Online Webinar

Forecasting service order duration with the help of machine learning

09/21/2021

Ruud Kockelkorn
CEO
PeachGroup B.V.
Ruud.kockelkorn@peachgroup.nl
www.peachgroup.nl

Maximilian Klein
Solution Consultant
mobileX AG
Maximilian.klein@mobilexag.de
www.mobilexag.de

mobileX AG

Team of 89 (75+14)

Used in > 40 countries

> 12.000 Users

> 7 Mio. Assignments / Year

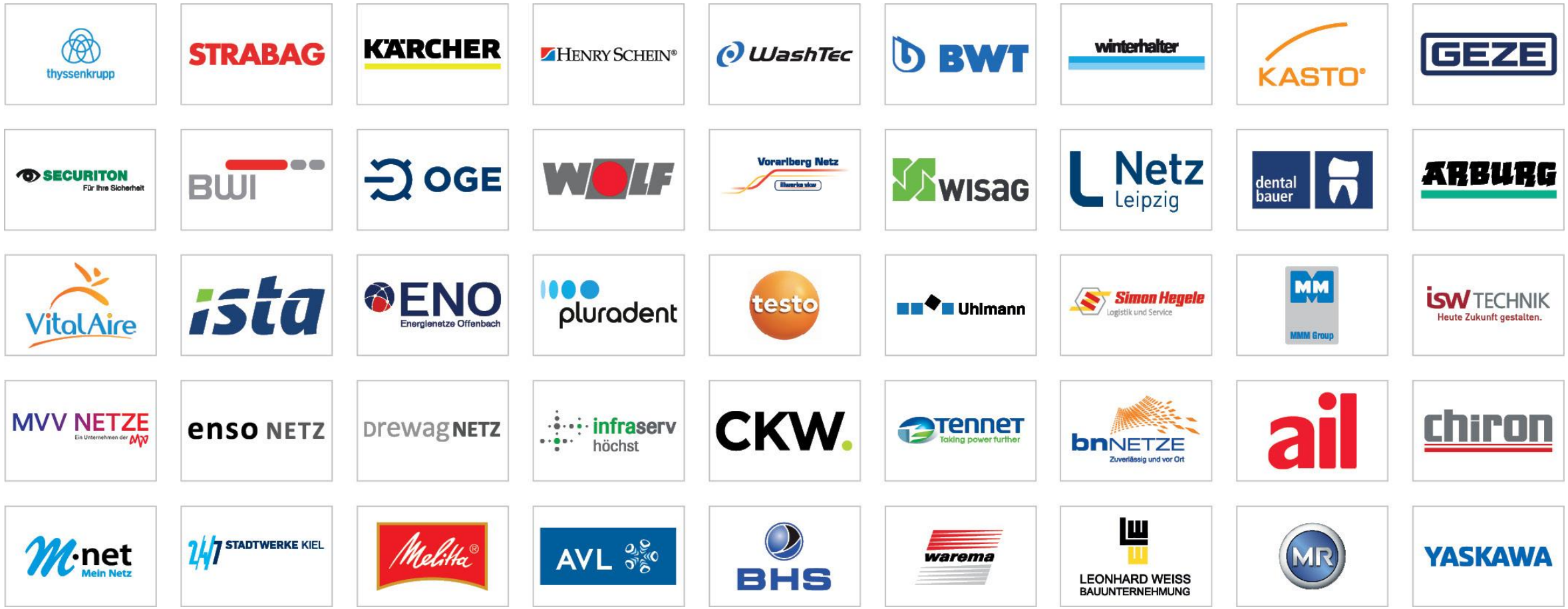
37 Years of Experience

mobile X

21 Years of Experience

PEACHGROUP

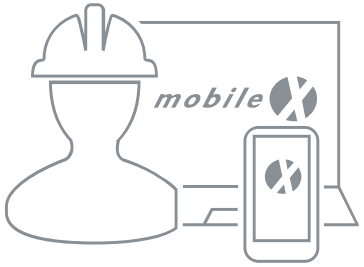
16 Years of Experience


thyssenkrupp
STRABAG
KÄRCHER
HENRY SCHEIN®
WashTec
BWT
winterhalter
KASTO
GEZE
SECURITON
Für Ihre Sicherheit
BWI
OGE
WOLF
Vorarlberg Netz
WISAG
Netz Leipzig
dental bauer
ARBURG
VitalAire
ista
ENO
Energienetze Offenbach
pluradent
testo
Uhlmann
Simon Hegele
Logistik und Service
MM
MMM Group
isw TECHNIK
Heute Zukunft gestalten.
MVV NETZE
Ein Unternehmen der MVV
enso NETZ
drewag NETZ
infraserv
höchst
CKW.
TenneT
Taking power further
bnNETZE
Zuverlässig und vor Ort
ail
chiron
M·net
Mein Netz
24/7 STADTWERKE KIEL
Melitta®
AVL
BHS
warema
LEONHARD WEISS
BAUUNTERNEHMUNG
MR
YASKAWA

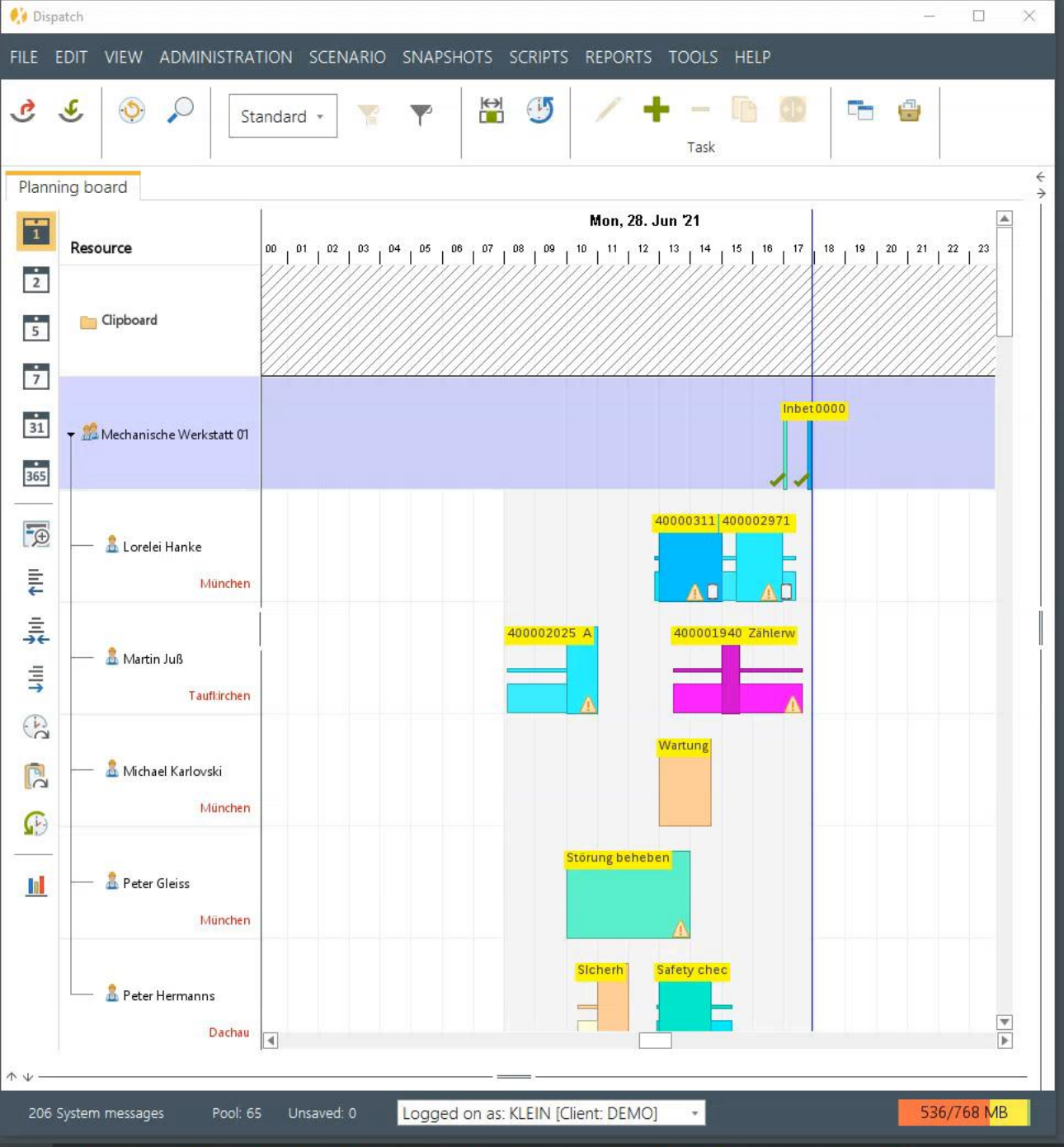
Coverage of the Service Process

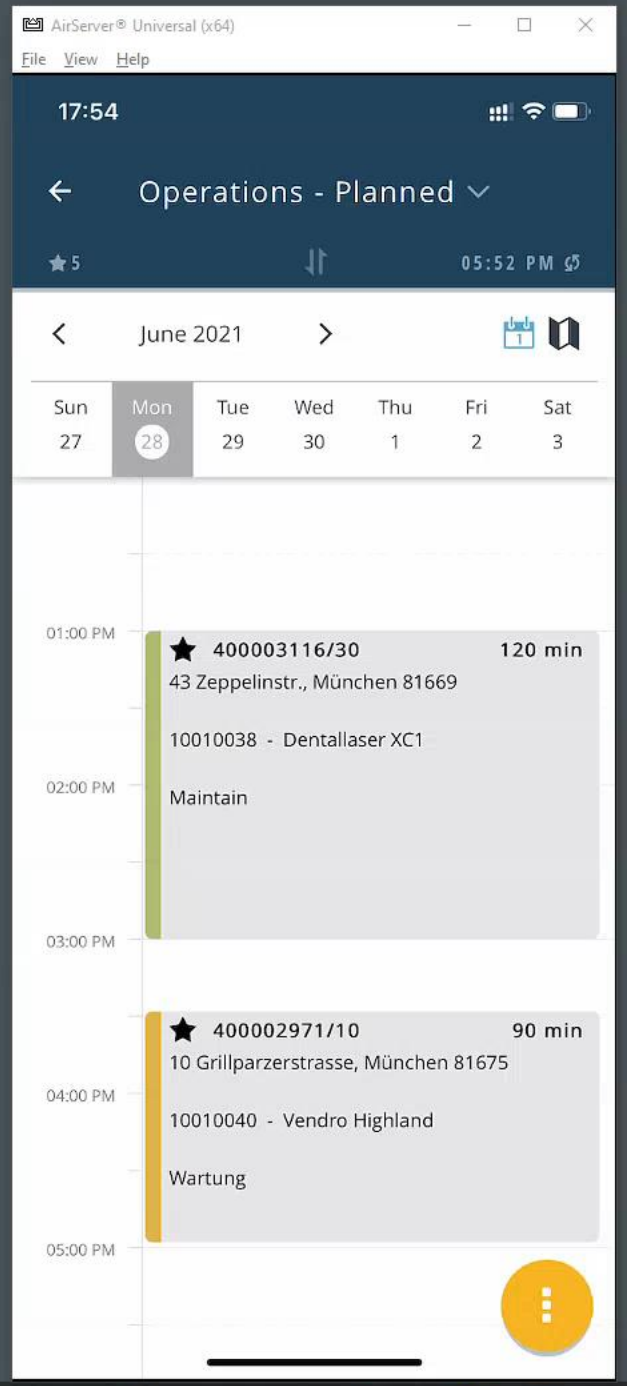
MX DISPATCH

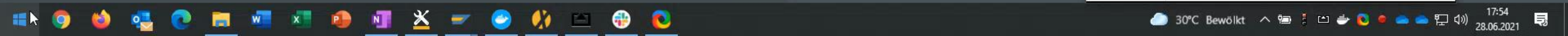
MX MIP



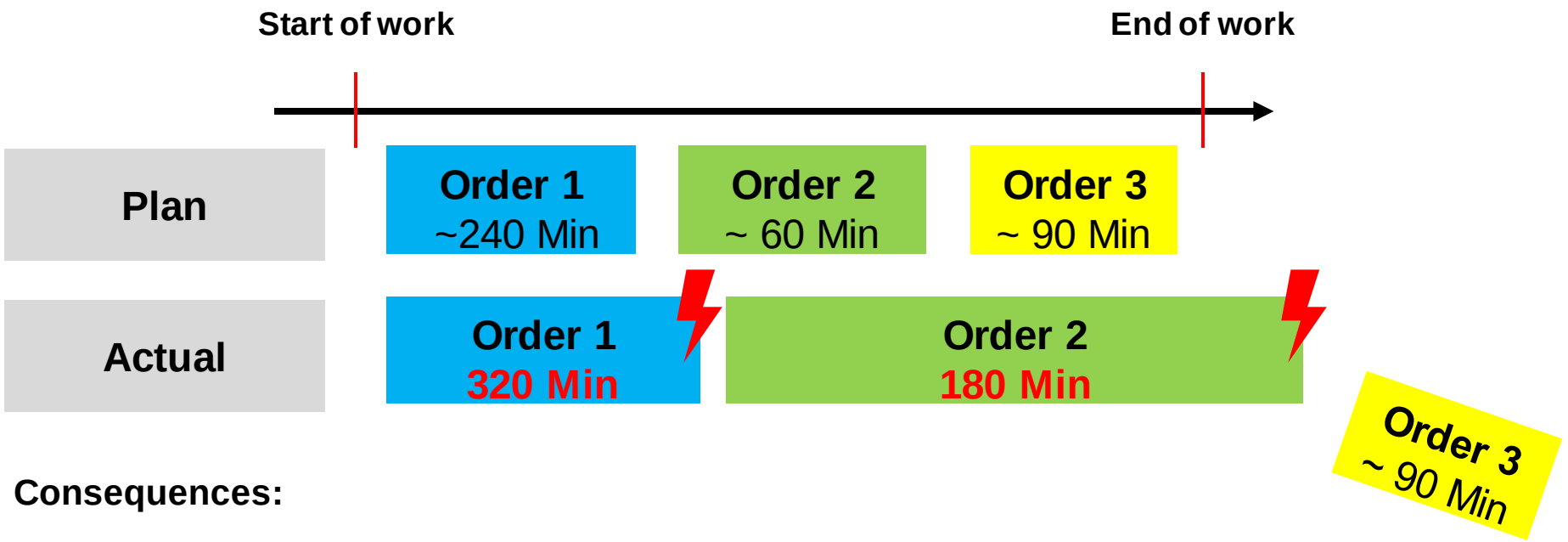
Service Order → Planning → Mobile Service → Control


Dispatch
FILE EDIT VIEW ADMINISTRATION SCENARIO SNAPSHOTS SCRIPTS REPORTS TOOLS HELP
Standard
Task
Planning board
Mon, 28. Jun '21
Resource
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Clipboard
Mechanische Werkstatt 01
Inbet0000
Lorelei Hanke
München
40000311
400002971
Martin Juß
Taufkirchen
400002025 A
400001940 Zählerw
Michael Karlovski
München
Wartung
Peter Gleiss
München
Störung beheben
Peter Hermanns
Dachau
SIcherh
Safety chec
206 System messages
Pool: 65
Unsaved: 0
Logged on as: KLEIN [Client: DEMO]
536/768 MB


AirServer® Universal (x64)
File View Help
17:54
Operations - Planned
5
05:52 PM
June 2021
Sun 27
Mon 28
Tue 29
Wed 30
Thu 1
Fri 2
Sat 3
01:00 PM
400003116/30
120 min
43 Zeppelinstr., München 81669
10010038 - Dentallaser XC1
Maintain
02:00 PM
03:00 PM
400002971/10
90 min
10 Grillparzerstrasse, München 81675
10010040 - Vendro Highland
Wartung
04:00 PM
05:00 PM


30°C Bewölkt
17:54
28.06.2021

Problem: Deviations from the planning time in day-to-day business



Consequences:

- Dispatcher has to reschedule (rescheduling causes much more effort than the original planning)
- Start of work on job 2 is delayed (customer must be informed)
- Order 3 can no longer be completed on the same day
- Technician has to work overtime

What would happen if you could predict the duration of service orders much more accurately?

What is Machine Learning?

> *Machine Learning can be broadly defined as computational methods using experience to improve performance or to make accurate predictions.*

— Mehryar Mohri, Foundations of Machine Learning (Adaptive Computation and Machine Learning Series)

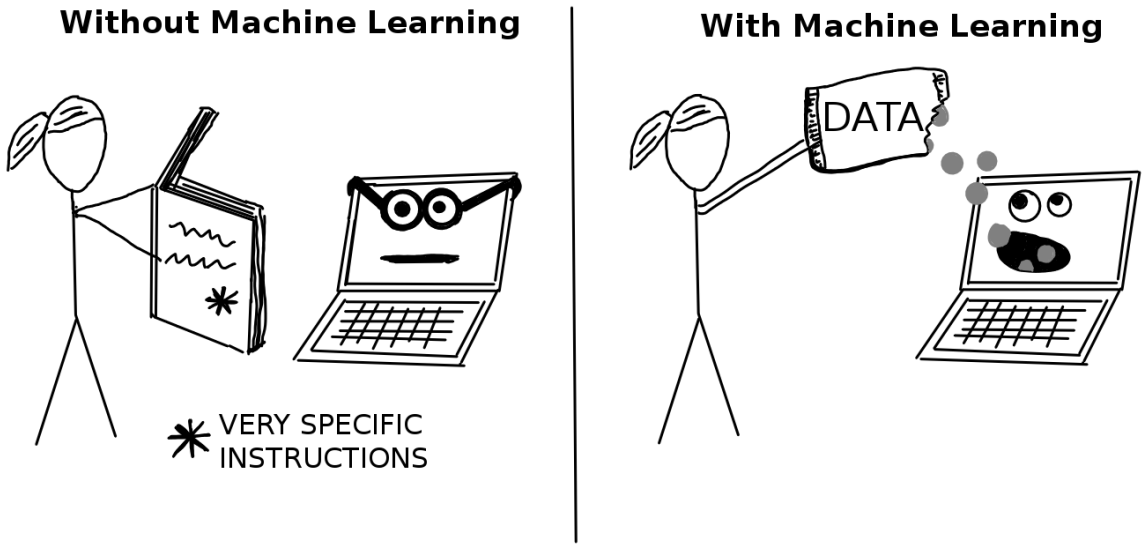


Image Source: https://christophm.github.io/interpretable-ml-book/terminology.html

What is Machine Learning?

What is Machine Learning?

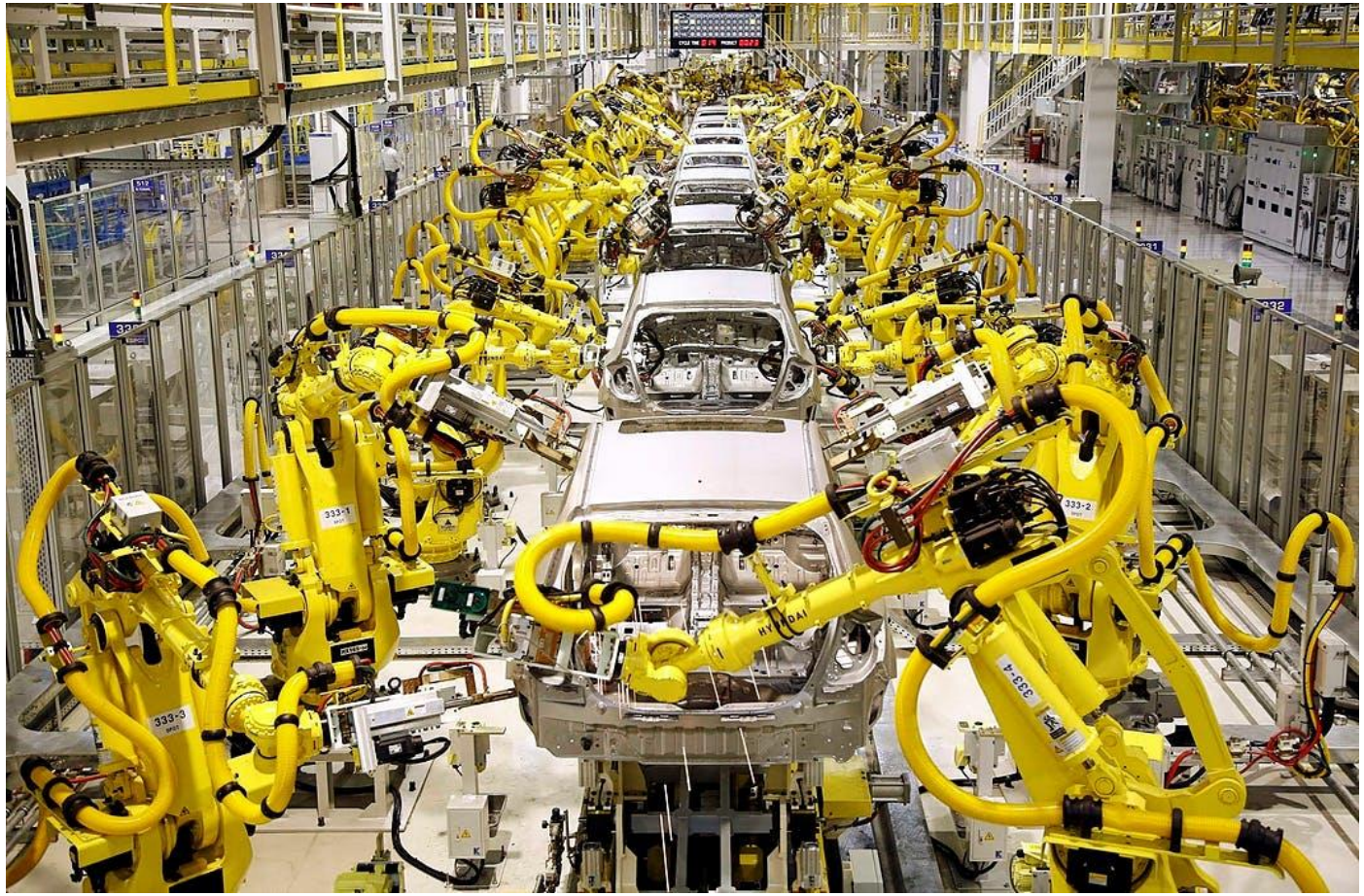
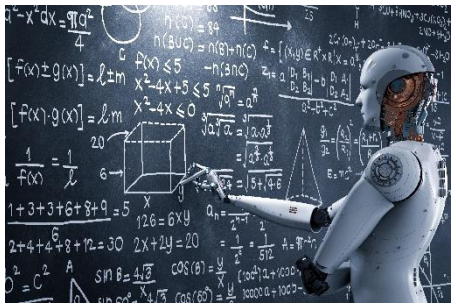


Image Source: https://hackernoon.com/five-successful-ai-and-ml-use-cases-in-manufacturing-ac3a30ol

Existing Business Cases



- **AI Powered Equipment failure prevention**

  Anamoly detection in oil temperatures to monitor and configure pumps. (case Schneider Electrics)

- **Deep leaning powered quality control**

  Deep learning approaches allow creating systems that achieve better perception than machine vision-based ones. By integrating high optical resolution cameras and GPUs with image classification, object detection, and instance segmentation algorithms, data engineers can create a precise AI inspection system to detect manufacturing defects.

- **Deep Learning-driven Product Design**

  General Motors, in collaboration with Autodesk, applied generative design algorithms to a seat belt bracket prototyping, which yielded in creating a product that is 40% lighter and 20% stronger than the original one.

Source: https://hackernoon.com/five-successful-ai-and-ml-use-cases-in-manufacturing-ac3a30ol

Existing Business Cases

- **Smart energy consumption**

  Being aimed to detect patterns and trends, ML models predict future energy consumption by processing and analyzing historical data. In this case, ML models rely on sequential data measurements, determined with the help of autoregressive models and deep neural networks. This ML approach gives a better understanding of how energy is being consumed at facilities, and optimizes manufacturing processes in a more data-driven way. For example, a Swiss corporation ABB provided manufacturers with an AI-driven platform to prevent peak-time energy costs.

- **Supply chain management**

  ML-based supply chain management software uses deep neural networks to analyze such data as material inventory, inbound shipments and work-in-processes, as wells as market trends, consumer sentiments, and weather forecasts. Continental, a German automotive supplier, utilized an AI-based solution to predict the optimal points for tire changes on commercial fleets, which allowed to optimize the stock of tires, increase up-time, and reduce maintenance costs.

Source: https://hackernoon.com/five-successful-ai-and-ml-use-cases-in-manufacturing-ac3a30ol

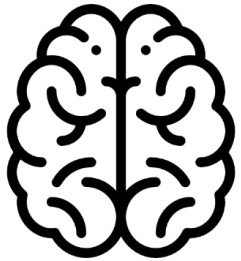
Solution: Forecasting service order duration with mobileX AI

Historical orders

Order data

- Actual times
- Customer
- Order object
- Order type
- Notification type
- Order address
- Weekday & time
- Material
- *Further data relevant for the order duration...*

Training of the algorithm with **as many** historical orders **as possible**



mobileX-AI

- Query based on existing order data
- Continuous training of the algorithm

Forecast of the **planning duration** based on all (!) historical data

New orders

Order data

- Predicted order duration
- Customer
- Order object
- Order type
- Notification type
- Order address
- Weekday & time
- Material

Testing of forecast quality within the scope of a PoC at three mobileX pilot customers

Historical order data

70%

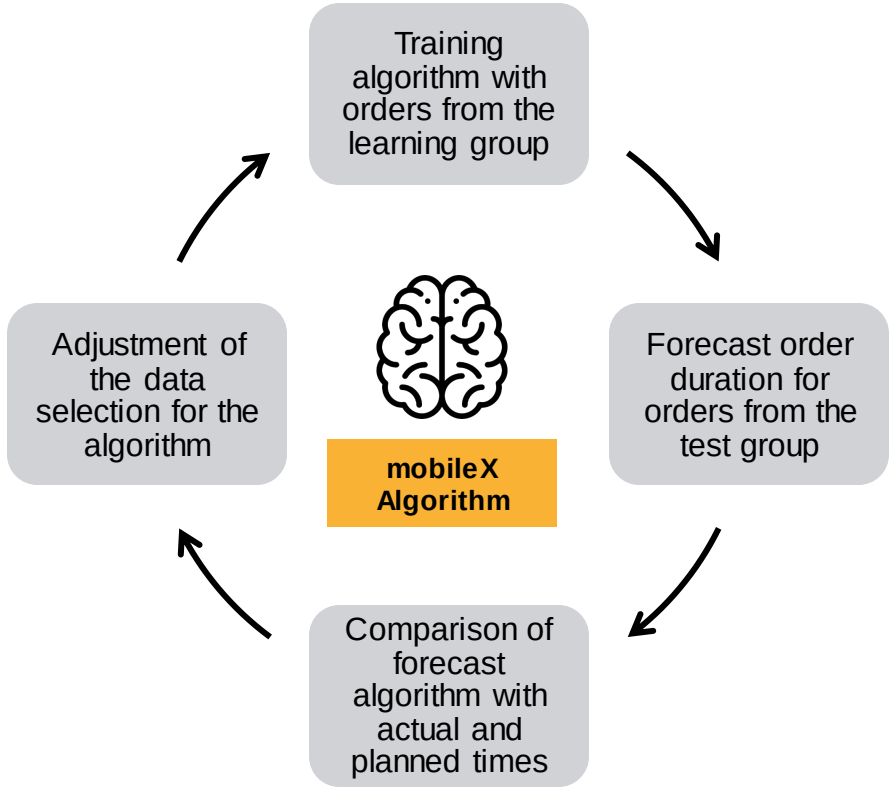
Learning group

- Definition of the individual order data relevant for the order duration
- Preparation of the data for the algorithm
- Training of the algorithm

30%

Test group

- Orders of the historical test group are "new" orders for the algorithm
- By comparison with existing planned and actual times of the orders, the forecast quality can be accurately determined



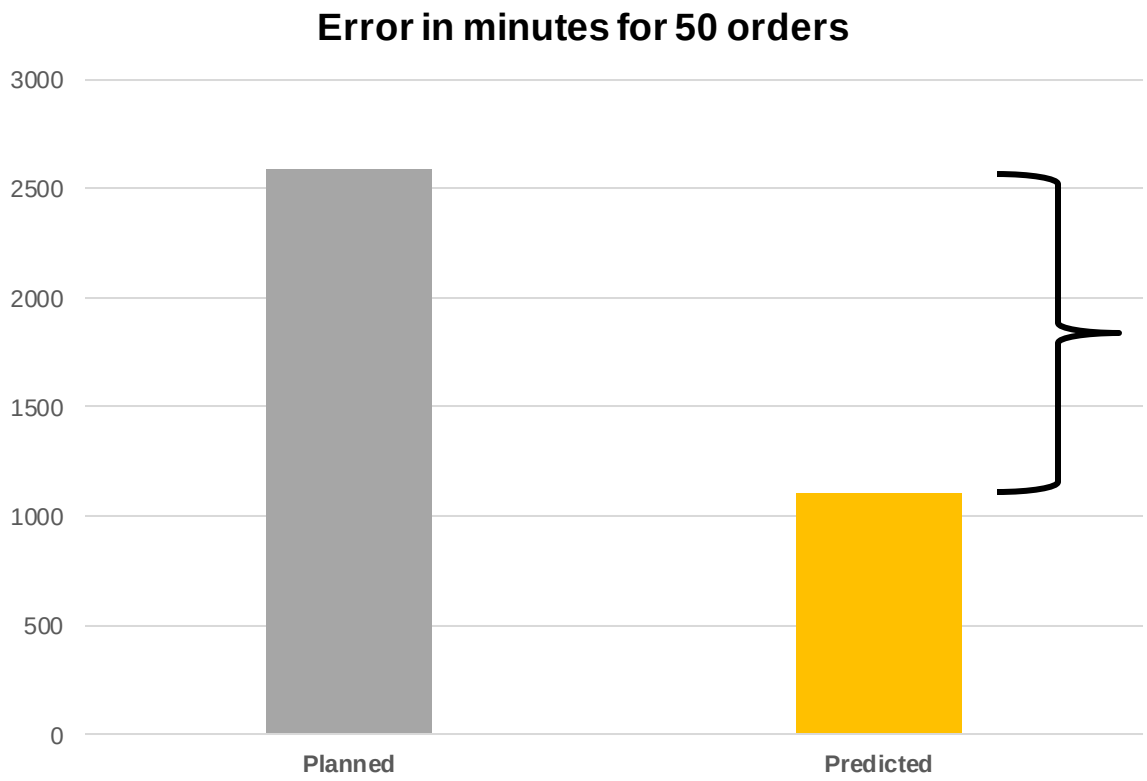
Result:
Improvement of the plan duration by 50%!

Evaluation results for 3 pilot customers

Data record	#Samples	#Features (Bin. columns)
A - Complete	96966	123
A - Incomplete	571414	130
B - Complete	10194	98
B - Incomplete	286471	127
C - Complete	16889	89
C - Incomplete	81918	99
Mixed - Incomplete	207001	179

Samples = Service orders
Features = Properties per service order (converted into machine-readable form)

Evaluation results for 3 pilot customers



As a result, the prediction of the planning duration by mobileX AI resulted in an average **50%** lower error rate!

Error rate = planned duration - actual duration
Sum of the errors = quality of the system, i.e. the smaller the sum the better

Example for improvement of service order plan duration

Frame parameters of service company:

- **Duration** of service order: **2** hours
- Number of **service orders** per year: **50,000**
- Number of **service hours** per year: **100,000**
- **Average error rate** in plan duration of service company: **20%**
- **Improved error rate** via **mobileX AI**: **10%**

➔ Yearly error sum of plan duration in regular plan duration is **20,000** hours

➔ **Improved** error sum of plan duration via **mobileX AI** is **10,000** hours.

➔ Forecasting using **mobileX AI** reduces the error sum by an average of **10,000** hours per year.

Potential benefits from using mobileX AI

Saving of working time in dispatching

Potential benefits from using mobileX AI

Saving of working time in dispatching

Optimization of the technician's workload

Potential benefits from using mobileX AI

Saving of working time in dispatching

Optimization of the technician's workload

Improvement of customer and employee satisfaction

Potential benefits from using mobileX AI

Saving of working time in dispatching

Optimization of the technician's workload

Improvement of customer and employee satisfaction

Eliminate effort for analysis of historical service order times