The Rise of Engineering-Driven Advanced Analytics

MATLAB EXPO 2016

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The Rise of Engineering-Driven Advanced Analytics
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Advanced Analytics

Apply robust, statistically-motivated methods to data produced from complex systems to understand what has happened, 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 predict what will happen.

- Engineering
- Business
- Transactional
- Desktop - Multi-core, GPU
- Clusters
- Cloud computing
- Hadoop
- Neural Networks
- Classification
- Clustering
- Regression
- ...and much more...
Analytics in e-commerce

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

**Engineering Data**
- Images
- Social profile
- Geolocation
- Keystroke logs
- Transactions

**Business Data**

IMPROVED Predictive Model

Offer to Customer
Engineering Data

Business Data

Transactions
Keystroke logs
Geolocation
Social profile
Sensor
Images
Audio
Video

Using now
Planned

Source: Gartner Big Data Industry Insights, March 2016
The Rise of Engineering-Driven Advanced Analytics
Architecture of an analytics system

Data from instruments and connected systems

Data from business systems

MATLAB Integrates in Embedded System and Enterprise IT Workflows

Predictive Model deployed in smart systems using Model-Based Design

Predictive Model deployed on cloud and business systems
Example – BuildingIQ

Adaptive building energy management
Real-time, closed-loop optimization algorithms

DATA - Billions

Physics, energy of ambient temperature, operation schedule

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!
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
Example – Scania
Automatic emergency braking using sensor fusion and analytics
50 km/h - sudden brake
Using Model-Based Design

A proven way to build and deploy the analytics in an embedded control system

MATLAB Integrates Analytics and Model-Based Design
Implementing Sensor Fusion at Scania

Vehicle logs of video and radar data

Predictive Model deployed on vehicle

Machine learning to develop fusion algorithms for situation detection

Control System Track

11:00 Keynote Presentation

“The Road towards Autonomous Transport”
Daniel Frylmark, Scania
The Rise of Engineering-Driven Analytics

- Automotive
- Off-highway vehicles
- Aeronautics
- Retail
- Finance
- Healthcare
- 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
Deployment – a MATLAB App used by machine operators
The need for data scientists
Big data talent shortage: How to bridge the gap?

By Abhishek Raval on May 28, 2015

What they say

• Expand university programs
• Train existing analysts
Core Concepts in Data Analysis

Learn both theory and application for basic methods that have been invented either for developing new concepts – principal components or clusters, or for finding interesting correlations – regression and classification. This is preceded by a thorough analysis of 1D and 2D data.

Teaching with MATLAB and Simulink Track

Machine Learning
Stanford University

Big Data Science with the BD2K–LINCS Data Coordination and Integration Center

Learn various methods of analysis including: unsupervised clustering, gene-set enrichment analyses, Bayesian integration, network visualization, and supervised machine learning applications to LINCS data and other relevant Big Data from high content molecular and phenotypic profiling of human cells.

Computational Methods for Data Analysis

<webpage>
IoT open data platform for students and makers

*Built-in MATLAB analysis*

*Simulink 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 is Designed and Documented to be Easy for Engineers and Scientists to Use
Big Data
- Engineering
- Business
- Transactional

Compute Power
- Desktop - Multicore, GPU
- Clusters
- Cloud computing
- Hadoop

Machine Learning
- Neural Networks
- Classification
- Clustering
- Regression
- ...and much more...

Limited users, scope, & technology

Pervasive users, scope, & technology

In MATLAB
- Native support for engineering data
- Database interfaces
- Streaming

MATLAB EXPO 2016
12:45 Signal Processing Track
“What’s New in MATLAB and Simulink for Signal Processing”
Big Data

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- Business
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In MATLAB

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- Database interfaces
- Streaming
- Datastore R2014b
  text, image, video, Excel files, ...
- Mapreduce R2014b
In MATLAB

- Native support for engineering data
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- Streaming
- **Datastore** R2014b text, image, video, Excel files, ...
- **Mapreduce** R2014b

MATLAB is fast:
- heavily optimized libraries
- JIT compiled
- takes advantage of the compute power you have

- **Multicore & GPU**
- MATLAB Distributed Computing Server and EC2 Support
- **Hadoop support** R2014b
- MATLAB Production Server
In MATLAB

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**NEW** from MathWorks

- Neural Networks
- Classification
- Clustering
- Regression

The open data platform for the Internet of Things

Limited users, scope, & technology

Big Data

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Compute Power

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Machine Learning

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- Statistics and Machine Learning Toolbox
- **Classification Learner App** R2015a
- Neural Network Toolbox
- **CNNs for Deep learning** R2016a
- Machine learning with code generation

**Big Data**
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**Compute Power**
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Limited users, scope, & technology
Pervasive users, scope, & technology
Classification Learner App in Statistics and Machine Learning Toolbox
MATLAB Apps for Data Analytics

Distribution Fitting
System Identification
Signal Analysis
Wavelet Design and Analysis
Neural Net Fitting
Neural Net Pattern Recognition
Training Image Labeler

and many more...

With MATLAB Apps, you can complete data science tasks more quickly and easily than custom programming
Using MATLAB R2016a

App Designer

“What’s New in MATLAB for Technical Computing”
Using MATLAB R2016a

App Designer
Deep Learning with Neural Network Toolbox - New in R2016a
Deep Learning with Neural Network Toolbox - New in R2016a
Example – **cellscope**

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

受限用户，范围及技术

大数据

计算力

机器学习

广泛用户，范围及技术

成为您自己的数据科学家！