

Impact of AI in the Product Lifecycle

Sky Matthews, CTO, IBM Watson IoT

GLOBAL PRODUCT DATA
INTEROPERABILITY
S U M M I T
2019



Who Am I?

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Sky Matthews **CTO, IBM Watson IoT**

- based in Research Triangle Park, North Carolina since 2004
- BSc in Computer Science, Acadia University 1990
- Bell-Northern Research 1990-1994
- ObjecTime Inc 1994-1999
- Rational Software 1999-2003
- IBM 2003-present

Focus Areas:

- Internet of Things, Systems Engineering and Embedded Software, Artificial Intelligence, Digital Twin
- Automotive, Telecommunications, Aerospace/Defense, Electronics



Topics

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- **Emerging Applications of Artificial Intelligence**
- **AI in Product Engineering**
- **AI in Product Manufacturing**
- **AI in Product Operations and Maintenance**
- **Issues and Challenges**
- **The Next Frontier: Automating AI**

Emerging Applications of AI

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AI is everywhere: many successful applications of AI that can apply to complex A&D Systems

AI Enablers

- Big Data
- Cloud Computing
- Internet of Things (sensors + communication)
- AI “brain” chips (e.g., IBM TrueNorth)

Recent AI Milestones

- | | |
|---|------|
| • Autonomous Vehicle Grand Challenge | 2005 |
| • Deep Learning Breakthrough | 2009 |
| • IBM Watson Jeopardy Challenge | 2011 |
| • Apple Siri voice interface | 2011 |
| • Waymo self-driving vehicle | 2015 |
| • ImageNet test accuracy > human | 2015 |
| • Partnership on AI (partnershiponai.org) | 2016 |
| • Robot passes medical exam | 2017 |
| • Language comprehension > human | 2017 |
| • First commercial self-driving systems | 2018 |

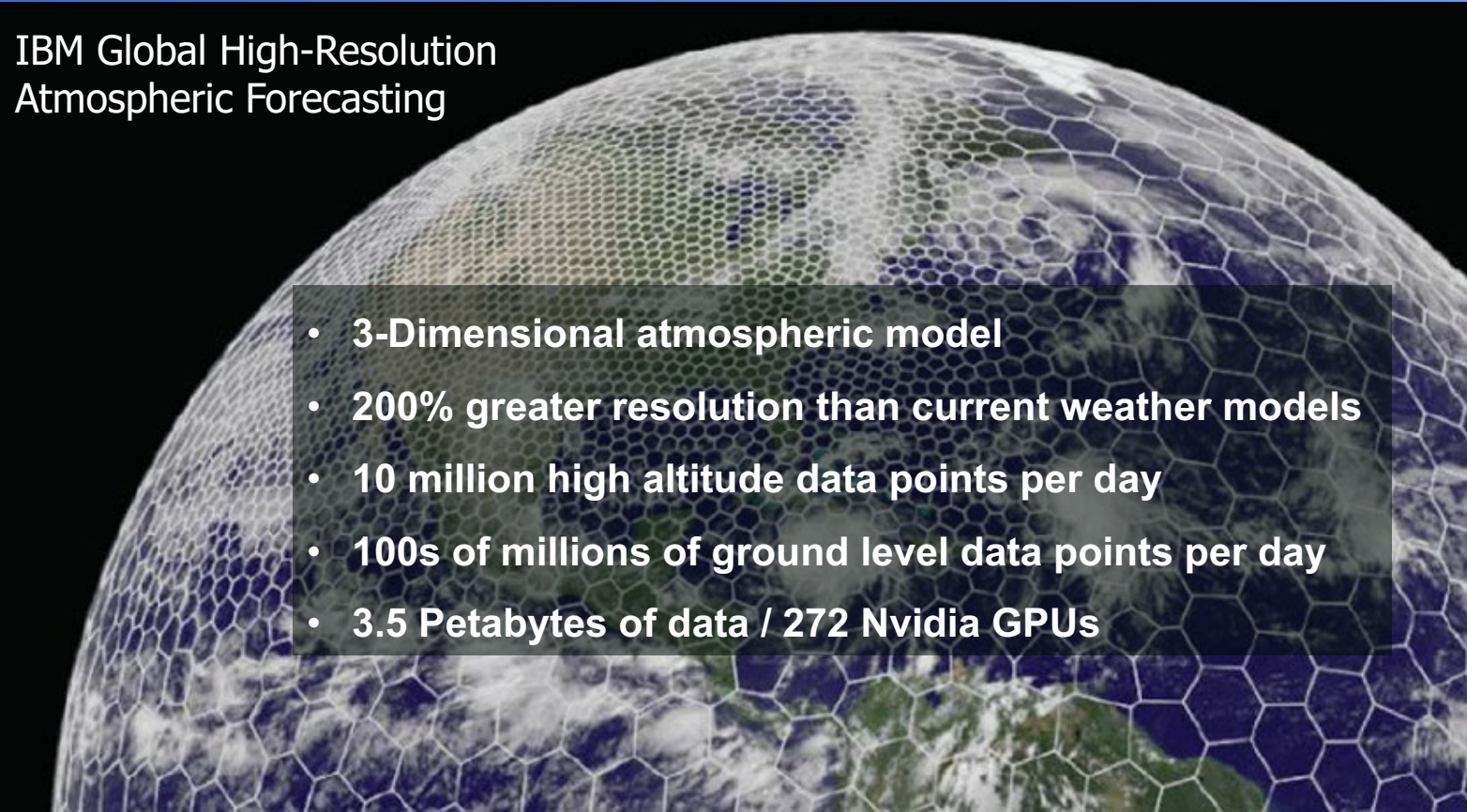
Common AI Applications

- Conversational Interfaces
- Image Recognition
- Acoustic Pattern Detection
- Language Translation
- Anomaly Detection
- Diagnosis
- Fraud Detection
- *Weather Prediction*
- Autonomous Robots
- Autonomous Vehicles
- Tone Analysis
- Route Optimization
- Traffic Prediction
- Supply Chain Optimization

Example: Weather Prediction

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IBM Global High-Resolution Atmospheric Forecasting

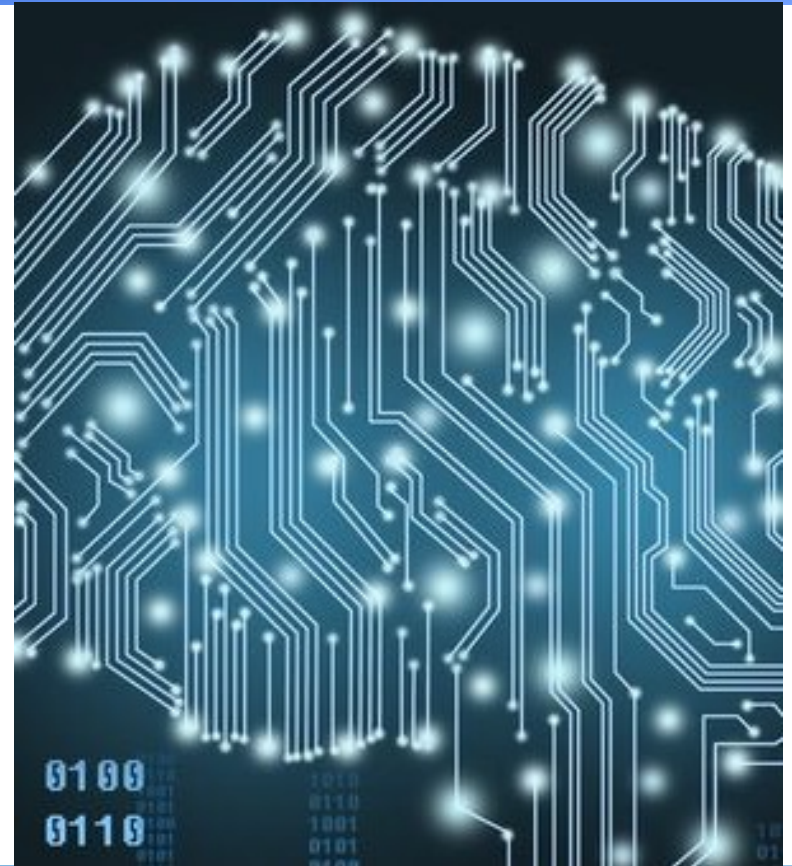
- 
- 3-Dimensional atmospheric model
 - 200% greater resolution than current weather models
 - 10 million high altitude data points per day
 - 100s of millions of ground level data points per day
 - 3.5 Petabytes of data / 272 Nvidia GPUs

AI in Engineering

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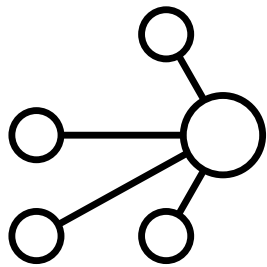
Current Applications

- Natural language analysis of documents
- Electronic layout optimization
- Mechanical shape optimization
- Materials selection and innovation
- Design space exploration and trade studies
- Test automation and test avoidance
- ...and many more



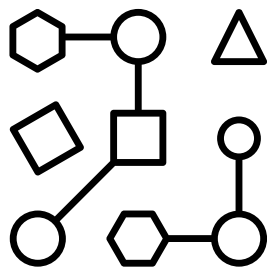
Example: IBM Requirements Quality Assistant

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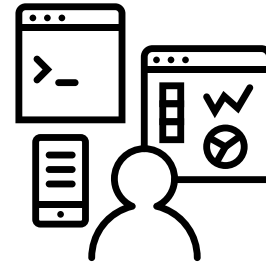
Watson Natural
Language
Understanding

+

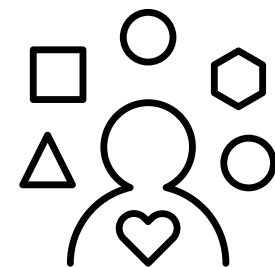


Requirements best
practices and
heuristics (from
INCOSE Guidelines)

+



Requirements training
data:
public data sets +
additional client-specific
data



**IBM
Requirements
Quality Assistant**

Enterprise benefits

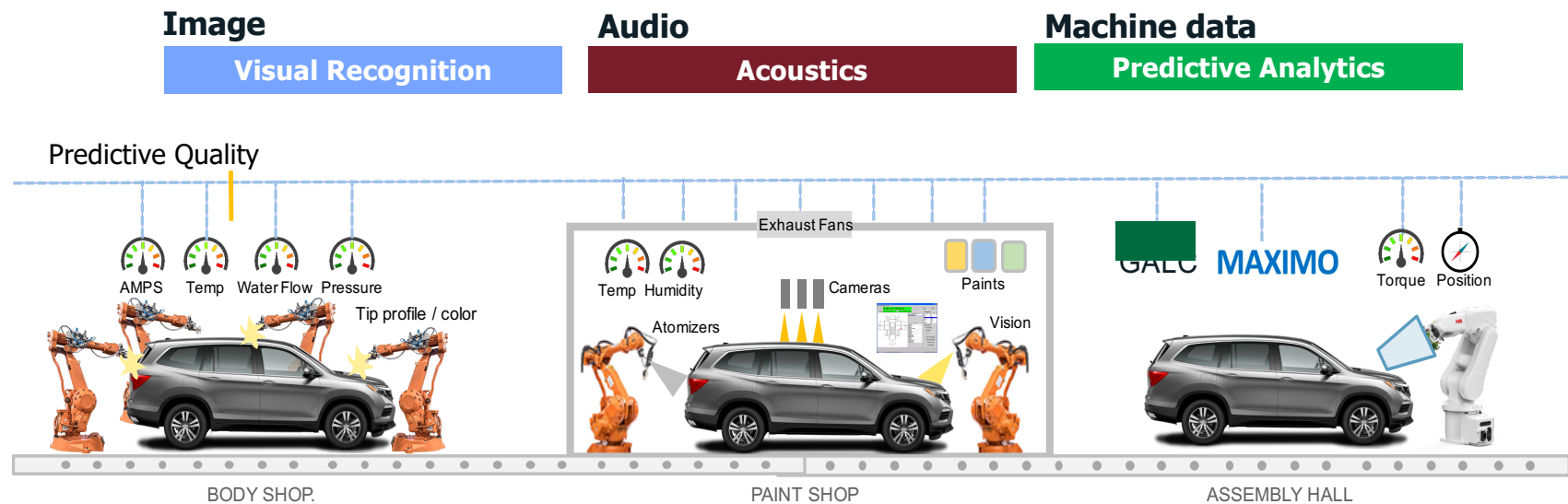
- *Reduce the cost of defects by 60%*
- *Reduce cost of manual reviews by 25%*
- *Retain engineering expertise for junior engineers*

AI in Manufacturing

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Multiple models, multiple applications

- Multi-sensory data inputs (example: combining sound and vibration)
- Many machine learning models
- Targeted AI solving specific problems



AI in Operations

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Learning Digital Twins



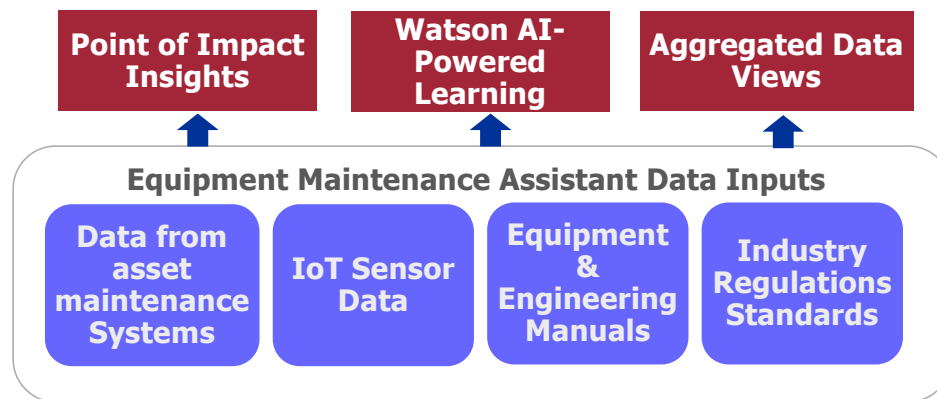
Digital Maintenance Assistants



Digital Assistants and Natural Language for the Technician of the Future

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AI helps equipment maintenance technicians improve problem diagnosis and provides guidance to identify the right action the first time



Watson learns from experienced technicians, and shares that expertise with **every field technician**

Issues and Challenges in AI Adoption

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Hype and over-optimism

FEATURE

The Great A.I. Awakening

How Google used artificial intelligence to transform Google Translate, one of its more popular services — and how machine learning is poised to reinvent computing itself.

NY Times 2016

Explainability

Geoff Hinton Dismissed The Need For Explainable AI: 8 Experts Explain Why He's Wrong

Forbes Dec 2018

Training



“Magic Box” Syndrome
Startups are exploiting AI's hazy definition to cash in on the hype

Wired UK Mar 2019

Bias



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The Next Frontier: Automating AI

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AdaBoost	Bernoulli Naïve Bayes	Calibrated Classifier with Cross-Validation	Decision Tree	Extra Trees
Gaussian Naïve Bayes	Gaussian Process	Gradient Boosted Tree	Nearest Neighbor Analysis	Label Propagation
Label Spreading	LGBM	Linear Discriminant Analysis	Linear Support Vector	Logistic Regression with Cross-Validation
Logistic Regression	MLP Classifier	Multinomial Naïve Bayes	Nearest Centroid	Nu Support Vector
Passive Aggressive	Perceptron	Quadratic Discriminant Analysis	Radius Neighbors	Random Forest
Ridge Classifier with Cross-Validation	Ridge Classifier	SGD	Support Vector	XGBoost

DOM GALEON | DECEMBER 1ST 2017