Towards Smart Organizations: Big Data- & Artificial Intelligence-driven Solutions in IoT Era

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Digitalization

- Blockchain
- Machine Learning (ML)
- Artificial Intelligence (AI)
- Analytics
- Big Data
- Internet of Things (IoT)
Internet of Things (IoT)
IoT, the networked connection of people, things, data, and process

- **Data**: Leveraging data into more useful information for decision making
- **Things**: Physical devices and objects connected to the Internet and each other for intelligent decision making
- **People**: Connecting people in more relevant, valuable way
- **Process**: Delivering the right information to the right person (or machine) at the right time
IOI Device

Device + Computational Intelligence + Network Connection → Intelligent Device

IoT Device
IoT Network Connectivity: Technology

Maximum Throughput, Power source, and Range
IoT Architecture: from Device, Edge/Fog, to Cloud
**Physical Devices & Controllers**
(The “Things” in IoT)

**Connectivity**
(Communication & Processing Units)

**Fog/Edge Computing**
(Data Element Analysis & Transformation)

**Data Accumulation**
(Ingestion & Storage)

**Data Abstraction**
(Aggregation & Access)

**Application**
(Reporting, Processing, and Analytics)

**Collaboration & Processes**
(Across Different Industries)

**Captures Data & Stores**

**Reduction & Convert Data into Ready to Store & Process Data**

**Adapts Multiple Data Formats & Ensures Consistent Semantics**

**Interprets Data, Monitors, Controls, Reports Based on Analysis**

**Consumes and Shares the Application Information**

**Generating Data**
# IoT Use Cases

## Smart Energy
- Smart meters
- Digital oil field
- Delivery
- Refinement
- Wind/solar management

## Connected Assets
- Asset tracking
- Asset insights
- Smart car
- Usage-based insurance
- Remote monitoring

## Smart Health
- Hospital-Centered System
- Patient-Centered System
- Wearable sensors
- Anomaly prediction

## Connected Markets
- Market insights
- Product recommendation

## Smart People Building & City
- Smart waste management
- Smart water
- Smart building accessories e.g., lock
- Smart traffic management

## Connected Factories
- Predictive maintenance
- Digital twins
- Quality assurance
- Product insights
- Supply networks
- Inventory optimization

## Management, Processing, Analytics, and Machine Learning

## Data Ingestion & Storage: IoT/Event/Stream Hub and Data Lake
Big/Smart Data
What is Big Data?

**3 V’s**
- **Volume**: Terabytes of data
- **Velocity**: Batch, real-time, stream processing
- **Variety**: Structured, unstructured, semi-structured

**Structured**
- CSV, Columnar Storage
- Strict data model structure

**Unstructured**
- Audio, video, images
- Meaningless without adding some structure

**Semi-Structured**
- JSON, XML, sensor data, social media, device data, web logs
- Flexible data model structure
Why Do You Need Big Data Solution

- Old Technology was based on a **Problem Driven** Methodology
  - Save some specific data
  - Archive and never visit the rest again
  - SQL Databases (e.g., SQL Server)
  - Schema on Write (Extract, Transform, Load (ETL)): Structured is applied to the data only when it’s **Write**!

- New Technology is based on a **Data Driven** Methodology
  - Store all the data!
  - Extract value from data
  - No-SQL Databases (e.g., Hadoop)
  - Schema on Read (Extract, Load, Transform (ELT)):
    - Structured is applied to the data only when it’s **Read**!
Artificial Intelligence & Machine Learning
What is Artificial Intelligence?(I)

AI is applied when a machine mimics cognitive functions that human associate with other human minds such as learning and problem solving.

Understands
Learn and understand text, voice, image, etc.

Reasons
Based on learn phase, it concludes, and solves problem.

Interacts
Bridge the gap between man & machine.
What is Artificial Intelligence?(II)

Artificial Intelligence (AI)

- Reinforcement Learning
- Learning on chip/edge
- Cognitive
- Vision
- Speech
- Natural Language Processing (NLP)

Data Science

- Rule engine
- Customer analytics
- Risk scoring
- Visualization

Machine Learning (ML)

- Predictive analytics
- Data based classification models

- Fuzzy logic

• Use of statistical methods to find patterns in data
• Processes and systems to extract knowledge or insights from data

• Infuse intelligence to machines
• Mimic human intelligence
Five years ago, we struggled to find 10 AI-driven IoT-based business applications.

In five years, we will struggle to find 10 that don’t!
Blockchain
When IoT met Blockchain

What is Blockchain?
A digital ledger or a database with a single version of the truth that maintains a continuously growing list of data records or transactions.

**SHARED PUBLICLY**
Servers of nodes maintain the entries (blocks) and every node sees the transaction data stored in the blocks when created.

**DECENTRALIZED**
There is no central authority required to approved transactions and set rules.

**SECURE**
The database is an immutable and irreversible record.

**TRUSTED**
Distributed nature of the network requires computed servers to reach a CONSENSUS, which allows for transactions to occur between unknown parties.

**AUTOMATED**
The software is written so that conflicting or double transactions do not become written in the data set and transactions occur automatically.

**GROWING APPLICATIONS**
It can be used more than the transfer of currency; contracts, records, and other kinds of data can be shared.
Logistics
(Artificial Intelligence Driven IoT Solutions for Logistics)

Predictive Maintenance (PM)
(Artificial Intelligence Driven Maintenance: From Device, Edge, To Cloud)

Customer Analytics
(Artificial Intelligence Driven Omni-channel Customer Journey: From Awareness, Purchase, Service, to Loyalty)
In a general business sense, logistics is the management of the flow of things between the point of origin and the point of consumption in order to meet requirements of customers or corporations.
IoT in Logistics

The use of IoT results in better efficiency

- Real-time asset & fleet management
- Inventory tracking & analytics
- Cargo integrity monitoring
- Smart labels

- End-to-end visibility to delivery process
- Environmental Intelligence & Storage conditions control
- Workforce monitoring
- Smart Energy Management
CASE: Port of Rotterdam- IoT to Digitize Operations

PROBLEM
As the largest port in Europe, the Port of Rotterdam handles over 461 million tones of cargo and more than 140,000 vessels annually. The port relied on traditional radio and radar communication between captains, pilots, terminal operators, tugboats and more to make key decision on port operations. To improve the efficiency and safety, the port would like to begin its digital transformation.

SOLUTION
Sensors are being installed across 42-kilometers of land and sea - spanning from the City of Rotterdam into the North Sea - along the Port’s quay walls, mooring posts and roads. These sensors will gather multiple data streams including water (hydro), weather data, tides and currents, temperature, wind speed and direction, water levels, berth availability and visibility. A centralized dashboard application collects and process real-time sensor readouts.

RESULT
Port of Rotterdam operators will also be able to view the operations of all the different parties at the same time, making that process more efficient. In fact, shipping companies and the port stand to save up to one hour in berthing time which can amount to about 80,000 US dollars in savings.
CASE: DHL- Item-level Tagging

PROBLEM
With critical cargo and packages, DHL wants it shipped without any problems. And when problems do occur, DHL needs to know why. With sensitive loads pharma-products, it’s important to maintain a stable environment to prevent spoilage and adhere to environmental regulations and also validate the shipment process to comply with regulation.

SOLUTION
• DHL Smart Sensor RFID: measures temperature data during the course of transportation
• DHL Smart Sensor GSM: measures temperature, location, humidity, shock and light data during the course of transportation

RESULT
• Real-time visibility to the LOCATION
• Quality & integrity control for sensitive goods
  • ENVIRONMENTAL conditions monitoring
• Transparency with customers in real-time
• Security of the packages
• Supply chain optimization
CASE: FedEx’s IoT Response to Supply Chain Optimization

**PROBLEM**

According to FedEx: Visibility is a prerequisite to logistics and supply chain agility and responsiveness. It requires tracking the location of a shipment not only at the transportation level, but also at a unit and item level. Location tracking is good protection against shipment theft or loss, but companies need a deeper level of visibility for their packages.

**SOLUTION**

FedEx developed IoT-inspired SenseAware, a sensor-based logistics (SBL) solution. SBL uses sensors to detect the shipment’s environmental conditions while warehoused or in transit and sends the data — via wireless communication devices — to a management software system where the data is collected, displayed, analyzed and stored.

**RESULT**

SBL provides intelligence that can help enterprises coordinate and manage product, information and financial flows.
Big data in Logistic

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<td>Strategic Network Planning</td>
<td>Risk Evaluation &amp; Resilience Planning</td>
<td>Anomaly Detection</td>
<td>Operational Capacity Planning</td>
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ORION—or On-Road Integrated Optimization and Navigation—is a route-optimization system that analyzes a collection of data points including the day’s package deliveries, pickup times, and past route performance to create the most efficient daily route for drivers.

UPS saves US$50 million a year by reducing daily travel resulting (on average six miles daily for each driver) resulting in significant fuel savings.
**CASE: DHL Resilience360**

**Problem:**
- Natural disasters, adverse weather, political unrest, cargo theft – all these events can cause disruption in a supply chain and logistics
- DHL needs a solution to provide insight into risk events and their impact on increasingly complex supply chains and help identify risk bottlenecks and supply chain pain points using historic and forward-looking risk information

**Solution:**
- DHL Resilience360 is an innovative, cloud-based supply chain risk management platform that helps companies to visualize, track and protect their business operations
- The solution facilitates intuitive supply chain visualization, tracks shipments and ETAs across different transport modes and enables near real-time monitoring of incidents capable of disrupting supply chains
- DHL solution easily integrates with business systems and helps companies keep track of risk in combination with their business performance indicators. It enables companies to better ensure business continuity, building risk profiles based on over 30 risk databases
CASE: Amazon - Anticipatory Shipping

✓ Demand Forecasting

✓ Outsource the shopping list to an algorithm so you don’t need to worry about it
✓ An advanced prediction technique to anticipate customer demand for specific products, in specific locations during specific time-ranges (Demand Forecasting)
✓ Prediction-based inventory adjustments
✓ Deliver products to customers before they place an order.
CASE: Porsche- Predictive Scheduling

✓ Porsche uses AI and Data Analytics to Forecast Your Waiting Time at each Electric Car Charging Station
Artificial Intelligence in Logistic

- Quality Control
- Anomaly Detection
- Workforce Monitoring
- Security
Quality control
- Surface defects - scratches, cracks, integrity
- Dimensional control relative to standards/tolerances
- Packaging - shape, color
- Verification of the presence of the logo

Automatic sorting packages
- Size, color, etc.

Augmented reality for safety & order picking
CASE: Axel Springer

Speed is everything. News is only news if it is fresh, not if it is old hat. Axel Springer (Das Bild, Die Zeit, etc.) is replacing laser scanners with image-based ID reading equipment from Cognex.
CASE: Caterpillar’s Driver Fatigue Avoidance and Management.

**Problem:**
Intense schedules, remote locations, long hours and repetitive tasks leave mining equipment operators especially prone to the dangers of fatigue. Even the smallest lapse in concentration can put operational people at risk and cost millions of dollars to the owners.

**Solution:** in collaboration with seeing machines a holistic video analytic platform is implemented that:
- Alerts operators the instant that they stop paying sufficient attention to vehicle operation
- Real-time event data is then transmitted to a specialist 24-hour facility where trained personnel can implement best practice risk mitigation processes
Blockchain in Logistic

- End-to-End Visibility
- Smart Contract
- Payment Integration
- Inventory Management
End-to-End Visibility into Delivery Process (Blockchain)

- **End-to-end visibility**
- **Traceability & transparency**
  - **Entire view**
  - **What, when, where!**
  - **How**
- **Smart contract**
- **Reduce delays from paper work**
- **Identify issues faster**
- **Safer transaction**
- **Improve inventory management**
- **Payment integration**
- **Reduce error and fraud**

**Blockchain**

**Producer**
- Sheep are equipped with suitable tag
- Load data on sheep, fodder, medicine, conditions, etc. to blockchain

**Haulage**
- Informed about origin and destination
- Given instruction how to store & transport
- Add smart tag to each sheep

**Processing Plant**
- Get information about required cuts & type of sausage!
- Add QR code to each package and upload information to blockchain

**Distributor**
- Informed about origin and destination
- Given instruction how to store & transport
- Add smart sensors (location | condition) to each package

**Retail**
- Transparency on all the supply chain e.g., delivery time, etc.
- Can adjust orders, price, etc.

**Customer**
- Scan QR code and check it in blockchain
- Gain detailed insight into the sausages e.g., origin, logistic, storing/transferring condition, etc.
CASE: Walmart; From Farm to Fork!

**Problem:** participants in the food industry supply chain each have their own information silos. Food can only be traced one step at a time.

**Solution:** Walmart and IBM began collaboration on a blockchain to accurately record the following:
- Farm origin data
- Batch number
- Factory and processing data
- Expiration dates
- Storage temperatures
- Shipping details

**Result:** Food tracking that would usually take seven days could be done in 2.2 seconds with blockchain.
CASE: Maersk

Problem:
- One shipment from East Africa to Europe can go through nearly 30 people and involve more than 200 different communications
- One lost form or late approval could leave the container stuck in port
- Documentation can be as much as a fifth of the total cost of moving a container

Solution: In collaboration with IBM, Maersk is developing a blockchain platform to achieve:
- **A shipping information pipeline**: end-to-end supply chain visibility to enable all actors involved in managing a supply chain to securely and seamlessly exchange information about shipment events in real time
- **Paperless Trade**: digitize and automate paperwork filings by enabling end-users to securely submit, validate and approve documents speeding up approvals and reducing mistakes
Predictive Maintenance (PM)

(Artificial Intelligence Driven Maintenance: From Device, Edge, To Cloud)
An unreliable machine results in waste of time, money, and very bad impression.
and unfortunately sometimes so many lives
That is why, we preventively keep maintaining ALL PARTS!!! Considering the fact that we cannot forecast which part will fail in future!
What is Predictive Maintenance?

Traditional Corrective Maintenance
- Faults are reported by end-user
- Afterwards, inventory and the team should be scheduled and dispatched

Time:

Real-time Monitoring (IoT)
- Faults are detected by connected sensors in near real-time
- Afterwards, inventory and the team should be scheduled and dispatched

Time:

Machine Learning (Prediction)
- Faults are predicted before they really occur
- There is enough time to schedule the team and inventory in advance

Time:
Business Statistics

20%
- Total cost of poor quality amounts to 20% of sale (American Society of Quality)

5%-20%
- Poor maintenance strategies can reduce plant capacity by 5-20% (Deloitte)

$50 Billion
- Unplanned downtime costs manufacturers approximately $50 billion per year (Deloitte)

2%-3%
- Warranty costs to companies amount to approximately 2-3% revenues (Warranty Week)

Up to 16%
- Up to 16% of manufactures have adopted IoT strategies! (McKinsey)

5%-40%
- Predictive Maintenance reduces the cost by 5%-40% (McKinsey)

3%-10%
- Predictive Maintenance reduces the equipment capital investment (3%-10%) by extending the life time of the machine (McKinsey)
Reliability Model of a Machine over Time (Bathtub Curve)

1 Early Life
- Machine learning based root-cause analysis is used to improve the manufacturing process and the quality of products

2 Normal/Random
- Machine learning driven maintenance is usually used in this phase
- Machine learning can
  - Postpone the wear-out
  - Forecast the failure
  - Change unplanned maintenance to planned maintenance

3 Wear-out
- To comply with the specification and manual of the machine, it is recommended to perform a maintenance at this phase
Business Value for Predictive Maintenance

**Standard (Planned) Maintenance**

- 5 weeks
- 5 weeks
- 5 weeks
- 5 weeks
- 4 services
- 5 weeks
- 5 weeks
- 5 weeks
- 5 weeks
- 4 services

**Predictive Maintenance**

- 15 weeks
- 5 weeks
- 2 services
- 10 weeks
- 4 weeks
- 6 weeks
- 3 services

- Understand nature and nurture of each machine
- Dynamically schedule the maintenance services
- Customize the maintenance service for each machine individually
## Use Cases of Predictive Maintenance

### Aerospace
- When this component of airplane will fail?
- How much delay will cause due to a specific mechanical issue?

### Utilities
- Which/when breakers of the smart grid will be broken?
- Which/when my vending machine or ATM will fail?
- What is remaining useful life of my machines?

### Manufacturing
- What is the root cause of this failure?
- How can I decrease my warranty cost?
- How can I create a new business model e.g., pay per use?
- How can I spend my maintenance wisely?

### Transportation & Logistics
- When do I need to replace my break disk?
- Which/when will elevator doors fail?
- How can I reduce the high costs of unscheduled maintenance of cranes?

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**Machine Learning (Predictive Maintenance)**

**IoT/Event/Stream Hub and Data Lake**
Benefits of Predictive Maintenance

- Opportunity to analyze real-time monitoring data
- Maintenance costs can be reduced because of better planning; parts can be ordered and shipped in advance without disrupting the equipment run time
- Unscheduled downtime can be significantly reduced thereby leading to improved productivity and output
- Product inventory maintenance based on upcoming maintenance
- Operations & Maintenance teams can address equipment issues before they become problems and significantly affect operations
- OEMs and operators can fix the issue in the first visit, since they already localized the root cause of the problem remotely!
- OEMs can reduce the warranty cost by root cause analysis methods to improve the production line accordingly
- OEMs can have new business model e.g., offer pay per use!
Machine Learning Overview

Ingestion, Cleaning, & Fusion → Noise Removal & Feature Engineering → Reinforcement Learning (user feedback) → Failure & Remaining Useful Life Prediction

Anomaly Detection
- Unsupervised Learning
  - Autoencoders
  - Principal Component Analysis

Supervised Learning
- Regression
- Classification

Deep Learning
- Recurrent Neural Network

Data Set
- Sensor Data (Machine Operation Data)
- Business Data (e.g., Maintenance History)
- Environmental Data
  - Operation Conditions (Geo-temporal Related)
  - Operator Features
  - Machine Features

Real-time Dashboard
- Health Scores
- Remaining Useful Life (RUL)
- Create Alarm & Notification
- Create Maintenance Ticket
- Change Product Spec
- Alter Maintenance Schedule
- Recommend Services
- Find “bad” Suppliers
- Inventory Optimization

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Classification vs Regression Techniques

- **Regression**
  - It is used to find “Remaining Useful Life (RUL)” of the machine based on the given inputs (e.g., sensor data)
  - How many more cycles the machine can work?

- **Binary Classification**
  - Classify/categorize the future status of the machine based on the given inputs such as sensor data
  - Will the Machine fail in next \( w \) cycles (time)?

- **Multiclass Classification**
  - Will the machine fail within the window \([1, w_0]\) cycles or fail within the window \([w_0+1, w_1]\)?

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**Regression**
Find: \( Y=f(x) \) e.g., \( X = \text{input} = \text{Sensor data}, \ Y = \text{output} = \text{RUL} \)

**Classifier (Decision Tree)**
Input: Sensor data; Group1 (Will fail): ◯ Group2 (Will not fail): ●
Anomaly Detection (Autoencoders)

- It is typically used for the purpose of dimensionality reduction.
- Output layer having the same number of nodes as the input layer, and with the purpose of reconstructing its own inputs.
- Do a feed-forward pass to compute activations at all hidden layers, then at the output layer to obtain an output $x'$. Measure the deviation $x'$ from the input $x$ (typically using squared error).
- The algorithm is trained to learn the normal behavior of your data.
- Having a distribution of the reconstruction error, if the value of the error does not lie in a right-sided (upper) confidence interval with confidence level $\alpha$ it is marked "faulty".

Human brain consists of millions of neurons

Autoencoders consist of several digital neurons
# A Real Life Demo

## Machine: Aircraft engine

Data Provider: NASA

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<td>0.32401</td>
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<td>0.32401</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Jet Engine ID**

**Time (cycle)**

**Data** (e.g., sensor, setting, config, maintenance history)

**Binary Classification**

**Multi-class Classification**

**Remaining Useful Life**

1 or 2: Alarm
1: Warning
0: Ok
Accuracy Results of Binary Classification

Accuracy depends on so many parameters such as:

- Predefined window size (how many cycles in advance we want to create an Alarm)
- Machine learning algorithms and the corresponding complexity
- Size and quality of data
- How the missing values are handled

Beside Accuracy, we need to consider Precision, Recall, and F-score
5 Risks

- 3 Machines need maintenance in 2 weeks
- 2 Machines will fail in 1 day

Machine Capacity

- Machine Capacity Chart

Performance

- Probability of Failure:
  - Machine #1: 74%
  - Machine #2: 63%
  - Machine #3: 32%

Maintenance Cost

- Current Maintenance Cost: $99,999
- Under Target: 16%

Maintenance Tickets

- 2 Days Ago: Machine #3, MON 00/00
- 3 Days Ago: Machine #102, TUE 00/00
- 10 Days Ago: Machine #308, FRI 00/00

Remaining Useful Life

- Category 1
- Category 2
- Category 3
- Category 4
Engagement Methodology

1) **Scope**
   (1-2 weeks)
   - Define Scope
   - Find Critical Points with help of stakeholders
   - Prepare Operation & Maintenance Manual
   - Practical Predictive Maintenance Methodology

2) **Analysis**
   (4-8 weeks)
   - Design Architecture (Sensor, Edge, Cloud)

3) **Implementation**
   (3-12 months)
   - Implementation of Sensors, Edge, Connectivity
   - Find best machine learning algorithm
   - Scale the machine learning algorithms
   - Cloud: ingestion, storage, processing, visualization

4) **Test**
   (2-6 months)
   - Periodic measurement of parameters
   - Acceptable Results?
   - Evaluate the system
We Tailor and Customize the Solution for You

There is no one-approach-fits-all

Each Predictive Maintenance is unique
Customer Analytics

(Artificial Intelligence Driven Omni-channel Customer Journey: From Awareness, Purchase, Service, to Loyalty)
Are you ready for AI-driven IoT-based CUSTOMER JOURNEY!?
AI, ML, and Big Data give you a 360 degree view over your business and customers.
AI, ML, and Big Data for Customer Analytics and Digital Transformation
AI, ML, and Big Data Deliver Omni-channel Insights

- 85% of generated data by 2020 are unstructured!
- AI, ML, and Big Data techniques can rapidly correlate, aggregate, and analyze your data and gain actionable insights
- AI, ML, and Big Data techniques can quickly combine and enrich your existing data sets with 3rd party data
The Evolution from Single-channel to Omni-channel

- Customers experience a single type of touch-point
- Retailers have a single type of touch-point

- Customers see multiple touch-points acting independently
- Retailers' channel knowledge and operators exist in technical & functional silos

- Customers see multiple touch-points as part of the same brand
- Retailers have a single view of the customers but operate in functional silos

- Customers experience a brand not a channel within a brand
- Retailers leverage their single view of the customer in coordinated and strategic ways
Brand Monitoring (I)
Social Network and Sentiment Analysis

Social Media Assessment
- Are we invest on right marketing channels
- What is the “share of voice” and “reachability” of our marketing strategy

Social Media Discovery
- Find meaningful insight about prospective customers
- Discover new ideas, trends, etc.
- Topic analysis
- What users say about our brand and campaign?
- Sentiment analysis

Social Media Segmentation
- What kind of audiences we have?
- Geographic, demographics
- Influence score
- Recommenders

Assess
Segment
Discover

✓ Improve customer satisfaction
✓ Identify patterns and trends
✓ Make smarter decision
Brand Monitoring (II)
Social Network and Sentiment Analysis

Share of voice (Author) by gender

Distribution of gender across geographic

Sentiment by gender

The trend (#mention) of the brand over time in different channels
Brand Monitoring (III)
Social Network and Sentiment Analysis

can exhaust featuring bigger html bit cnn
Sport cool youtube don’t comment
cnnmoney overview davidcward Sam
twitter
scene July hotel finance AOK million march
Action public answer iot pic days AI drone
Qualcomm
Automatically thanks round public ces data
Okay

Context of discussion

Influence of social media authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Share of voice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sara</td>
<td>20.808%</td>
</tr>
<tr>
<td>Alex</td>
<td>12.203%</td>
</tr>
<tr>
<td>Tara</td>
<td>11.309%</td>
</tr>
<tr>
<td>Nick</td>
<td>9.503%</td>
</tr>
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</table>

PIROUZAN GROUP
Product/Service Recommendation
What else are you interested in?

Cross-selling & Collaborative Filtering

Upselling & Item Hierarchy

Content-based Filtering

You and your friend like angry bird in Facebook

Social Interest Based

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Love Story
Love story

Titanic

PIROUZAN GROUP
Real-life scenarios

- Female: 99%
- Age (25-30): 95%
- Happy: 97%
- Sarah O'Connor: 98%
- Last visit: 7.8.2018
- Gold Customer
- Interest: Gucci, Armani
- Birthday: 21.03.1984
- Single
- Address: Dusseldorf

- Can be combined with other source of data e.g., CRM, Social networks, etc.
- Loyalty program
- Customer satisfaction
- Upselling/Product Recommendation
- Tailored marketing
Location-based Service
AI-driven Beacon (I)

Bluetooth Beacon transmit small packets of data

Immediate
Near
Far

... Which wake up an application on your mobile device and lets you to calculate your location and PROXIMITY to the Beacon.
AI-driven Beacon (II)

**Beacon**
- BLE transmission

**Mobile App**
- Sends contextual data (User, Device, Application & Location) to cloud
- Display tailored context-aware profile-based message to users (received from cloud)

**Data Ingestion**

**Cloud**
1. Trace Apps/Users
2. Combine beacon data with CRM, marketing, and other sources of data
3. Create User Specific Experiences (tailored proximity and profile-based marketing/info/message)
4. Geofence analytics (how many visitors, gender of visitors, time spent by users, pick time)
5. Perform location/traffic pattern analytics
6. Perform Demographic Analysis
7. Category management & heatmap (which products get more attention)
How Categorize Customers (Customer Segmentation)?

We need to spend our budget in a wise way!

**RFM Model**

<table>
<thead>
<tr>
<th>Recency</th>
<th>Frequency</th>
<th>Monetary Value</th>
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<tbody>
<tr>
<td>5 days ago</td>
<td>3x month</td>
<td>EUR 120</td>
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- **Current Value**
  - High potential value
    - High Current Value
      - Keep These Customers
  - Low potential value
    - Low Current Value
      - Grow These Customers
      - Should you spend money here?

- **Potential Value**
  - High potential value
    - Low Current Value
    - Grow These Customers
How Much is Your Future Business Worth?
Focus your marketing focuses on most valuable customers!

- Build a model that predict the customer group of a new customer

**Data Set**
- Demographics (e.g., Age, Gender, Income)
- Transactions

**Classification (e.g., Random Forest)**
- Nina: Silver
- Sarah: Platinum
- Tara: Silver
- Katrin: Gold
- Sam: Platinum

**Regression**
- Nina: $2,132
- Sarah: $1,200
- Tara: $3,750
- Katrin: $10,000
- Sam: $950

- 80% of your business comes from 20% of your customers
- It costs 10x less time to sell to an existing customer than finding a new customer
Are you Happy with me? (Churn Analysis)(I)
Find unsatisfied users and predict customer churn!

We need to find unsatisfied users, or they go to our competitors

Data Set
- Demographic
- History
- Transaction
- Social medias
- Surveys

Only 10% of customers answer to surveys

<table>
<thead>
<tr>
<th>Customer</th>
<th>SAT. Score</th>
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<tbody>
<tr>
<td>Nina</td>
<td>1.1</td>
</tr>
<tr>
<td>Sarah</td>
<td>2</td>
</tr>
<tr>
<td>Tara</td>
<td>4.3</td>
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<tr>
<td>Katrin</td>
<td>5</td>
</tr>
<tr>
<td>Sam</td>
<td>3.5</td>
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Are you Happy with me? (II)
ML-driven incentives recommendation and loyalty program engine

1. Based on attrition and satisfaction score, we can detect which customer is willing to leave us!
2. Marketing and support team to reach customer with an offer that makes them stick with us!
3. We need to find an appropriate offer for each person, since different customers react differently to different offers (longer warranty, coupon)

- Sam: Extended Warranty
- Stefan: Free Software
- Katrin: Coupon

➢ Machine Learning (Recommendation Engine) will find incentives for each user
Customer Satisfaction: 63%
Probability to leave: 83%
Probability to Call: 95%
Customer Lifetime Value (CLV)

Appropriate Incentives
- Free Software
- Discount
- Coupon
- Longer warranty

Customer Journey
- July 1, 2017
- Dec 5, 2017

Contact Information:
- Sam
- Male
- 1983
- Tehran
- +98 21 12121333

Probability to Call: 95%
Conclusion

► Digital transformation
► Internet of Things, Big Data, Artificial Intelligence, Block-chain
► Different Industries
  ► Transportation, Banking, Healthcare, Hospitality, Insurance, ...
► Use cases
  ► Artificial Intelligence Driven IoT Solutions for Logistics
  ► Artificial Intelligence Driven Maintenance: From Device, Edge, To Cloud
  ► Artificial Intelligence Driven Omni-channel Customer Journey: From Awareness, Purchase, Service, to Loyalty
Thank you
www.pirouzangroup.com