

# BIG DATA & ANALYTICS

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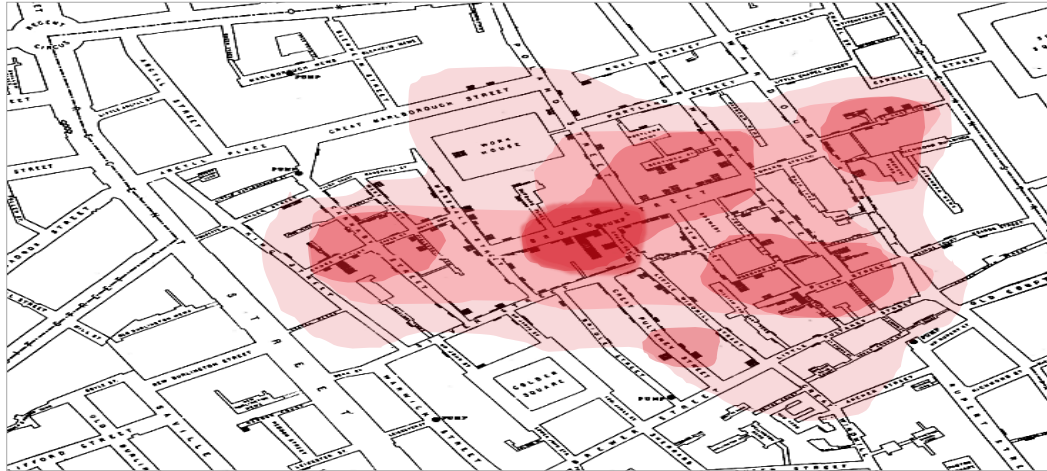
# BIG DATA



**Every day, millions of shipments are tracked, creating vast data sets that logistics providers have to manage**

# HOW DATA CAN CHANGE THE WORLD

## 1854 Broad Street cholera outbreak in London





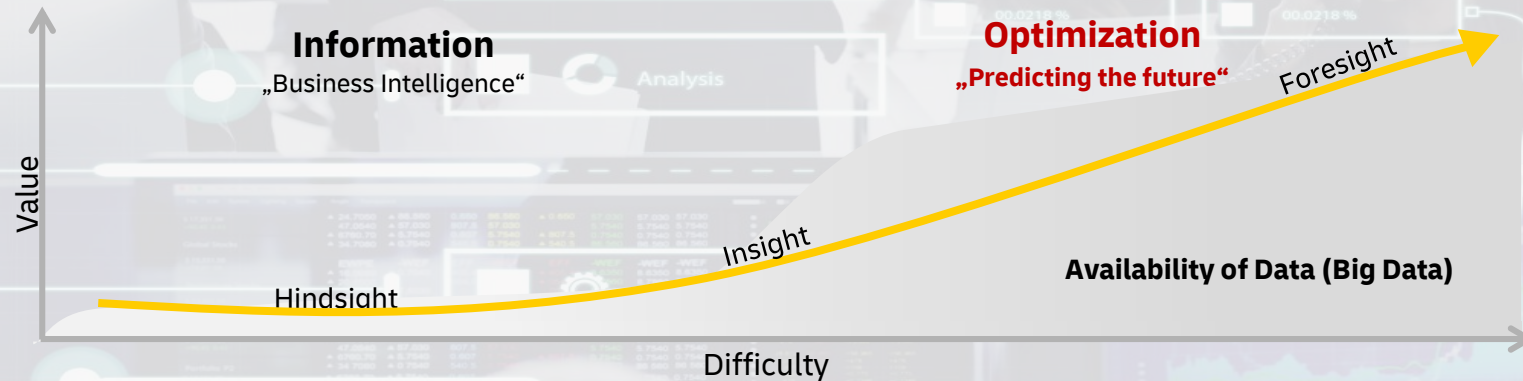
# VALUE CREATION THROUGH DATA ANALYTICS

**Descriptive Analytics:**  
What happened?

**Diagnostic Analytics:**  
Why did it happen?

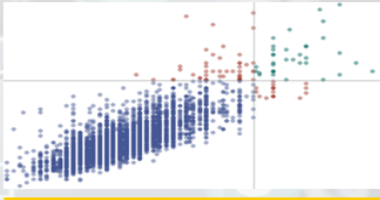
**Predictive Analytics:**  
What will happen?

**Prescriptive Analytics:**  
How can we make it happen?



# WIDE RANGING OPPORTUNITIES IN LOGISTICS

## Operational Capacity Planning



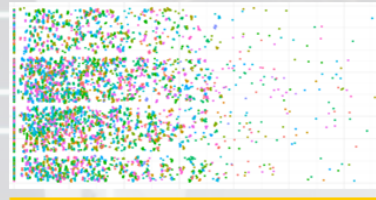
- Short- and mid-term capacity planning, based on material flow data, allows optimal utilization and scaling of resources along the supply chain

## Demand Forecasting and Peak-Season Analysis



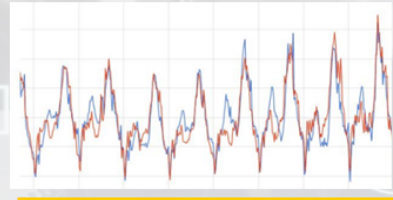
- Predicting customer demand as well as peaks and troughs to drive adaption by supply chain and business management processes

## Risk Evaluation and Resilience Planning



- Tracking and predicting events that lead to supply chain disruptions and identification of supply chain weaknesses to increase resilience

## Inventory Planning



- Predicting inventory flow to optimize production planning and inventory management and eliminate under- and overstocking

# USE CASE EXAMPLE 1: **VOLUME PREDICTION**

## Using Big Data inputs to predict surge of delivery volumes



- Improved predictions prediction, saving costs and increasing on time delivery assurance (improved customer experience)

- External data sets (correlations)

- ▶ Google Trends (high)

- ▶ Influenza outbreaks (medium)

- ▶ Weather (medium)



# USE CASE EXAMPLE 2: AIRFREIGHT DELAYS



## Predicting potential shipment delays

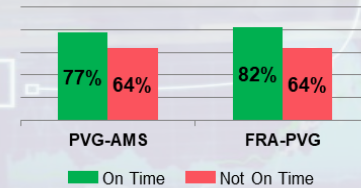
- Facilitate proactive mitigation, e.g. alternative routing; Route optimization / planning
- Leveraged machine learning to achieve advance notice
- Identifying top influencing factors

### Predicting next Sunday's airfreight transit time delay risk on Monday

Mon Tues Wed Thu Fri Sat Sun



### Prediction accuracy of an event in 10 days time



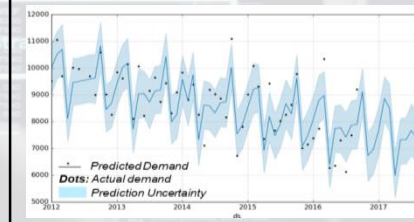
# USE CASE EXAMPLE 3: DEMAND PREDICTION



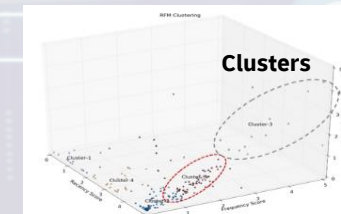
## Predicting demand at individual SKU and Client level

- Demand pattern identification (i.e. surges)
- Improving fill-rate
- Profiling customer order behavior
- Finding hidden relationships

### Predicting aggregate SKU demand with 75-93% accuracy



### Identifying key demand clusters across multiple variables





# USE CASE 4: INVENTORY PLANNING



## In-depth stock analysis to enable network and inventory optimization

- Predicting demand across all SKUs
- Optimizing inventory safety-stock levels
- Decomposing trends to identify seasonality & impact of external influences

### Improving forecasts to lower safety stock levels

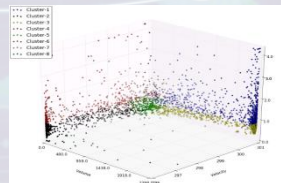


### Multi-dimensional clustering to identify optimal distribution approach

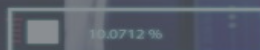
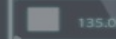
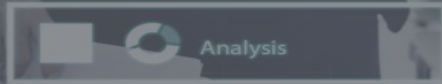
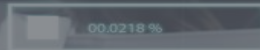
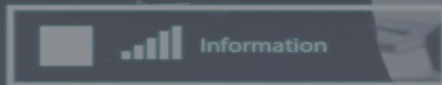
Volume

Velocity

Volatility



# THANK YOU



# (LOW-COST) SENSOR TECHNOLOGIES & AI IN LOGISTICS

to fullscreen, ctrl+click to snap to video size

141 cm

146 cm

Ben Gesing  
Head of Trend Research  
DHL Customer Solutions & Innovation

15 October 2019



**DHL**



**...ONCE UPON A TIME**



**DHL**



CONFIDENTIAL

**...ONCE UPON A TIME**



- Microsoft Kinect
- 30 million units
- \$99 MSRP

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- 3.5 billion devices
- 14 sensors/device
- 3D cameras



- **47 million** US households
- **95% accuracy**, improving w/self-learning
- Prediction, translation & **identification**





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**VALUE SHIFT:  
SOFTWARE > HARDWARE**





# WHAT AN AUTONOMOUS VEHICLE SEES

traffic light



traffic light



traffic light  
traffic light

traffic light traffic light



bus

truck

car

car

car

truck

truck

person

person person person

car

person

car

person person

handbag

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**SO WHAT ABOUT  
LOGISTICS?**

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EVERYTHING

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**FROM INDIVIDUAL ITEMS...**



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**...TO (MASSIVE) INFRASTRUCTURE**





**CAN BE SEEN  
AND  
UNDERSTOOD  
IN NEW WAYS**



**USING  
AI & LOW-COST  
SENSORS**



# LOW COST SENSORS & AI **IN LOGISTICS**

## Dimensioning



## Identification

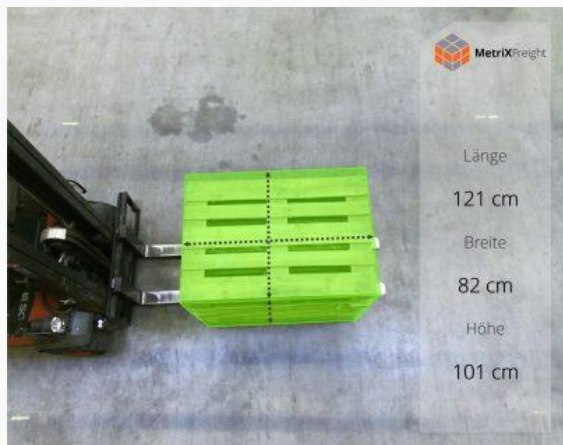


## Inspection



# COMPUTER VISION & AI IN LOGISTICS

## Dimensioning



## Identification



## Inspection



# PROJECT EXAMPLE: AQUIFI DISCOVERY



## Mobile Dimensioning

Point-and-shoot UX using  
proprietary AI & computer  
vision from Aquifi



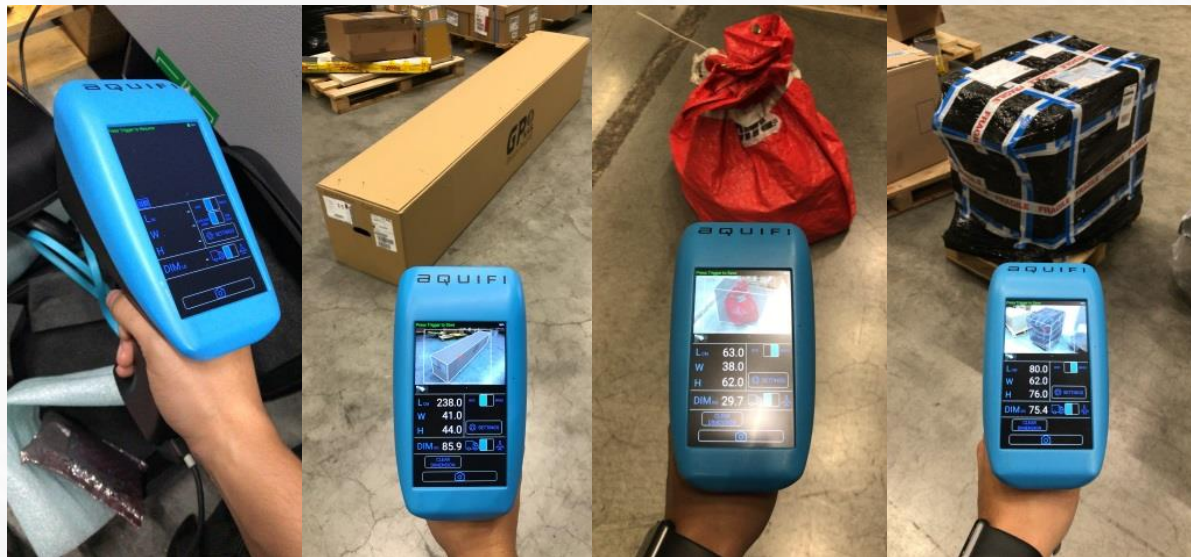
## Accuracy

<+/-1 cm tolerance  
1.5 meters LxWxH  
Cuboids & non-cuboidal  
regular re-training



## Flexibility

Familiar form factor  
simplifies deployment &  
adoption





# PROJECT EXAMPLE: METRIX FREIGHT



## **Pallet Dimensioning**

Solution co-developed by  
Metrilus with DHL Customer



## **Accuracy**

1-2 cm measurement range  
2.5 meters LxWxH  
0% human errors  
**regular re-training**



## **Speed & Cost**

70% faster at 1/3 of  
competitive industrial laser-  
based solution



# FROM PILOT TO SCALE-UP: METRIX FREIGHT



# PROJECT EXAMPLE: MASTER DATA BUILDING



## Master Data

For all customer parts  
needed at greenfield  
distribution center



## MetriX Freight M & L

Product information  
Weight & dims  
Images  
Packing & handling info



## Speed, Cost, Quality

Less time/piece  
HD images captured  
>35k scans in 3 months





# PROJECT EXAMPLE: DIMENSIONING XL



## DGF Industrial Projects

Ultra-large, ultra-heavy  
cargo transport via land, air,  
and sea



## Dimensions & Simulation

Critical for successful moves  
Slow, difficult, & dangerous  
Low failure tolerance



## Speed, Cost, Quality

Accuracy through automation  
Precise simulation  
Increase worker safety



# LOW COST SENSORS & AI **IN LOGISTICS**

Dimensioning



Identification



Inspection



# PROJECT EXAMPLE: AIR PALLET CONTOURING



## **Air Cargo Pallets**

Loose cargo secured by nets, labor intensive and tricky to maximize loads.



## **Delayed Departures**

Re-work at ramp  
Re-work in warehouse  
ULD dropped, misses flight



## **Human Assistance**

Visual contour check  
Increase utilization  
Eliminate Delays





# PROJECT EXAMPLE: PALLET STACKABILITY



## Aquifi Endeavour AI

9 deep learning computer vision algorithms

- 1 Is it on a pallet?
- 2 Pallet-to-object ratio?
- 3 Is it a Television?
- 4 Irregular top surface
- 5 Aspect ratio & depth disparity
- 6 Cone or pyramid present?
- 7 Has open top?
- 8 Has non-stackable text?
- 9 Has non-stackable icon?



### NSP Sign on Pallets



### Unstable Top



### Odd Shape Commodity



### Round/Pyramid Shape



### Protruding Parts



### Open-Top Crates



\*Based on in-person observation of 80-260 samples. NSP label detection at 50% accuracy and improving.

# COMPUTER VISION & AI **IN LOGISTICS**

## Dimensioning



## Identification



## **Inspection**



# USE CASE: **VISUAL ASSET INSPECTION**



## **Sensing**

Steps 1-2, data is collected from camera bridges placed along tracks



## **Processing**

Steps 3-4, classifiers trained on up to 7 cases “look” for damage types, or no damage



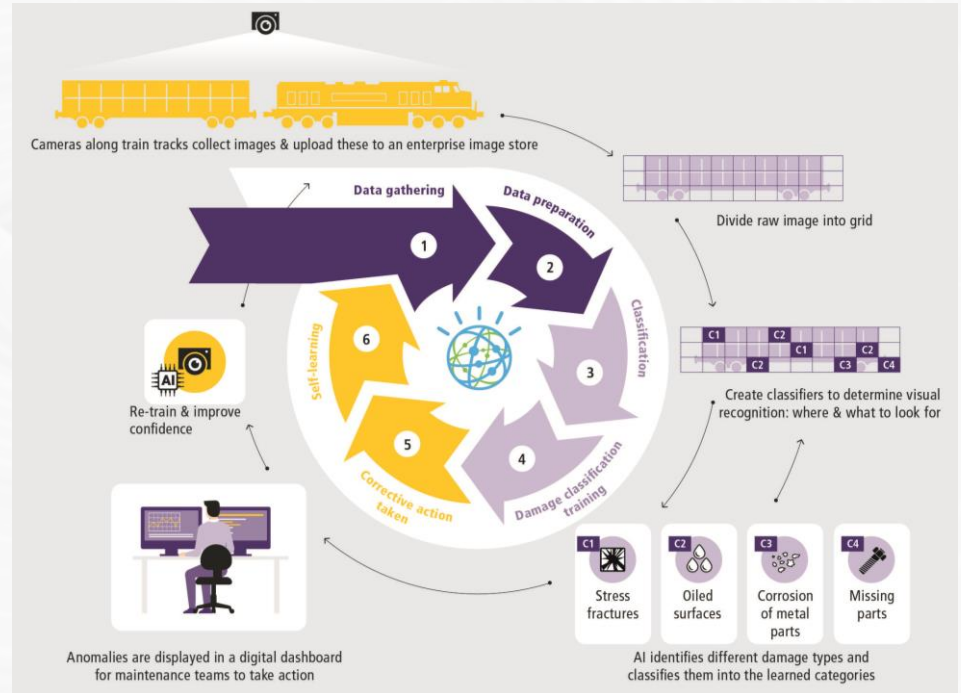
## **Learning**

Steps 5-6, insight generation, corrective action and resource allocation, self-learning



## **Outcome**

single classifier (unsecure bolt) initially achieved 67% percent, improved to 89% with more iteration and data





# CHALLENGES IN AI



Low Cost Sensor Technology & AI in Logistics | Ben Gesing | January 2019



**...MACHINES SUPPORT AND INCREASE  
THE NEED FOR HUMAN JUDGMENT**

# The Worst Day for AI is the First Day



**What people think AI is about**



**The reality**





**TECHNOLOGY IS THE EASY PART  
DON'T TRIVIALIZE CULTURAL TRANSFORMATION**

A photograph of the DHL Innovation Center, a modern multi-story building with large glass windows and a facade decorated with horizontal stripes in yellow, orange, and red. Several tall flagpoles in the foreground hold yellow flags with the DHL logo and the text 'Deutsche Post'. A yellow DHL delivery van is parked on the left. The sky is blue with some clouds. A semi-transparent yellow triangle is overlaid on the right side of the image.

# LET'S SHAPE THE FUTURE TOGETHER



Low Cost Sensor Technology & AI in Logistics | Ben Gesing | January 2019

A photograph of the DHL Innovation Center building, a modern structure with large glass windows and a facade decorated with yellow and red horizontal stripes. Several tall flagpoles in the foreground hold yellow flags with the DHL logo and the text 'Deutsche Post'. A yellow DHL delivery van is parked on the left. A large, semi-transparent yellow triangle is overlaid on the right side of the image.

Thank you. Let's stay in touch.

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