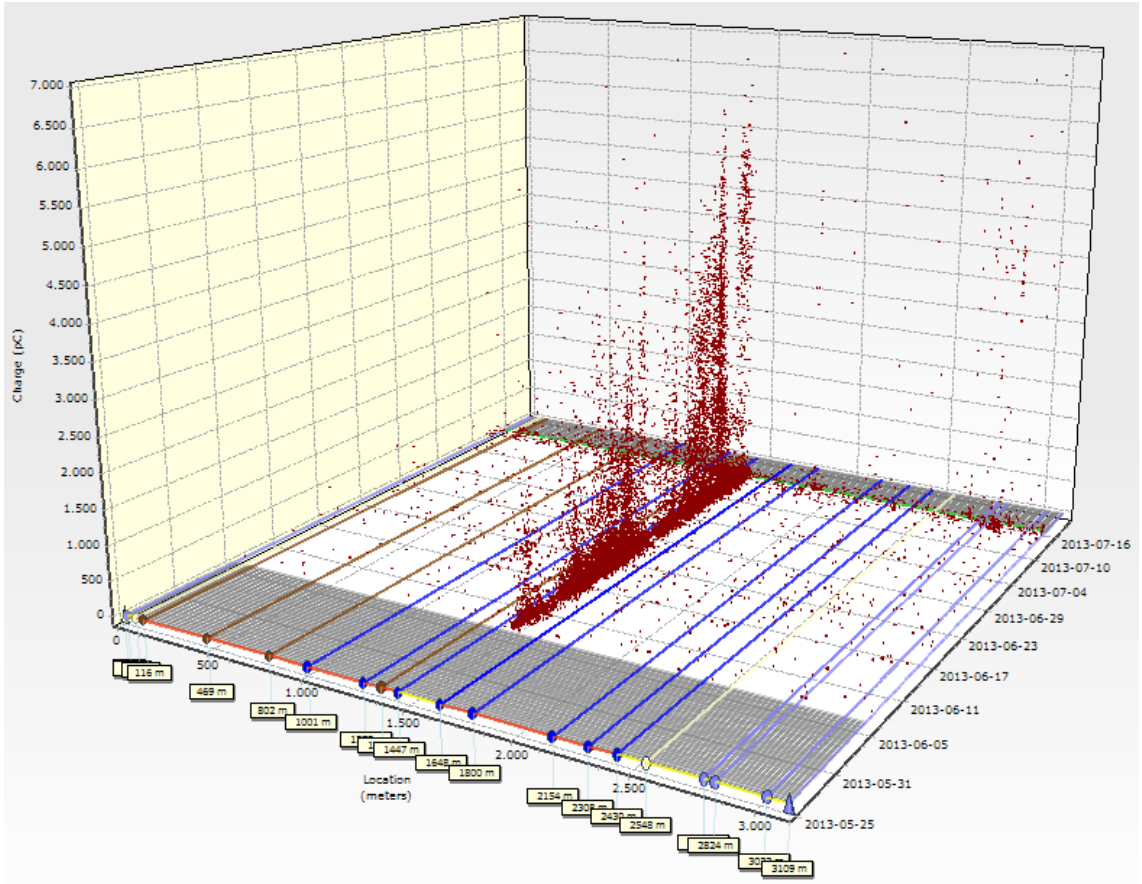
Smart Cable Guard: Predictive analytics solution for cable failures

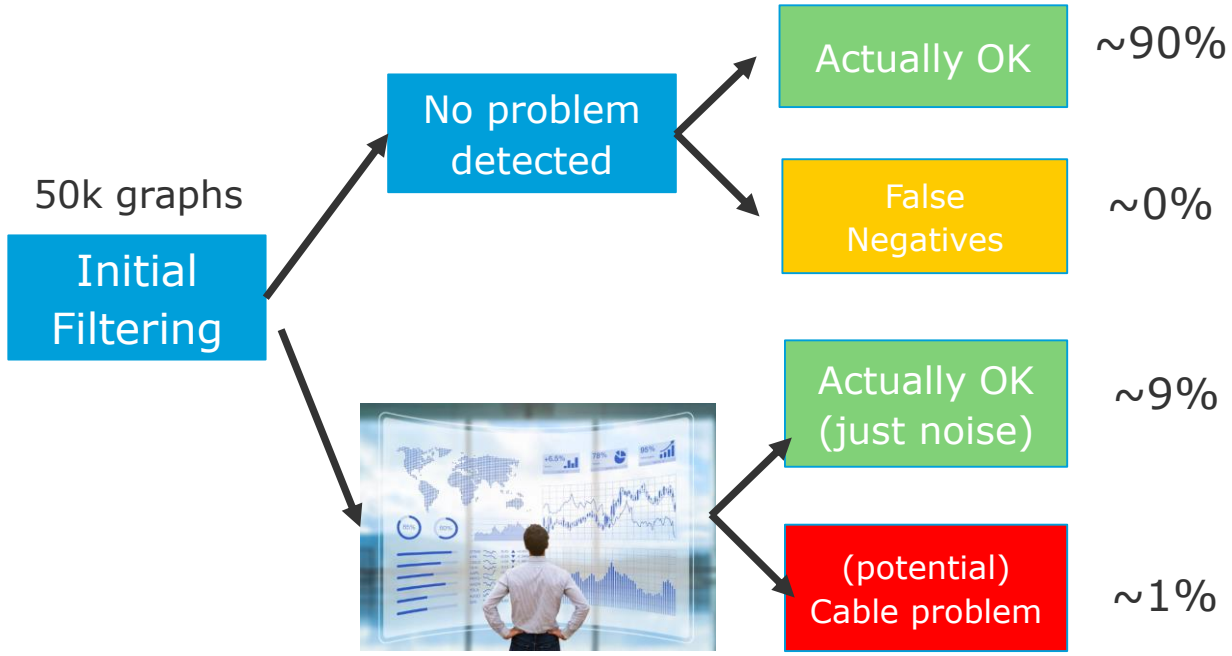




PD pulse Synchronization pulse

Developing a Machine Learning model to automate detection problematic cables in Smart Cable Guard



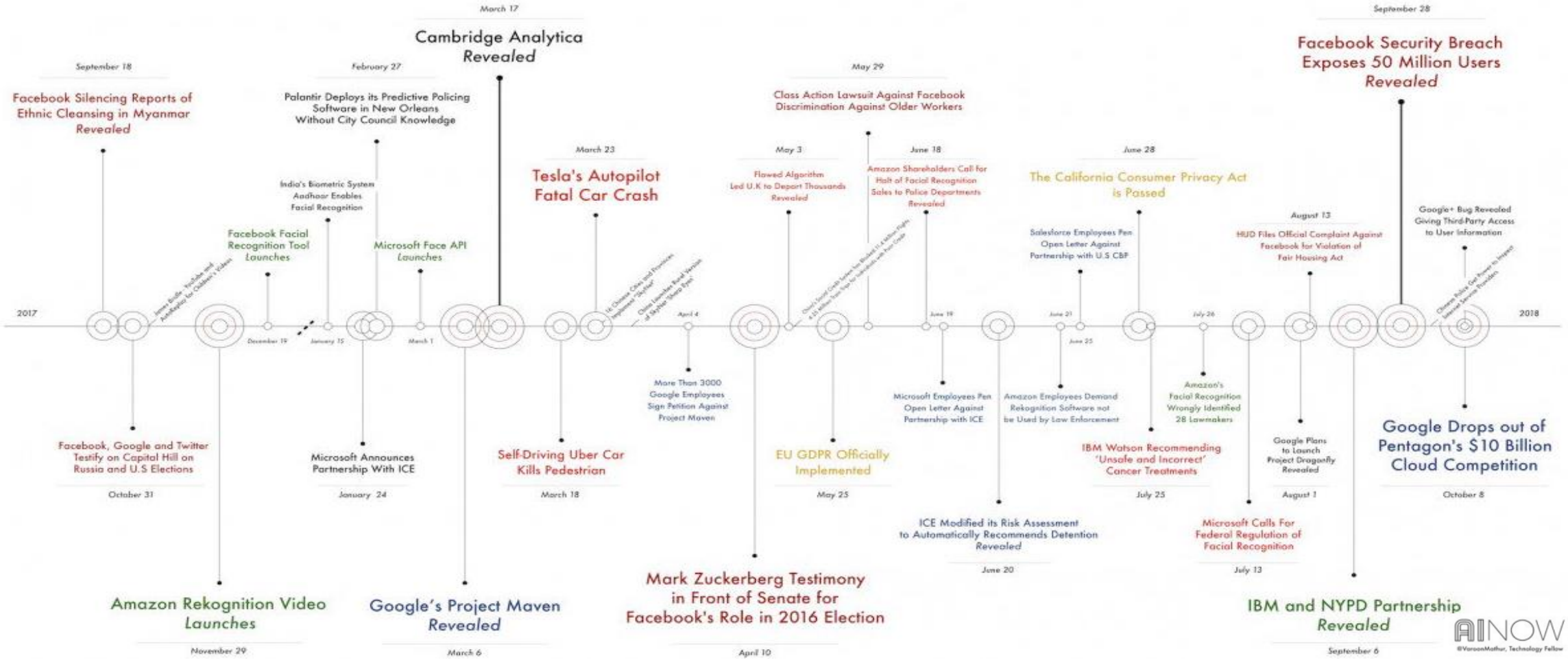


Operator analysis in 10 % of the cases
(currently at 5000 reviews a year, but growing fast)

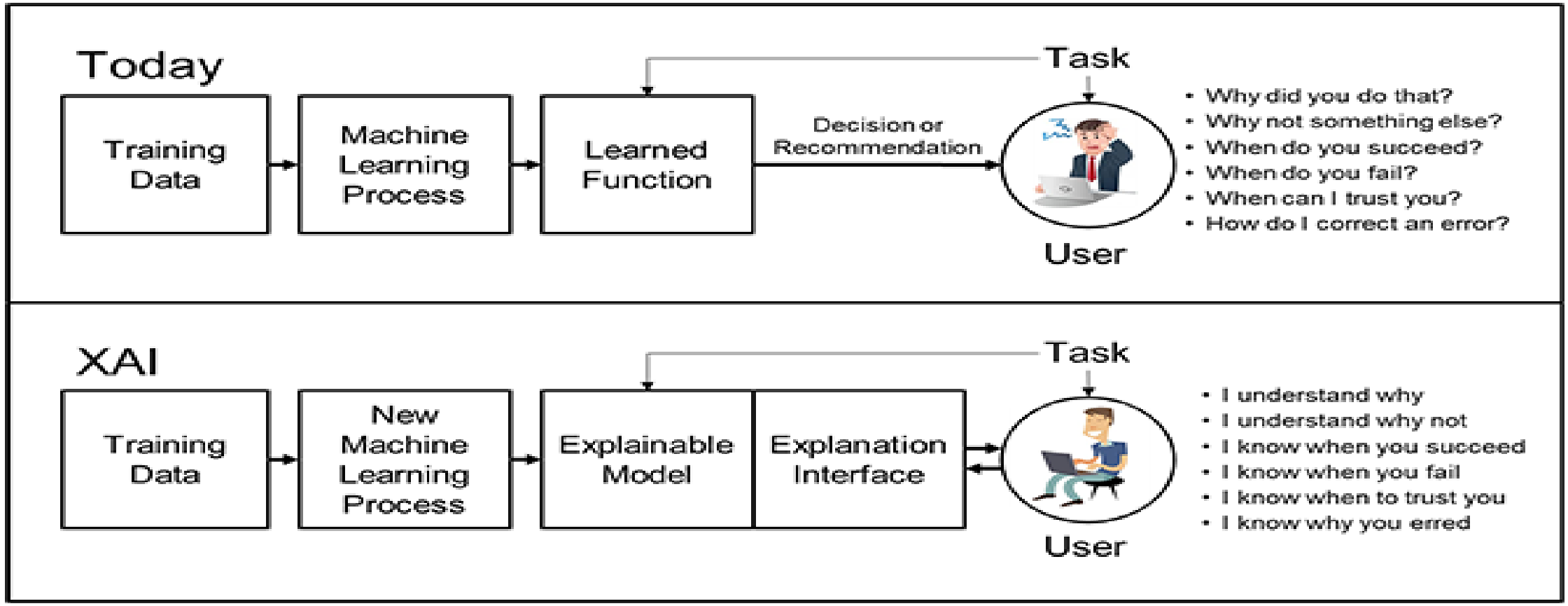
Initial goal: Automatic detection of cable problems through ML.
This was not feasible because not enough failure data was available

New goal: Reduce amount of human review from 10 % down to 1% by introducing ML

How can we put trust in AI?
Especially when it concerns operational technology?



Explainable AI (X-AI) and AI Safety



When machines are increasingly responsible for crtical decisions in real-time, we have the responsibility for designing **explainable** and **inherently safe** AI systems.

DNV GL helps to unlock the power of Digital Transformation in Energy
https://www.dnvgl.com/energy/themes/digitalization

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