MATLAB EXPO 2016

The Rise of Engineering-Driven Analytics

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Senior Manager, Design Automation
The Rise of Engineering-Driven Analytics
The Rise of Engineering-Driven Analytics
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

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 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...

What's New in MATLAB and Simulink
The Rise of Engineering-Driven Analytics
50 km/h - sudden brake
Example – Scania

Automatic emergency braking using sensor fusion and analytics
Model-Based Design and Machine Learning Combined

Vehicle logs of video and radar data

80 TB of data

Machine learning to develop fusion algorithms for situation detection

Predictive Model deployed on vehicle

Keynote: Speed of Development: The Future of Machine Building

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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*
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 systems using Model-Based Design

Predictive Model deployed on cloud and business systems

MATLAB & Simulink Integrates in Embedded Systems and Enterprise IT Workflows
Example – BuildingIQ
Adaptive building energy management
25% cost reduction
Real-time, closed-loop optimization algorithms

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

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

MATLAB Toolboxes Just Work – and work together!

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

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Analytics in e-commerce

Use Image Processing to add image data to the model, improving performance

IMPROVED Predictive Model

Offer to Customer

Engineering Data

- Images
- Social profile
- Geolocation
- Keystroke logs
- Transactions

Business Data

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The Rise of Engineering-Driven Analytics

- Automotive
- Off-highway vehicles
- Aeronautics
- Retail
- Finance
- Healthcare management
- Internet
- Industrial Automation
- Oil & Gas
- Medical Devices
- Clean Energy
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

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Deployment – a MATLAB App used by machine operators

Get More from Your Data with Data Analytics

State NOT OK

State 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
ThingSpeak

IoT open data platform for students and makers

Built-in MATLAB analysis

Simulink support via Raspberry Pi
ThingSpeak

IoT open data platform for students and makers

Peak volume on July 27, 2015

Traffic Volume for the week of July 25

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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

The Tough Fight for One More Bit
MATLAB lets you be your own data scientist

MATLAB & Simulink are Designed and Documented to be Easy for Engineers and Scientists to Use
Example – **CellsScope**

First consumer otoscope in a mobile device
machine learning and computer vision
The Rise of Engineering-Driven Analytics

Be your own Data Scientist!