MATLAB EXPO 2016
The Rise of Engineering-Driven Analytics

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The Rise of Engineering-Driven Analytics
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Apply robust, statistically-motivated methods to data produced from complex systems to
understand what has happened and why,
predict what will happen, and
suggest decisions or actions.
Analytics are now pervasive

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Analytics are pervasive – *Why Now?*

**We have data**
- Engineering
- Business
- Transactional

**We have compute**
- Desktop
  - Multicore, GPU
- Clusters
- Cloud computing

**We know how**
- Neural Networks
- Classification
- Clustering
- Regression
- …and much more…
Analytics are pervasive – Why Now?

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The Rise of Engineering-Driven Analytics
50 km/h - sudden brake
Example – Scania
Automatic emergency braking using sensor fusion and analytics
Vehicle logs of video and radar data

Machine learning to develop fusion algorithms for situation detection

80 TB of data

Model-Based Design and Machine Learning Combined

Predictive Model deployed on vehicle

Model Based Design to simulate, test and perfected the application
Consider the Data in Data Analytics

Engineering Data
- Video
- Audio
- Images
- Sensor

Business Data
- Social profile
- Geolocation
- Keystroke logs
- Transactions

Level of Industry / User Adoption

Source: Gartner Big Data Industry Insights, March 2016
Consider the *Data* in Data Analytics

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Architecture of an analytics system

- Data from instruments and connected systems
- Data from business systems
- Analytics and Machine Learning
Architecture of an analytics system

Data from business systems

Data from instruments and connected systems

Predictive Model
deployed in smart and embedded systems

Predictive Model
deployed on cloud and business systems

MATLAB & Simulink Integrates in Embedded Systems and Enterprise IT Workflows
Example – BuildingIQ
Adaptive building energy management
degrees Celsius

24 C
21 C

Comfort bounds

Actual temperature
Temperature setpoint

0:00  8:00 am  6:00 pm  0:00

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25% cost reduction
Real-time, closed-loop optimization algorithms

DATA - Billions of data points:
Physics, energy cost, ambient temperatures, operation schedule, etc.

Analytics and Machine Learning
plus system identification, control theory & more

Predictive Model
deployed on cloud with client system
and real-time data feeds

MATLAB Toolboxes Just Work – and work together!
We could rapidly translate our prototypes into production algorithms that deal reliably with real-world noise and uncertainty.

Borislav Savkovic, BuildingIQ

Why MATLAB?

- Robust numerical algorithms
- Extensive visualization and analytics tools
- Industry-robust and reliable mathematical optimization routines
- Good object-oriented framework
- Ability to interface with Java (for backend work)
- Running MATLAB in the cloud in production
- Unit-testing framework

MATLAB Impeccable Numerics for Trusted Results
We could rapidly translate our prototypes into production algorithms that deal reliably with real-world noise and uncertainty.

Borislav Savkovic, BuildingIQ
Analytics in e-commerce

Site makes recommendations using Image Processing techniques on the fashion photos.
Analytics in e-commerce

Use Image Processing to add image data to the model, improving performance
The Rise of Engineering-Driven Analytics
Predictive Maintenance for polymer-based production machines

Sensor Data (~1 minute)
10-100 sensors/machine

Quality State (~40 minutes)

Classification using Statistics, Machine Learning, and Neural Networks
Deployment – a MATLAB App used by machine operators

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State OK

State NOT OK
The need for data scientists

- Domain expertise
- Coding and integration skills
- Statistical and mathematical knowledge
What they say

- Expand university programs
- Train existing analysts
IoT open data platform for students and makers

**Built-in MATLAB analysis**

- New MATLAB Analysis
- MATLAB Analysis Templates
  - Custom (no starter code)
  - Get data from a private channel
  - Get data from a public channel
  - Get data from a webpage
- MATLAB Analysis Examples
  - To see MATLAB Analysis in action, select the example and click Create.

**Simulink support via Raspberry Pi**

- Simulation support via Raspberry Pi
Student Contest
use process control data to improve semiconductor yields

- 21 teams competed
- Wafer Big Data in Hadoop
- MATLAB used by winning team and 2nd place team
MATLAB lets you be your own data scientist

MATLAB & Simulink are Designed and Documented to be Easy for Engineers and Scientists to Use
Example – cellscope®
First consumer otoscope in a mobile device using machine learning and computer vision
The Rise of Engineering-Driven Analytics

Limited users, scope, & technology

Big Data

Compute Power

Machine Learning

Pervasive users, scope, & technology

Be your own Data Scientist!