

The Rise of Engineering-Driven Advanced Analytics

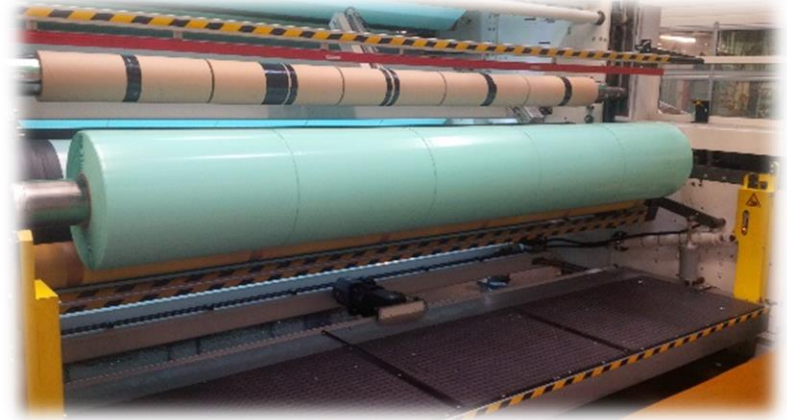
MATLAB EXPO 2016

Loren Shure

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MathWorks

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The Rise of Engineering-Driven Advanced Analytics



The Rise of Engineering-Driven **Advanced Analytics**

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 -
- Multicore, GPU
- Clusters
 - Cloud computing
 - Hadoop
- Neural Networks
- Classification
- Clustering
- Regression
- ...and much more...

Analytics in e-commerce



Engineering Data



Images

Social profile

Geolocation

Keystroke logs

Transactions



Business Data

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

**IMPROVED
Predictive
Model**

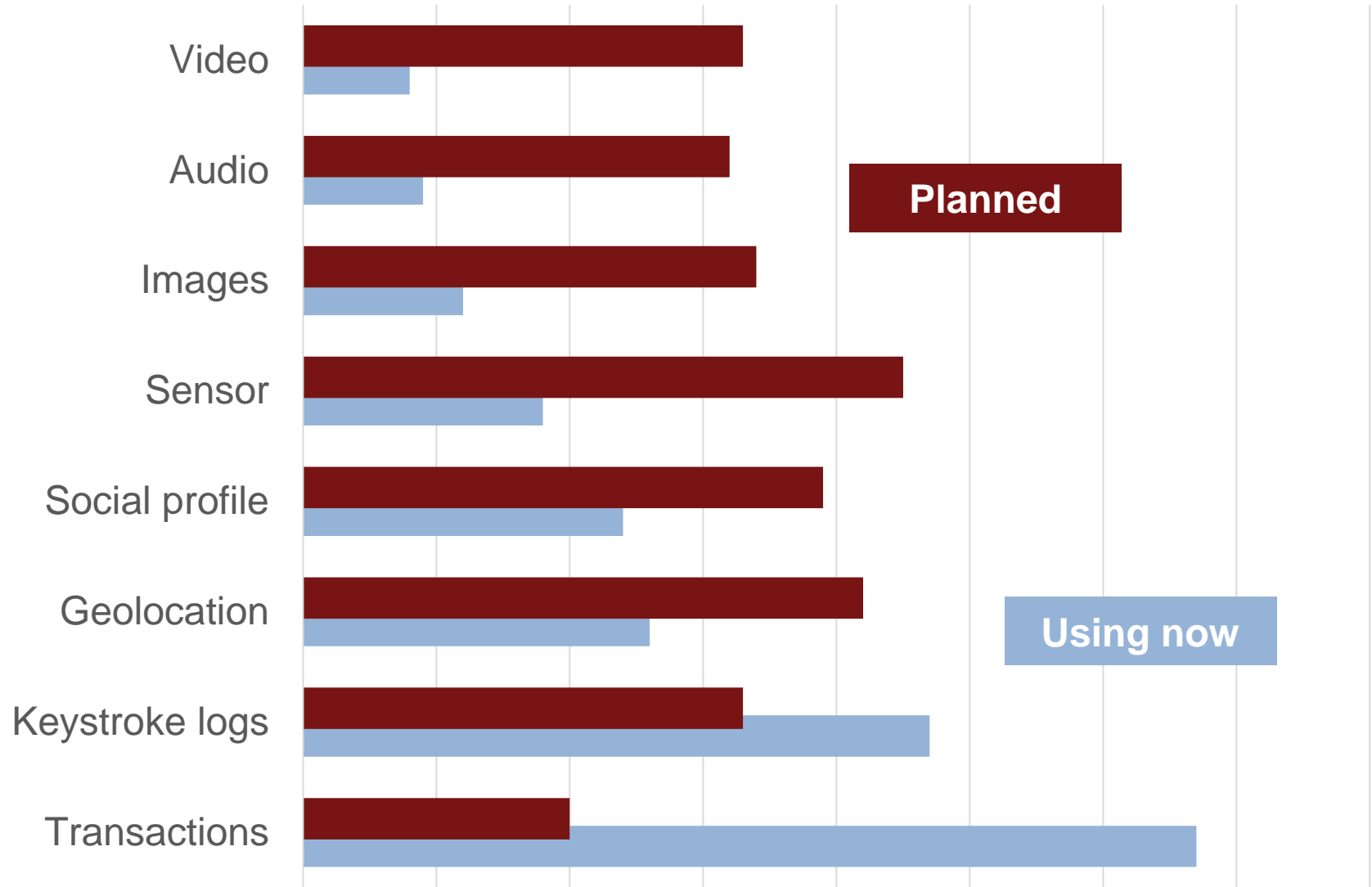
**Offer to
Customer**



Engineering Data



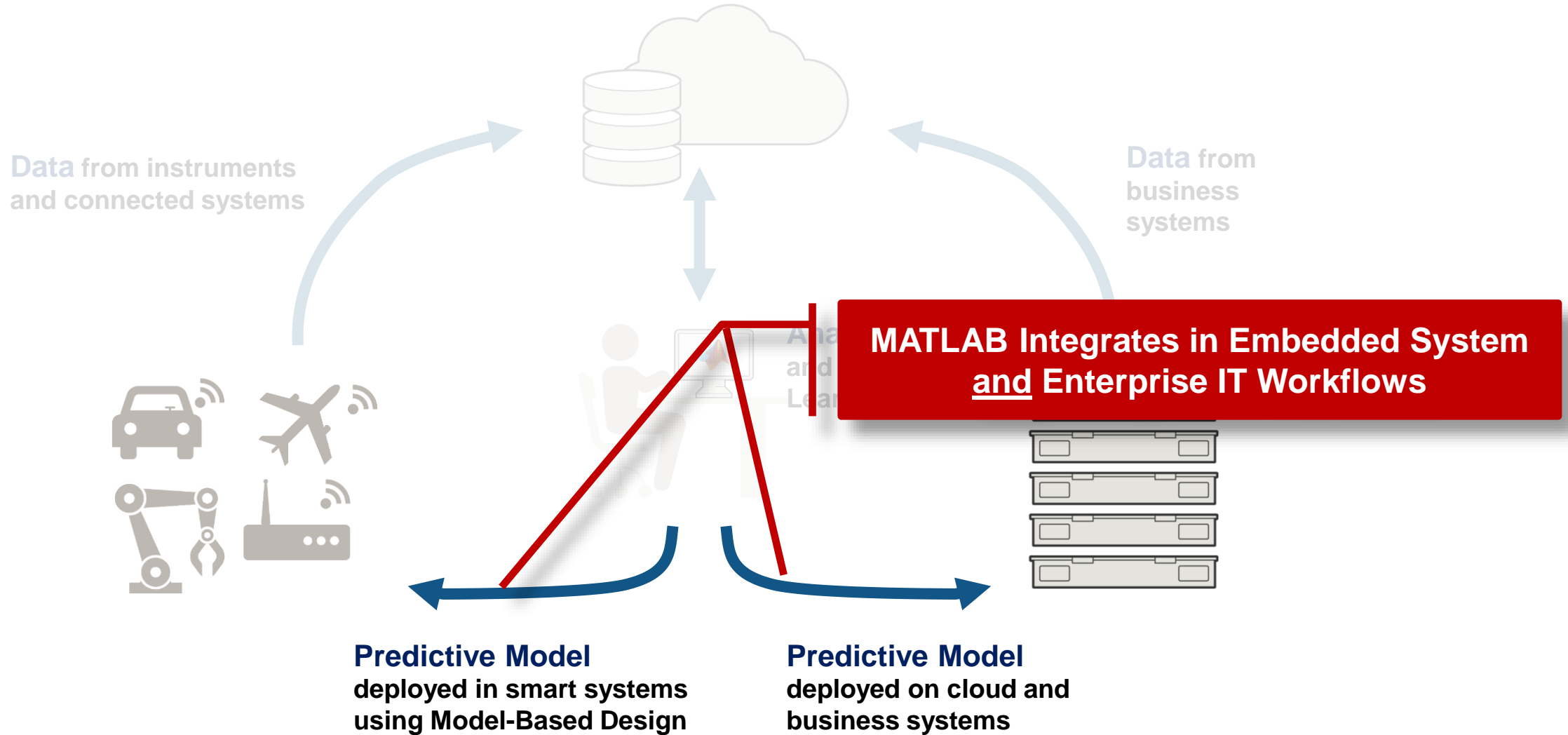
Business Data



Source: Gartner Big Data Industry Insights, March 2016

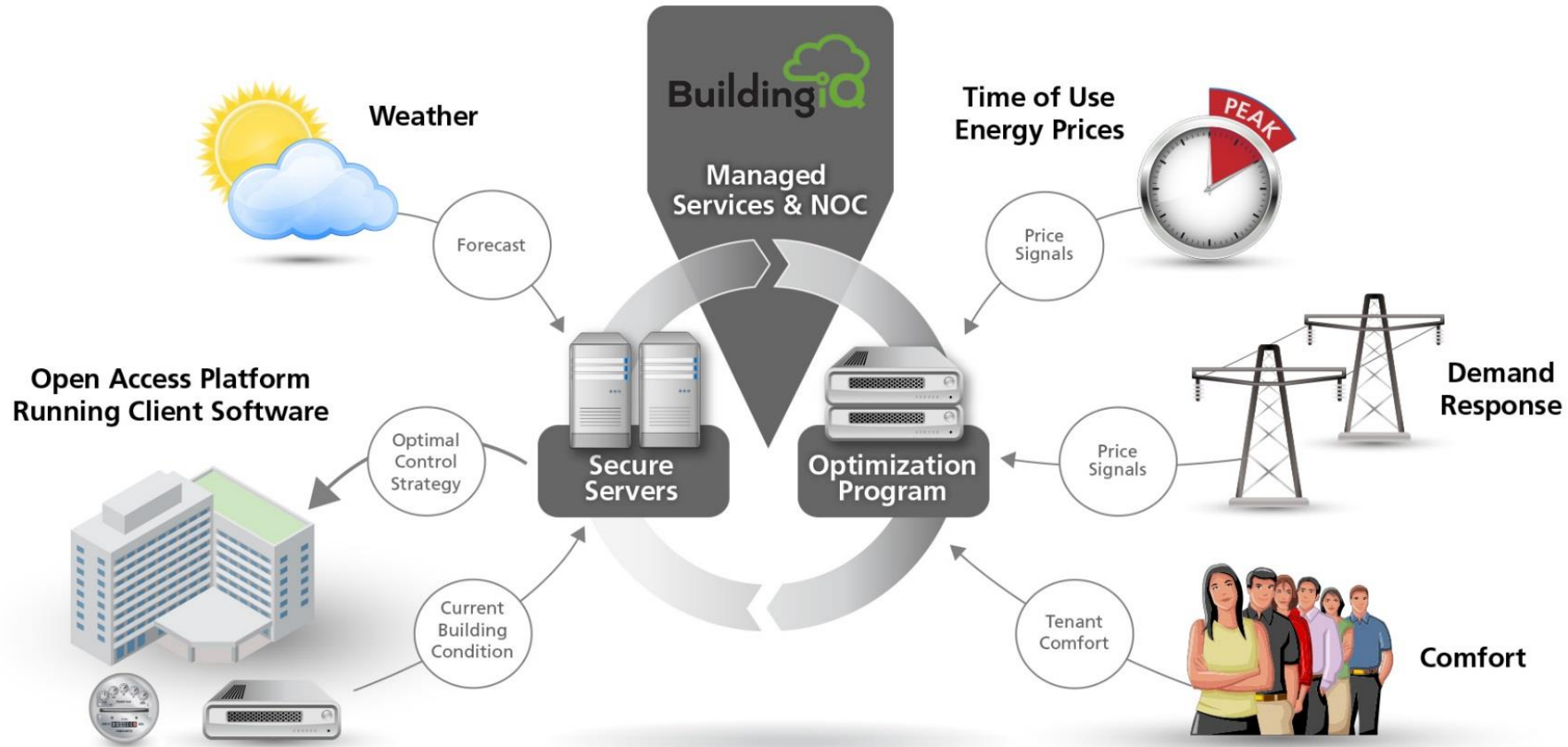
The Rise of **Engineering-Driven Advanced Analytics**

Architecture of an analytics system



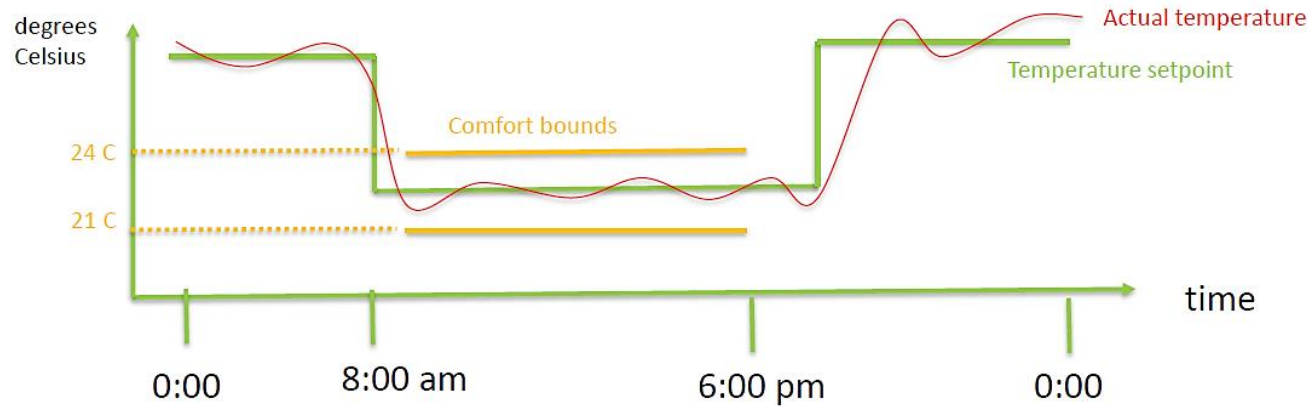
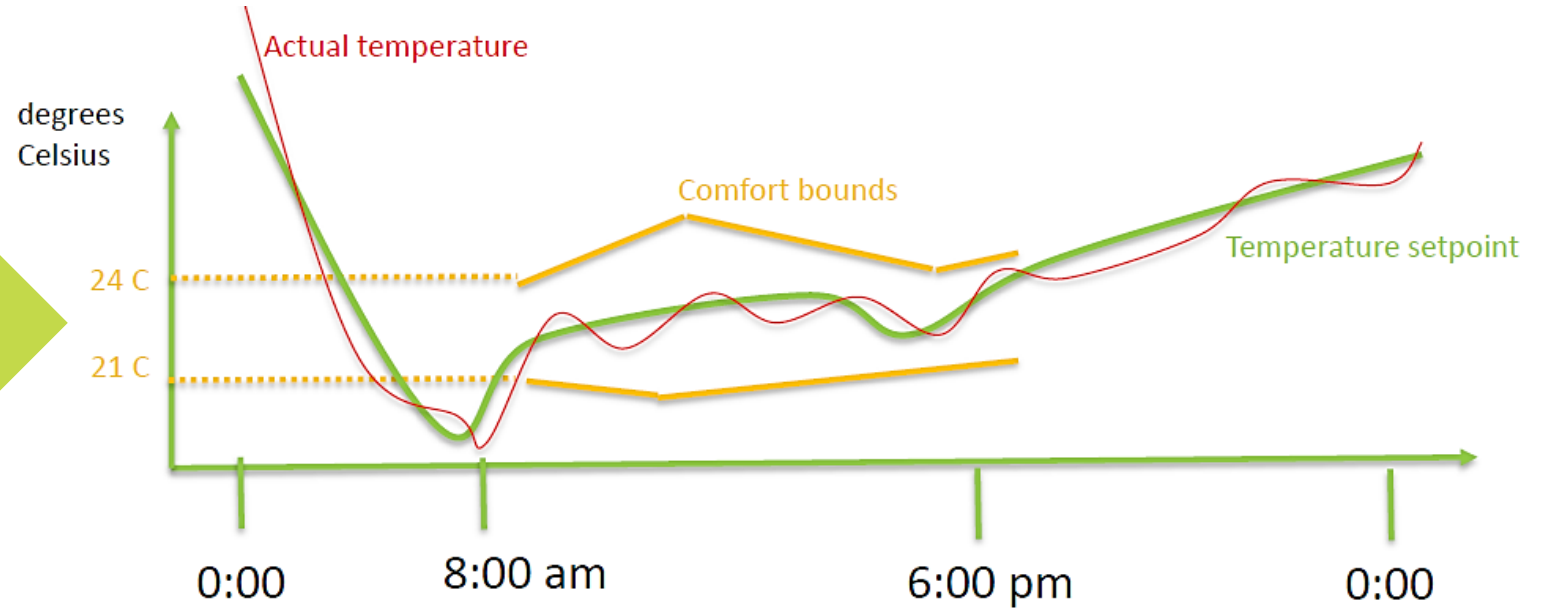
Example – BuildingIQ

Adaptive building energy management

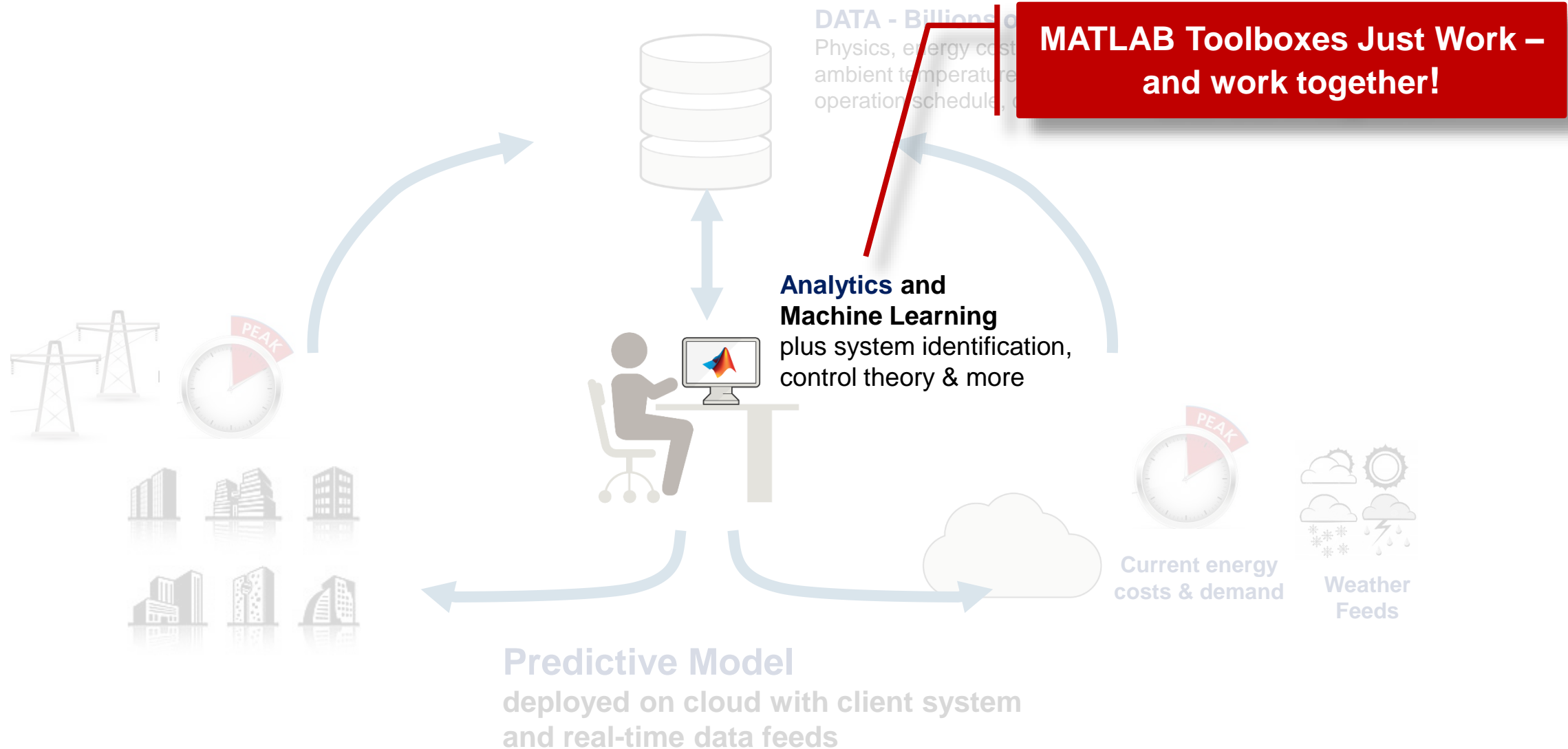


BuildingIQ

25% cost reduction



Real-time, closed-loop optimization algorithms



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**

BuildingIQ



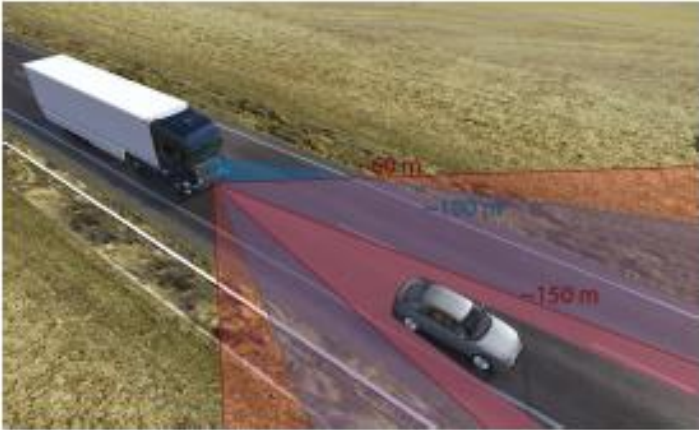
We could rapidly translate our prototypes into production algorithms that deal reliably with real-world noise and uncertainty

Borislav Savkovic, BuildingIQ

Example – Scania

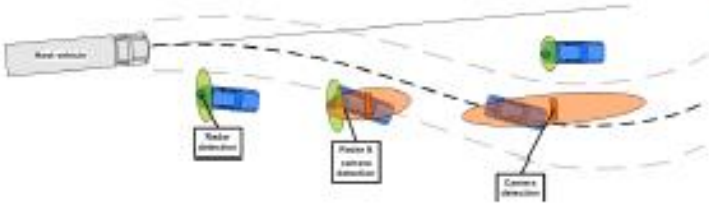
Automatic emergency braking using sensor fusion and analytics

Sensor fusion
Two sensors -> One "truth"




Sensors have different advantages

- Radar
 - + Range (longitudinal)
 - + Relative velocity
 - + Solid object reflection
 - No shapes
 - Lateral position
- Camera
 - + Object type
 - + Object width
 - + Lateral position
 - Range
 - Optical illusions



2015-09-24 Jonny Anderson



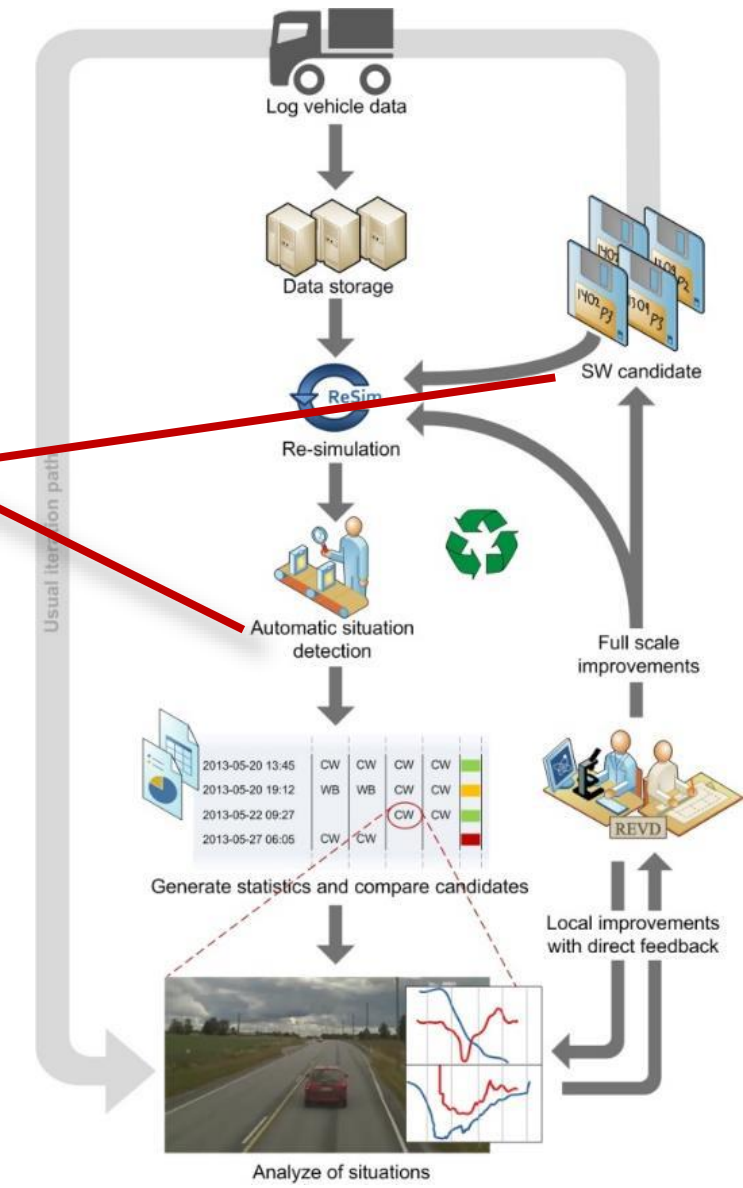
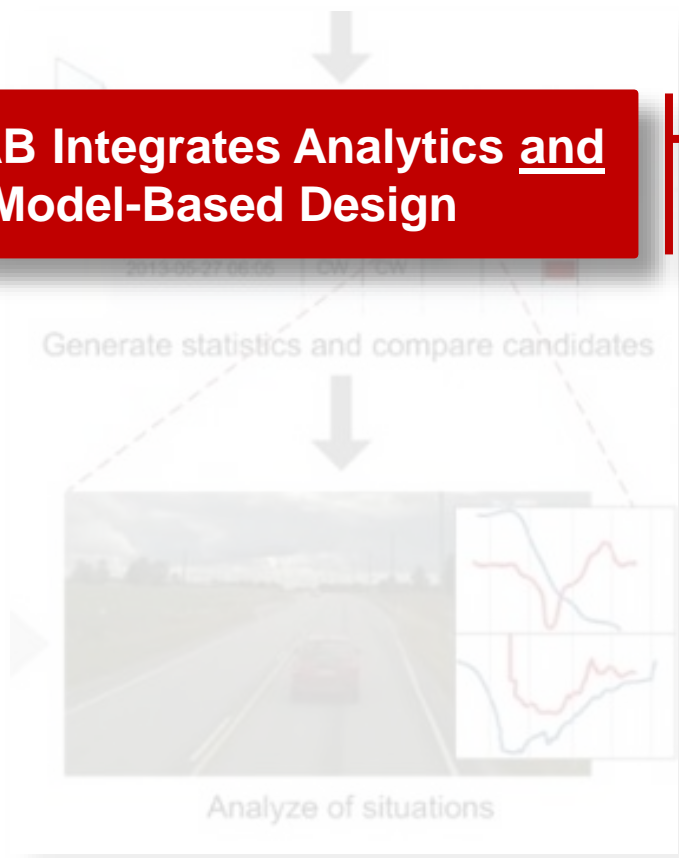
50 km/h - sudden brake



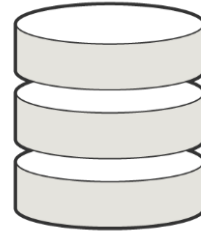
Using Model-Based Design

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



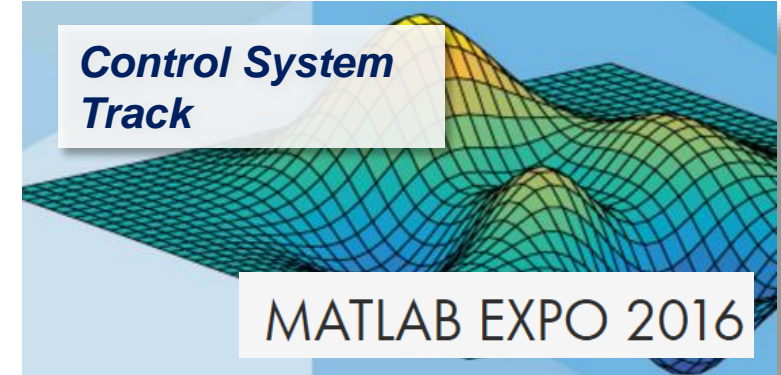
Machine learning
to develop fusion algorithms
for situation detection

| | | | | | |
|------------------|----|----|----|----|--------|
| 2013-05-20 13:45 | CW | CW | CW | CW | Green |
| 2013-05-20 19:12 | WB | WB | CW | CW | Yellow |
| 2013-05-22 09:27 | | | CW | CW | Red |
| 2013-05-27 06:05 | CW | CW | | | Red |

Generate statistics and compare candidates



Analyze of situations



Vehicle logs
of video and radar data



Predictive Model
deployed on vehicle

Automotive



Off-highway vehicles



Aeronautics



The Rise of Engineering-Driven **Analytics**

Retail



Finance



Healthcare



Internet



Industrial Automation



Oil & Gas



Medical Devices



Clean Energy

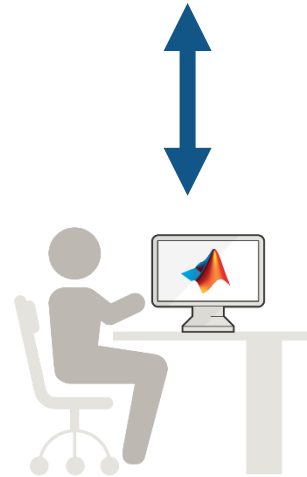
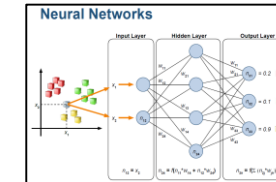
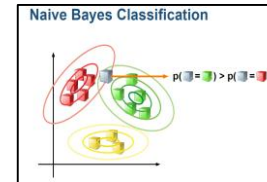
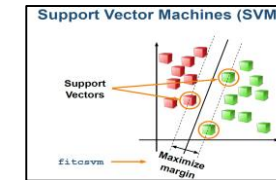


Predictive Maintenance for polymer-based production machines

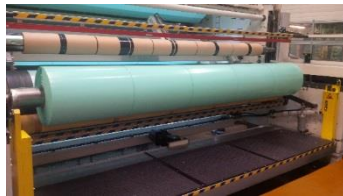
Sensor Data (~1 minute)
10-100 sensors/machine
Quality State (~40 minutes)

| 1 TIMESTAMP | 2 PARAMETER | | | | | | | | 3 STATE | | |
|-------------------------|----------------|-----|-----|-----|------|---|------|----|------------|----|---|
| '2015-07-14 00:49:12.0' | 160 | 160 | 160 | 160 | 1000 | 7 | 1000 | 9 | 33 | 32 | 1 |
| '2015-07-14 00:50:12.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 10 | 33 | 32 | 1 |
| '2015-07-14 00:51:13.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 10 | 33 | 32 | 1 |
| '2015-07-14 00:52:12.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 10 | 33 | 32 | 1 |
| '2015-07-14 00:53:12.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 11 | 33 | 32 | 2 |
| '2015-07-14 00:54:12.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 12 | 33 | 32 | 2 |
| '2015-07-14 00:55:12.0' | 160 | 160 | 160 | 160 | 1000 | 8 | 1000 | 10 | 33 | 32 | 2 |

Classification using Statistics, Machine Learning, and Neural Networks



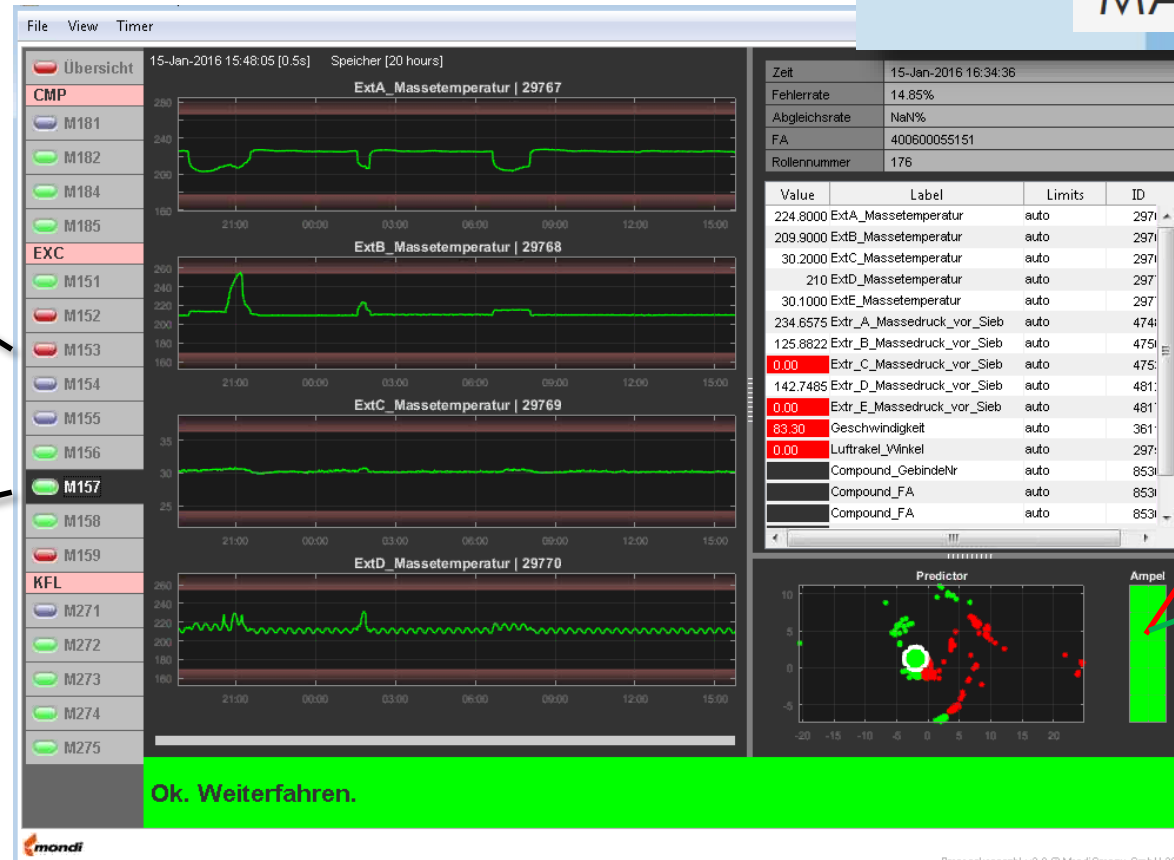
Deployment – a MATLAB App used by machine operators



M153

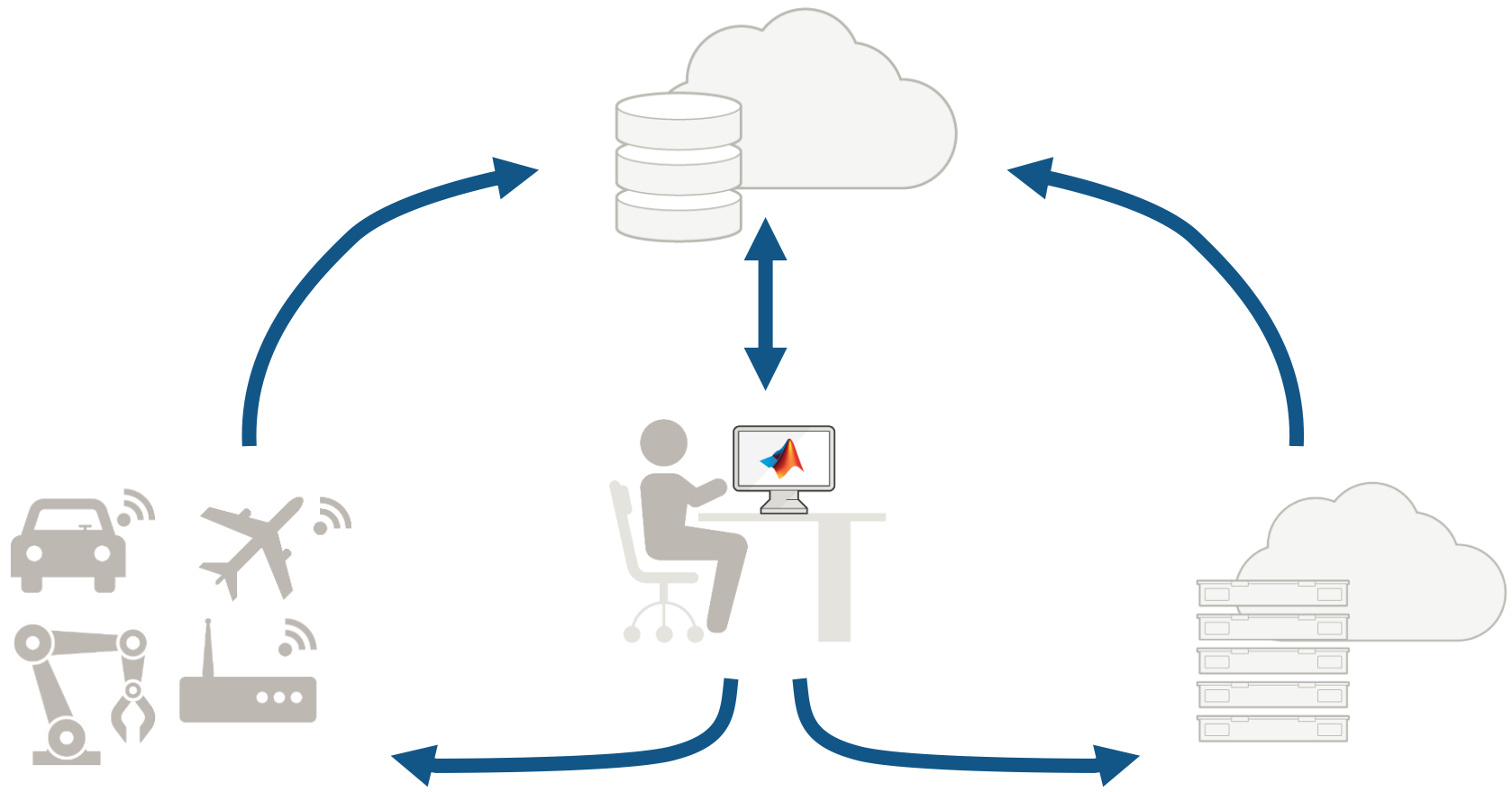


M157

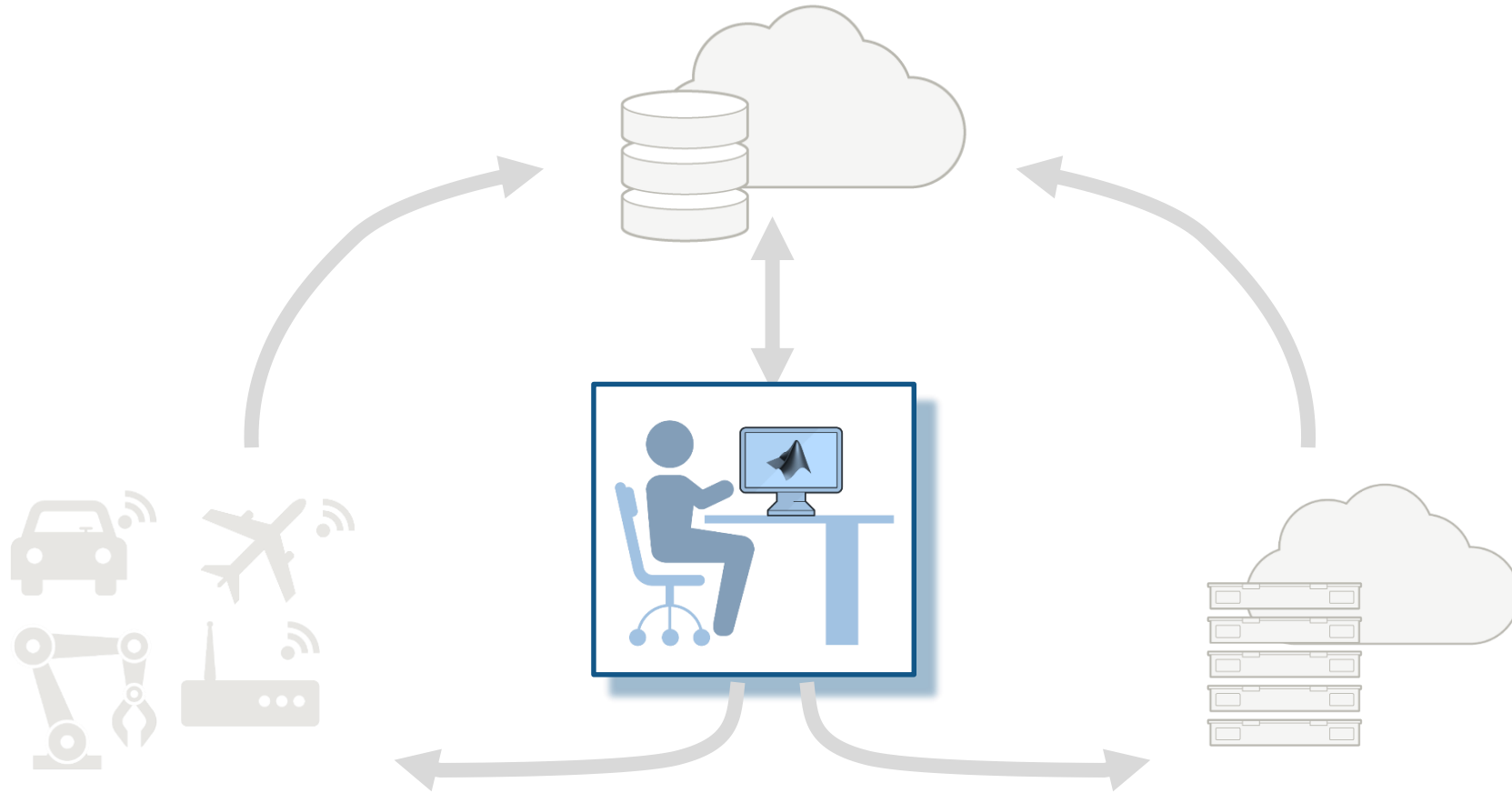


State **NOT OK**

State **OK**



The need for data scientists



Essential Guide IoT analytics guide: Understanding Internet of Things data
A comprehensive collection of articles, videos and more, hand-picked by our editors

Shortage of data scientists, big data pros vexes IoT efforts

academic search

AMITA OSS EXECUTIVES CHIEF & SPECIALISTER LEDIGA TJANSTER TALENT MANAGEMENT OM OSS

FÖLJ OSS + LOGGA IN SWAPA PROFIL INTEGRITETSPOLICY IN ENGLISH

Data Scientist

King.com is a worldwide leader in casual social games with over 40 million monthly players and more than 3 billion games played per month globally. King.com offers over 150 exclusive games in 14 languages through its premier destination, King.com (www.king.com), mobile devices, Google+, and Facebook, where it is a top 10 Facebook developer and has over 11 million daily active users. The company is the exclusive provider of online games for leading global portals, websites and media companies. King.com has offices in London, Stockholm, Barcelona, Bucharest, Hamburg, Milan, Malta and San Francisco. For more information, please visit <http://about.king.com>.

MIDASPLAYER AB (KING.COM)

PUT YOUR TALENT TO WORK FOR 200 MILLION CUSTOMERS AROUND THE WORLD

Data Scientist in Customer Insights & Analyses - Telenor Norge AS, Mobile

Telenor, Telenor Norge AS

Telenor Norway AS is the largest provider of telecommunications and data services in the country. Through our mobile and landline network we provide telephony, broadband, and cable TV services to residential and business customers across the country. We also sell services to other telecoms operators. We have 4200 employees working in 30 locations around Norway, including Svalbard. Our head office is located at Fornebu in Bærum. Read more about Telenor Norway at www.telenor.no

The Mobile Division at Telenor Norway is responsible for product development, marketing and sales to mobile customers in the Norwegian consumer market on behalf of both the Telenor and djvice brands.

CRUNCH NETWORK

How To Stem The Global Shortage Of Data Scientists

Posted Dec 31, 2015 by [Amy Gershkoff \(@amygershkov\)](#)

Big data talent shortage: How to bridge the gap?

By [Abhishek Raval](#) on May 29, 2015

Data Scientist till Connected Services

SCANIA CV AB · Teknik & Ingenjör · 11 apr

Om jobbet

Inom vår sektion Connected Services på Scania R&D utvecklar vi lösningar för konnektivitet ("Internet-of-things") som en del av Scantias produkt- och tjänsteutveckling. Inom sektionen utvecklar vi bland annat Fleet Management-lösningar.

Jobbfakta

ORT
Södertälje

ANSTÄLLNING
Heltid

Bevaka liknande jobb

Få nya jobb liknande detta till din e-post.

CSJOBBS IT24 SÄKERHET24 EVENT KATEGORIER

2014-04-11 16:16

Data science - därför är det glödhet just nu

What they say

- Expand university programs
- Train existing analysts

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HIGHER SCHOOL OF ECONOMICS
NATIONAL RESEARCH UNIVERSITY

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.

CALIFORNIA INSTITUTE OF TECHNOLOGY

LEARNING FROM DATA

Machine Learning course - recorded at a live broadcast from Caltech

HIGHLIGHTS

A real Caltech course, not a watered-down version

Featured on

- [\[Home\]](#)
- [The lectures](#)
- [Homework](#)
- [Textbook](#)
- [Forum](#)

coursera [Catalog](#)

Stanford University

Machine Learning
Stanford University

[Course Info](#)

Teaching with MATLAB and Simulink Track

MATLAB EXPO 2016

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BD2K-LINCS DATA COORDINATION AND INTEGRATION CENTER

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 phenotype profiling of human cells.

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UNIVERSITY of WASHINGTON

Computational Methods for Data Analysis

Exploratory and objective data analysis methods applied to the physical, engineering, and biological sciences.



IoT open data platform for students and makers

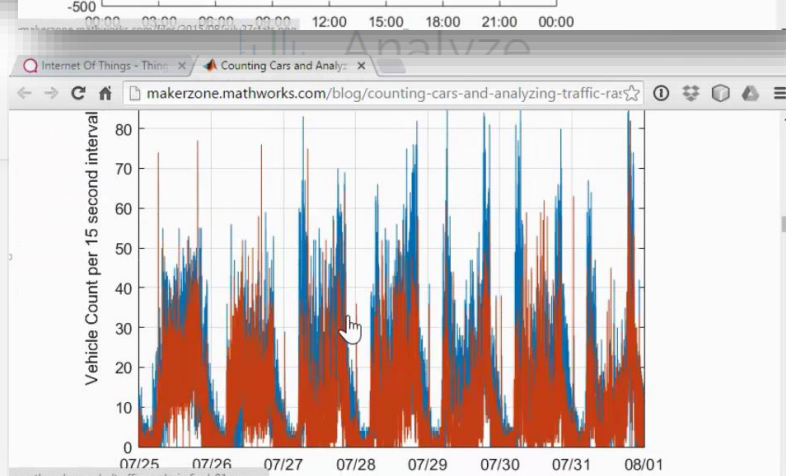
Built-in MATLAB analysis

The screenshot shows the ThingSpeak website's 'MATLAB Analysis' section. It features a 'New MATLAB Analysis' heading and a list of templates: 'Custom (no starter code)', 'Get data from a private channel', 'Get data from a public channel', and 'Get data from a webpage'. Below this, there are 'MATLAB Analysis Examples' and a 'Help' section. The browser address bar shows 'https://thingspeak.com/apps/matlab_analyses/templates'.

Simulink support via Raspberry Pi

The screenshot displays a Simulink model titled 'Live Car Counting with Raspberry Pi Hardware'. The model includes blocks for 'Image Acquisition', 'Image Filter', 'Image Processing', 'Video Analysis', 'Car Counter', and 'Raspberry Pi'. A text box explains: 'To run this model on hardware, on the Simulink Editor toolbar, click the "Run" button. Note that the simulation mode is "External". This mode allows you to tune parameters and monitor signals in the model while the application is running on hardware.'

Collect
Send sensor data to the cloud.

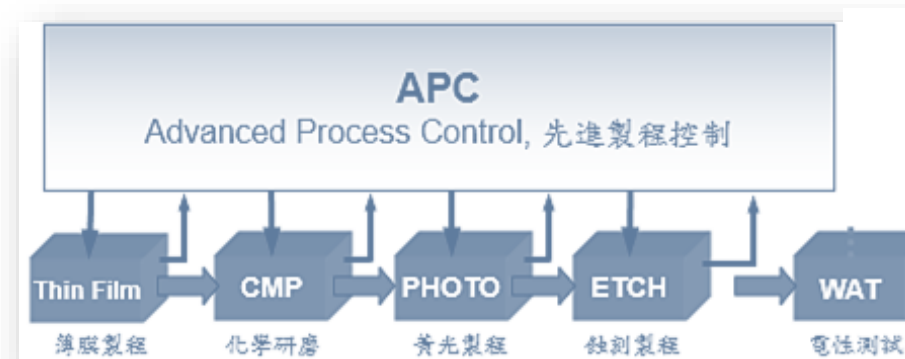
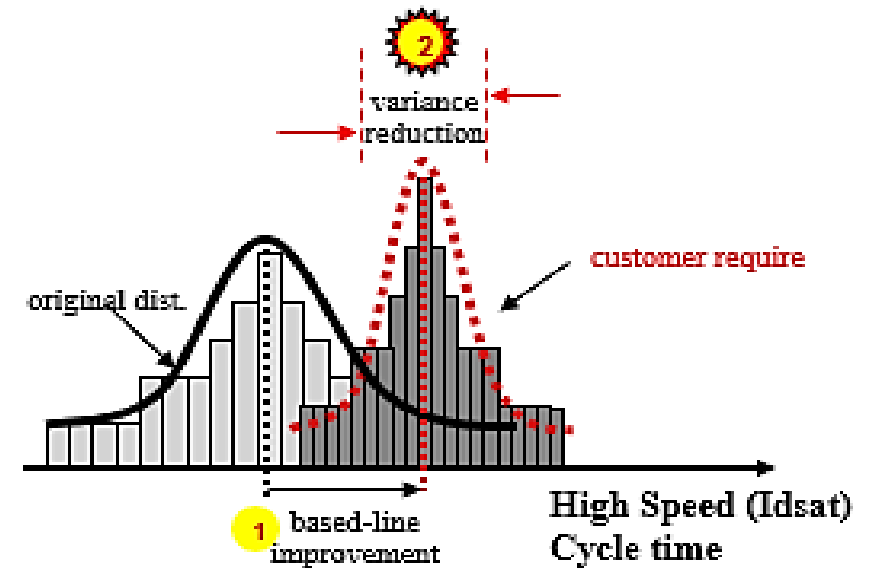


Act
Trigger a reaction.

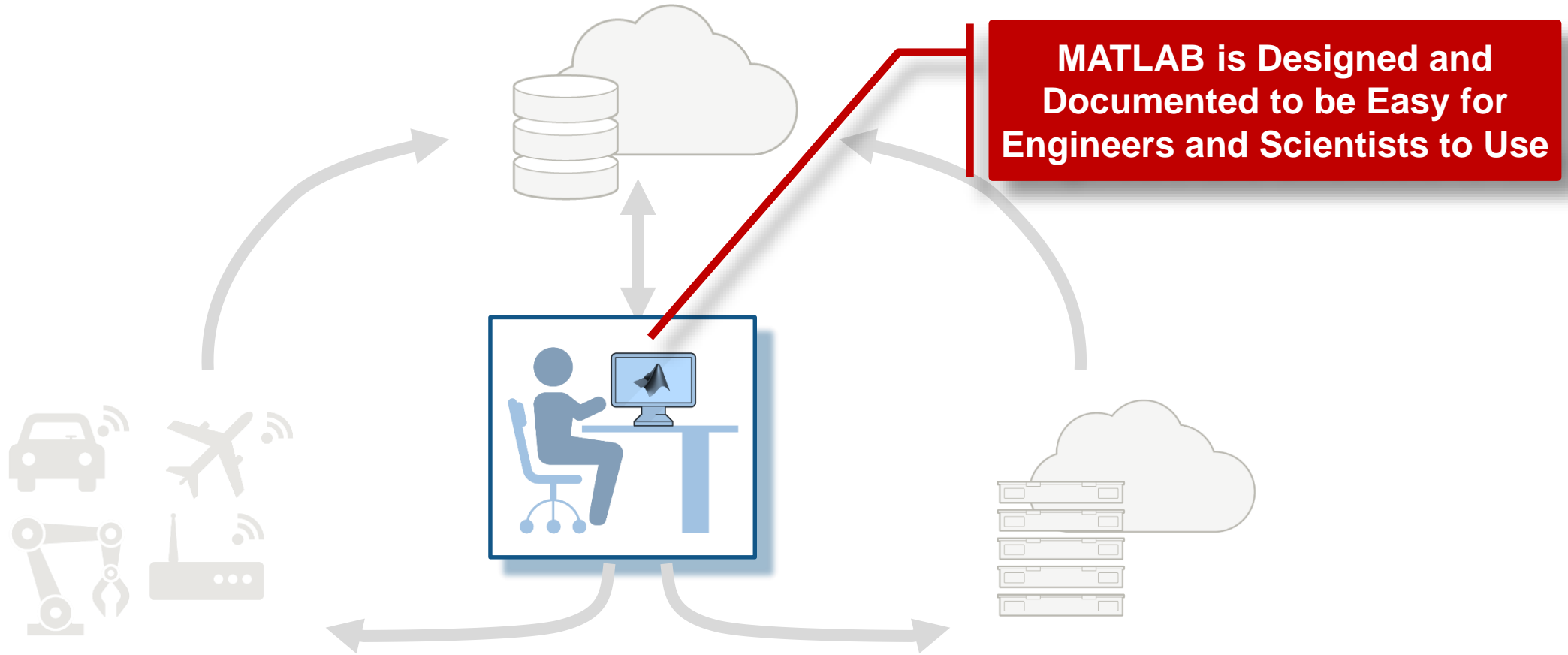
Student Contest

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

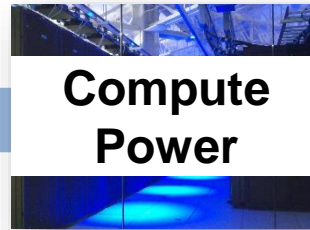


Limited users, scope, & technology



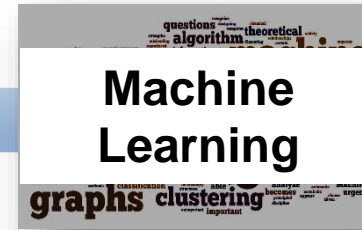
Big Data

- Engineering
- Business
- Transactional



Compute Power

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



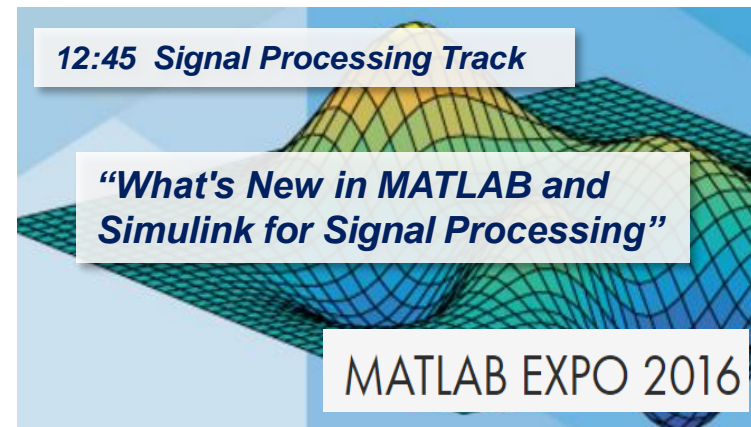
Machine Learning

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

Pervasive users, scope, & technology

In MATLAB

- Native support for engineering data
- Database interfaces
- Streaming

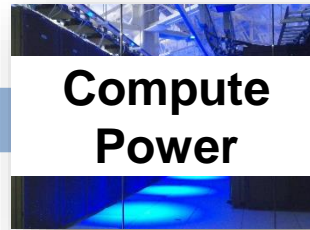


Limited users, scope, & technology



Big Data

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Machine Learning

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Pervasive users, scope, & technology

In MATLAB

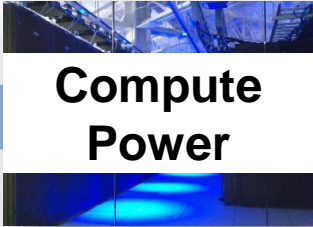
- Native support for engineering data
- Database interfaces
- Streaming
- **Datastore** R2014b text, image, video, Excel files, ...
- **Mapreduce** R2014b

Limited users, scope, & technology



Big Data

- Engineering
- Business
- Transactional



Compute Power

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



Machine Learning

- Natural language processing
- Classification
- Clustering
- Regression

Pervasive users, scope, & technology

MATLAB is fast:

- heavily optimized libraries
- JIT compiled
- takes advantage of the compute power you have

In MATLAB

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

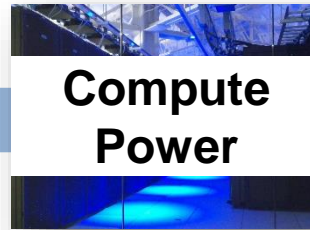
- **Multicore & GPU**
- **MATLAB Distributed Computing Server and EC2 Support**
- **Hadoop support** R2014b
- **MATLAB Production Server**

Limited users, scope, & technology



Big Data

- Engineering
- Business
- Transactional



Compute Power

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



Machine Learning

- Neural Networks
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- Clustering
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Pervasive users, scope, & technology

In MATLAB

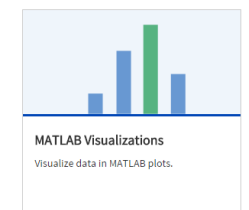
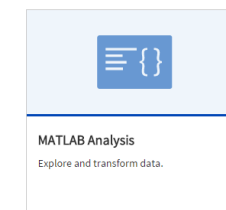
- Native support for engineering data
- Database interfaces
- Streaming
- **Datastore** R2014b text, image, video, Excel files, ...
- **Mapreduce** R2014b
- Multicore & GPU
- MATLAB Distributed Computing Server and EC2 Support
- **Hadoop support** R2014b
- MATLAB Production Server

NEW from MathWorks



The open data platform for the Internet of Things

Analytics

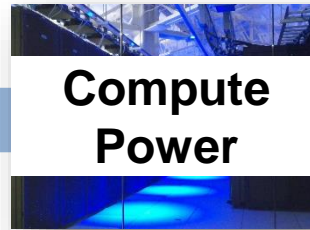


Limited users, scope, & technology



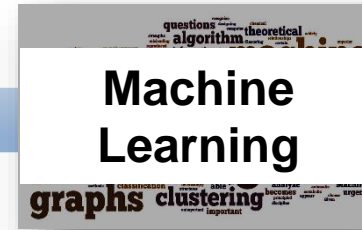
Big Data

- Engineering
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- Transactional



Compute Power

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



Machine Learning

- Neural Networks
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Pervasive users, scope, & technology

In MATLAB

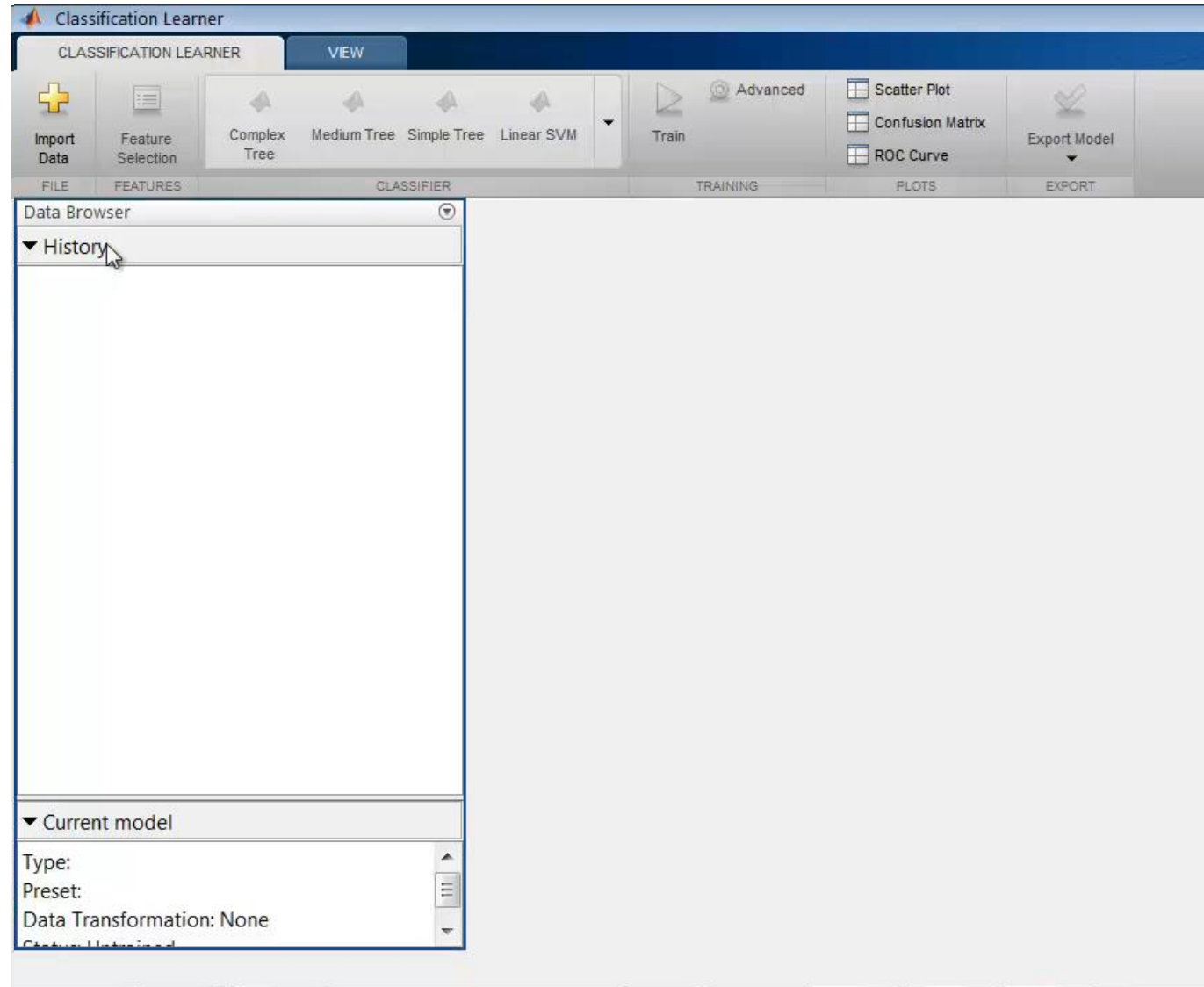
- Native support for engineering data
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- **Mapreduce** R2014b

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

- 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 Data Analytics

Distribution Fitting

System Identification

Signal Analysis

Wavelet Design and Analysis

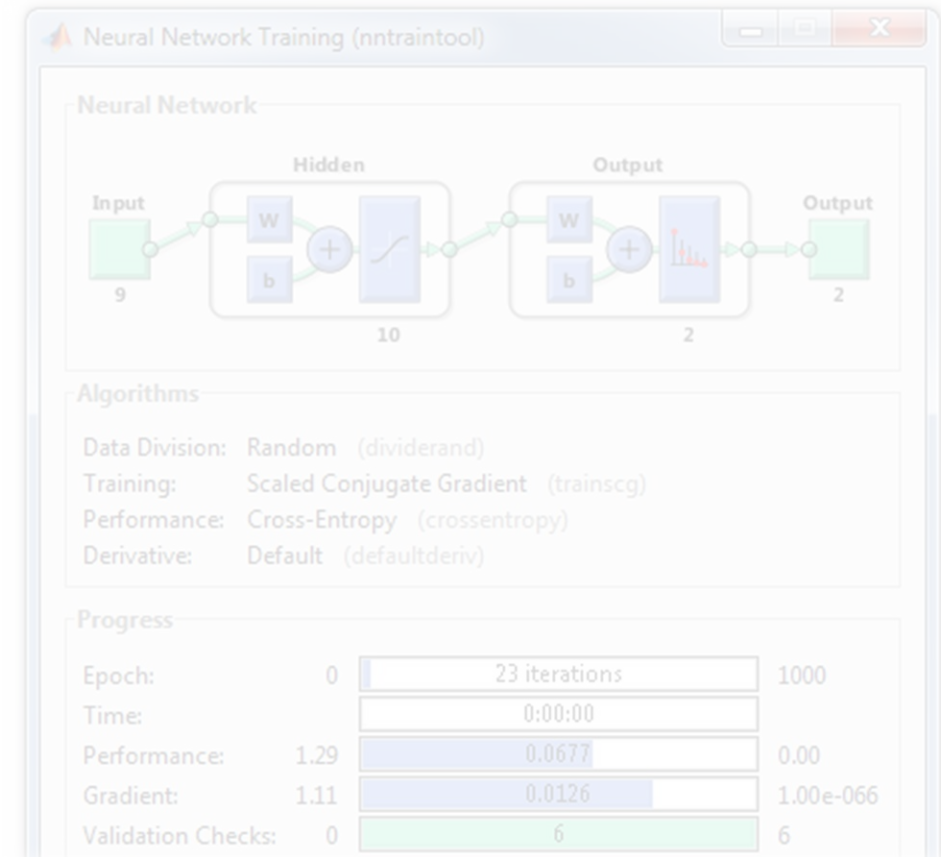
Neural Net Fitting

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

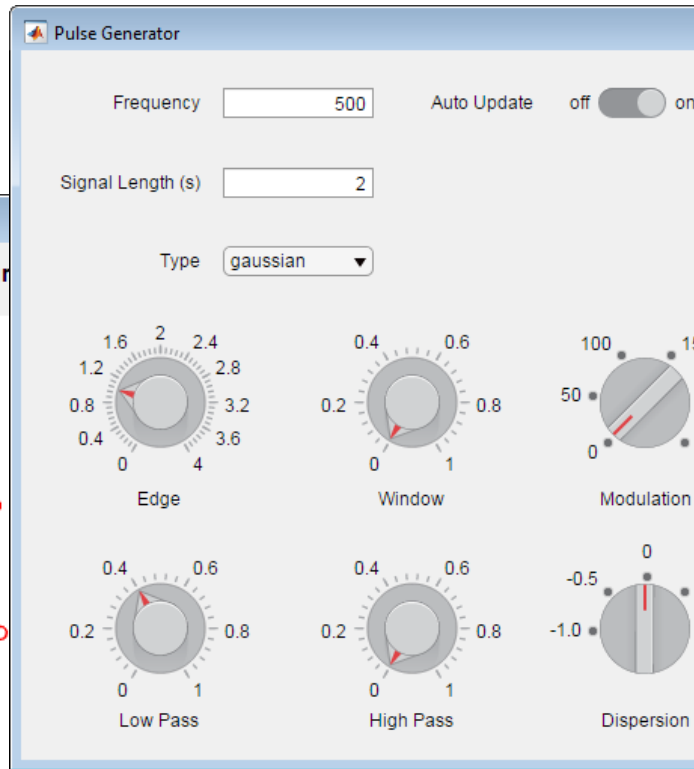
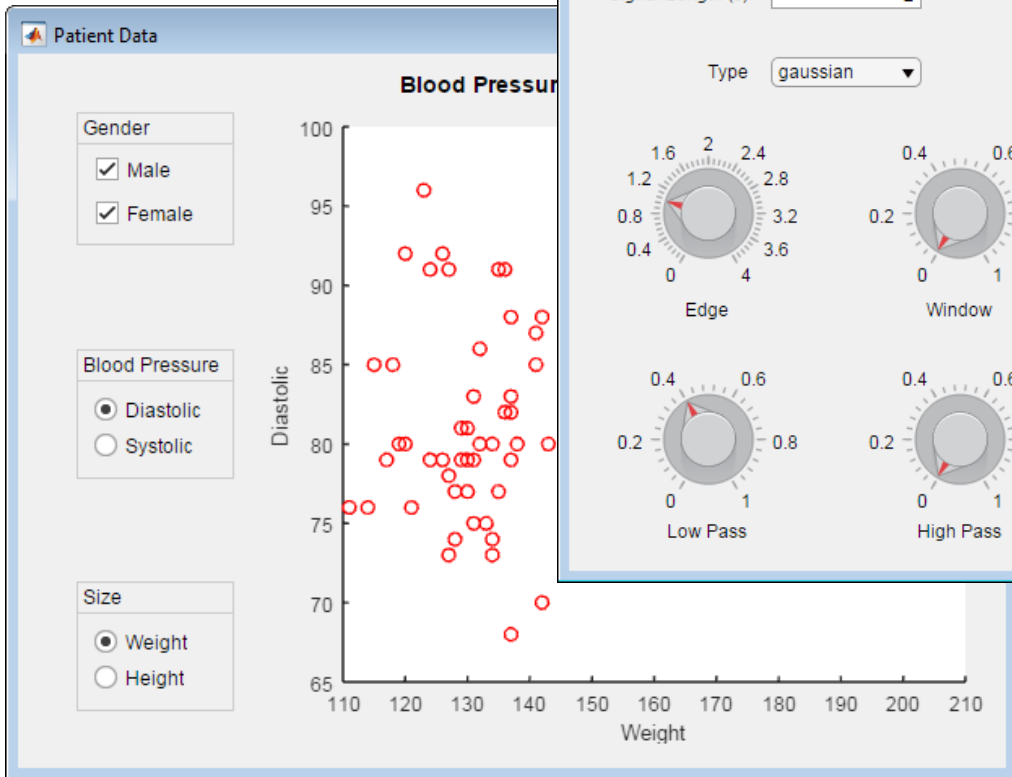
App Designer



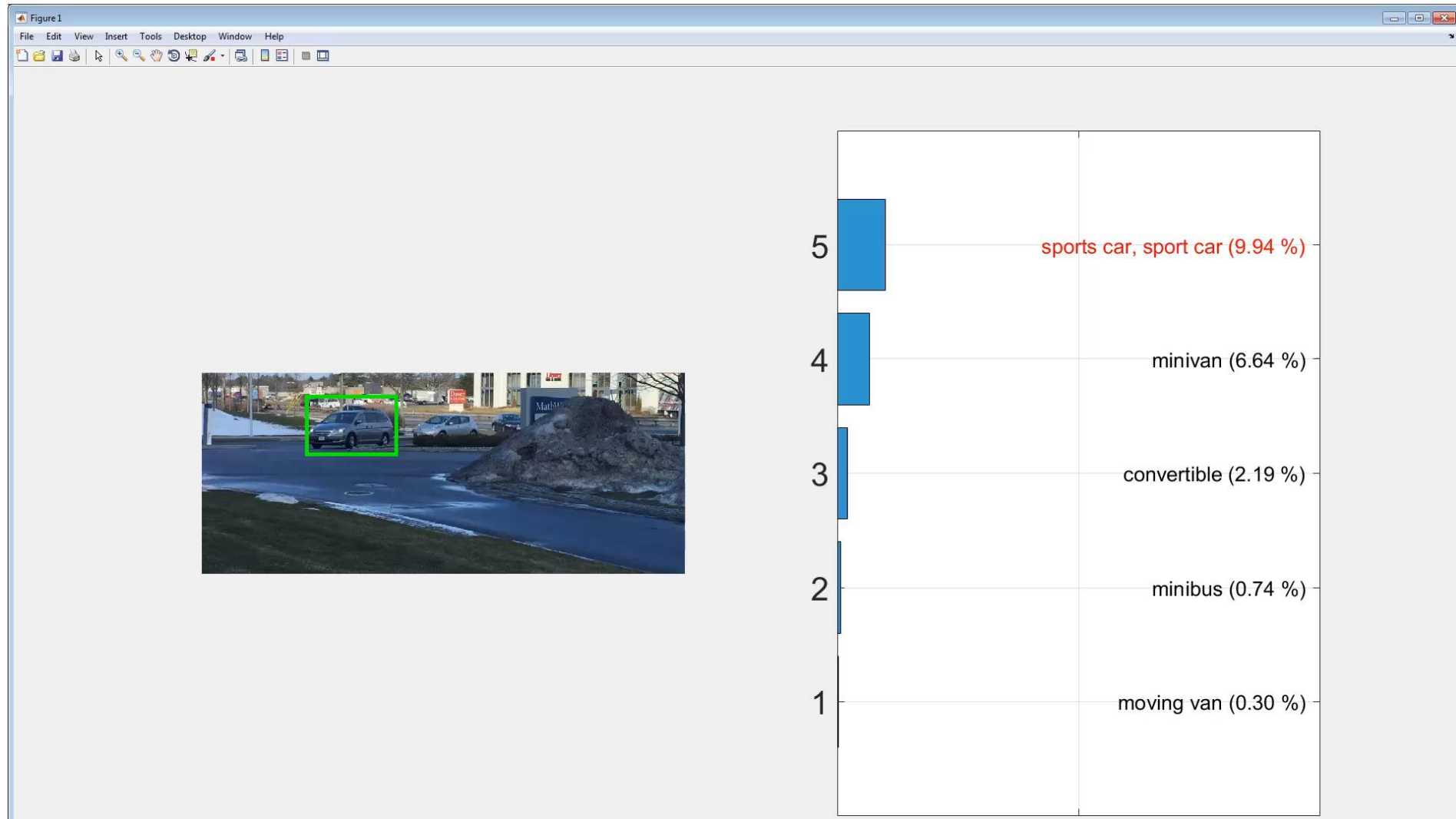
The screenshot shows the MATLAB App Designer interface. The main canvas displays a design with several components: a 'Gear' control with 'Low', 'Medium', and 'High' buttons; three numeric input fields labeled 'k', 'mu', and 'L', each with a value of 0; a 'Don't Touch' button; a plot titled 'Title' with X and Y axes ranging from 0 to 1; and a 'Speed' slider ranging from 30 to 80. The interface includes a 'DESIGNER' toolbar with options like 'Save', 'Grouping', 'Apply Horizontally', and 'Run'. On the left, there is a 'COMPONENT LIBRARY' with categories like 'Drop Down', 'Edit Field', 'List Box', 'Slider', 'Spinner', 'Text Area', and 'Gauges'. On the right, a 'COMPONENT BROWSER' shows a tree view of the app's components, with 'app.ToggleSwitch' highlighted. Below the browser, there are sections for 'MULTIPLE COMPONENTS PROPERTIES', 'Configuration', 'Font' (set to Helvetica, size 12), and 'General' (with 'Enable' checked).

Using MATLAB R2016a

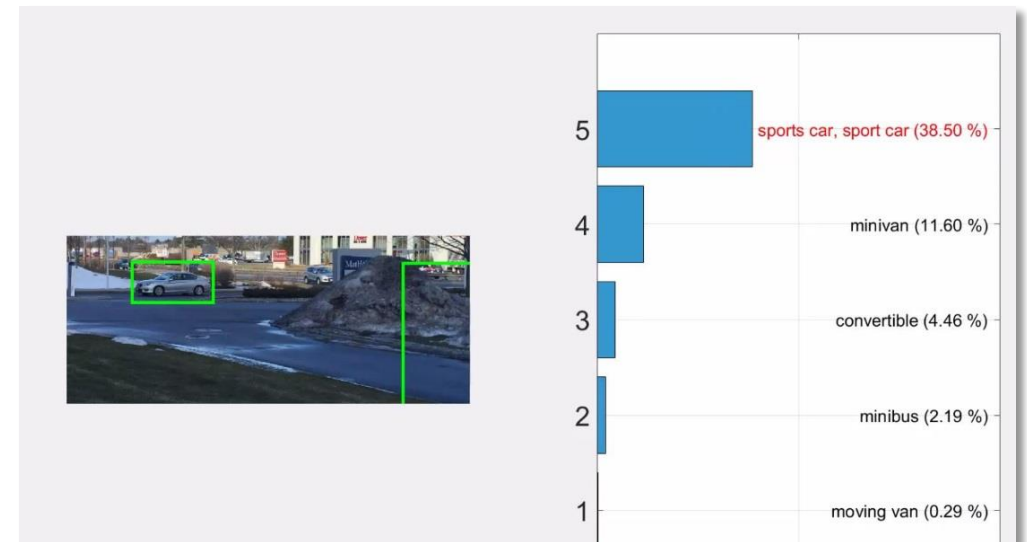
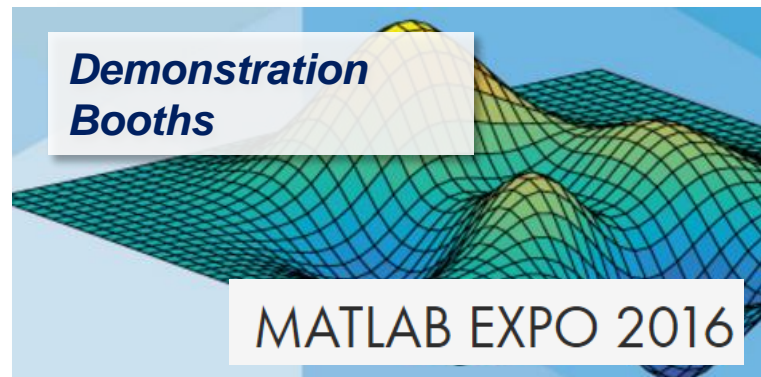
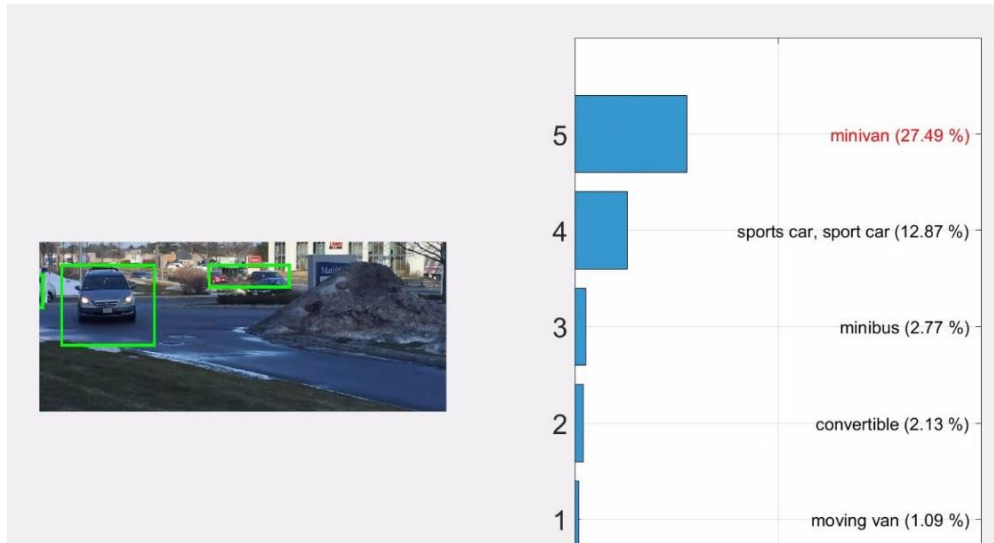
App Designer



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

Limited
users, scope,
& technology

Big Data

**Compute
Power**

**Machine
Learning**

Pervasive
users, scope,
& technology

Be your own Data Scientist!