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.
Advanced Analytics are now pervasive.

• Engineering
• Business
• Transactional

• Cloud computing
• Hadoop
• ...and much more...

Track 2-1: MATLAB에서의 Big Data 처리와 개발 플로우 소개
Advanced Analytics in e-commerce

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

**IMPROVED Predictive Model**

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

Offer to Customer

**Engineering Data**

**Business Data**
Track 1-2: 센서 데이터 애널리틱스를 위한 신호처리 및 머신러닝 기법

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

Data from business systems and connected systems

Advanced Analytics and Machine Learning

Predictive Model deployed on cloud and business systems

MATLAB Integrates in Embedded System and Enterprise IT Workflows

Track 2-5: 비즈니스 애널리틱스 솔루션 개발을 위한 MATLAB 활용 기법 소개

MATLAB EXPO 2016

Data from instruments and connected systems
Example – BuildingIQ
Adaptive building energy management

- Weather
  - Forecast

- Managed Services & NOC
  - Time of Use Energy Prices
    - Price Signals

- Secure Servers
  - Optimization Program
    - Price Signals

- Open Access Platform
  - Running Client Software
    - Optimal Control Strategy
    - Current Building Condition

- Demand Response
  - Comfort
  - Tenant Comfort
25% cost reduction
Real-time, closed-loop optimization algorithms

DATA - Billions
Physics, energy of ambient temperature, operation schedule

Advanced 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

Current energy costs & demand

Weather 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
Example – Scania

Automatic emergency braking using sensor fusion and advanced analytics
50 km/h - sudden brake
Using Model-Based Design to build and deploy the advanced analytics in an embedded control system.
Implementing Sensor Fusion at Scania

Machine learning to develop fusion algorithms for situation detection

Vehicle logs of video and radar data

Predictive Model deployed on vehicle

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The Rise of Engineering-Driven Advanced 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

Nearest Neighbor Classification

Support Vector Machines (SVMs)

Naive Bayes Classification

Neural Networks
Deployment – a MATLAB App used by machine operators
The need for data scientists
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.

Machine Learning
Stanford University

Big Data Science with the BD2K-LINCS Data Coordination and Integration Center
Learn various methods of analysis including unsupervised clustering, genome enrichment analysis, Bayesian integration, network visualization, and supervised machine learning applications to LINCS data and other relevant Big Data from high content molecular and phenotype profiling of human cells.
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
In MATLAB

- Native support for engineering data
- Database interfaces
- Streaming

NEW for MATLAB

Audio System Toolbox R2016a
Vision HDL Toolbox R2015a
In MATLAB

• Native support for engineering data
• Database interfaces
• Streaming
  • Datastore R2014b
    text, image, video, Excel files, ...
• Mapreduce R2014b

• Engineering
• Business
• Transactional

• Desktop - Multicore, GPU
• Clusters
• Cloud computing
• Hadoop

• Neural Networks
• Classification
• Clustering
• Regression

Limited users, scope, & technology

Big Data

Compute Power

Machine Learning

Pervasive users, scope, & technology
In MATLAB

- Native support for engineering data
- Database interfaces
- 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

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

- Multicore & GPU
- MATLAB Distributed Computing Server and EC2 Support
- Hadoop support R2014b
- MATLAB Production Server
Big Data

- Engineering
- Business
- Transactional

Compute Power

- Desktop - Multicore, GPU
- Clusters
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Machine Learning

- Neural Networks
- Classification
- Clustering
- Regression

In MATLAB

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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
Classification Learner App
in Statistics and Machine Learning Toolbox
MATLAB Apps for Advanced 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
Using MATLAB R2016a

App Designer
Deep Learning with Neural Network Toolbox - New in R2016a
Deep Learning with Neural Network Toolbox - New in R2016a

Track 2: 지능정보 기반 서울시 대규모 교통흐름 예측

Dr. HS Lee, Korea Institute of Science and Technology Information
Example – **cellscope**

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

Be your own Data Scientist!