MATLAB EXPO 2017

Problem-Based Learning: Data Analytics and Machine Learning Techniques for Solving Real-World Challenges

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Teaching in the Classroom: Then and Now
Workplace: Then

The term “computer”, in use from early 17th century, meant “one who computes”: a person performing mathematical calculations, before electronic computers became commercially available. Teams of people were frequently used to undertake long and often tedious calculations.  
(Source: Wikipedia)
Workplace: Now
Technology Trends
Data Everywhere – Algorithms in Everything
Companies using MathWorks products
Google has more than 50,000 employees right now, and they earn great salaries. Average pay at Google is $141,000. It's relatively easy to get a job at Google, too. The company is so large and has such a massive need for talent that hiring for Google is something of a headache, so if you have the right skills, Google is really enthusiastic to hear from you.

Especially if you know how to use MatLab, a coding and data analysis and management tool.
What is Data Analytics?

*Turn large volumes of complex data into actionable information*

- **Descriptive**
  - What happened?
- **Diagnostics**
  - Why did it happen?
- **Predictive**
  - What will happen?
- **Prescriptive**
  - What should be done?

Data → Decisions
Data Analytics Workflow

Access and Explore Data
- Files
- Databases
- Sensors

Preprocess Data
- Working with Messy Data
- Data Reduction/Transformation
- Feature Extraction

Develop Predictive Models
- Model Creation e.g. Machine Learning
- Parameter Optimization
- Model Validation

Integrate Analytics with Systems
- Desktop Apps
- Enterprise Scale Systems
- Embedded Devices and Hardware
Demo: Diagnosing Arrhythmia
Classification Learner App

% Train using fitglm.
GeneralizedLinearModel = fitglm(...
concatedenatedPredictorsAndResponse,
'Distribution', 'binomial', ...
'link', 'logit');

% Convert predicted probabilities to pr
convertSuccessProbsToPredictions = @(p)
Demo: Deployed Analytics – Energy Load Forecasting

Predictive Data Analytics
This website tightly integrates MATLAB analytics with web technologies for demonstrating predictive data analytics models in production with live data.

Get started »

Demand Forecasting
Forecast electricity demand for US power grids with live data from ISOs and weather stations using Neural Network models. Forecasts can be compared to past data as well as normal weather. Prediction bands at different confidence intervals also quantify uncertainty in forecast.

Start »

Web Service Information
Documentation on end points and query parameters for demand forecast web services

Read more

App Documentation
Documentation of the en components

Coming soon

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Demo: Deployed Analytics – Energy Load Forecasting
MATLAB Production Server

Web Application Server
- Apache Tomcat
- Web Server/Webservice

MATLAB Production Server
- MATLAB Production Server
- Request Broker
- CTF

MATLAB Desktop
- Train in MATLAB
- Predictive Models
- Weather Data
- Energy Data

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Demo: Object Detection with Deep Learning

<table>
<thead>
<tr>
<th>Training</th>
<th>Millions of images from 1000 different categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction</td>
<td>Real-time object recognition using a webcam connected to a laptop</td>
</tr>
</tbody>
</table>
How Many Lines of Code Did We Use for Object Detection with Deep Learning?

10 lines of MATLAB code!

camera = webcam;  % Connect to the camera
nnet = alexnet;   % Load the neural net

while true
    picture = camera.snapshot;  % Take a picture.
picture = imresize(picture, [227, 227]);  % Resize the picture.

    label = classify(nnet, picture);  % Classify the picture.

    image(picture);  % Show the picture.
title(char(label));  % Show the label.
drawnow;
end
Demo: Human Activity Analysis and Classification

Courtesy of:
Davide Anguita, Alessandro Ghio, Luca Oneto, Xavier Parra and Jorge L. Reyes-Ortiz.


Dataset available at:
http://archive.ics.uci.edu/ml/datasets/Human+Activity+Recognition+Using+Smartphones
Internet of Things
Internet of Things
University College London Improves Computational Literacy with Online and Onsite MATLAB Training

Challenge
Enrich student coursework with project-based learning while enabling instructors to focus on teaching core concepts

Solution
Acquire a MathWorks Total Academic Headcount license and use MathWorks onsite training and online courses to accelerate student adoption of MATLAB campus-wide

Results
- Program scalability enabled
- Faculty and students focused on addressing real-world problems
- Students equipped with required tools and skills

“One advantage of teaching with MATLAB is that our students are exposed to a tool that is used in the commercial world. The quality of the learning materials delivered online and onsite was excellent, enabling me to focus on teaching analytics and working with students.”

Daniel Hulme
University College London
Industry Links

“On one project, students used MATLAB to develop a solution that helped an energy company reduce costs by £59 million.”
MATLAB Enabled Campus for Everyone, Anywhere

MATLAB Courseware

Cody Coursework Autograding

MATLAB Academy

MATLAB Central

MATLAB Online

Big Data Support

Dedicated Engineers

HPC

Student Competitions

Low-Cost Hardware Support

Project-Based Learning

On-Campus Events

Integration with Production Systems

Ambassadors

Technical Support

MATLAB ENPC 2017
Key Takeaways

- MATLAB is a learning tool for Data Analytics
- MATLAB is an Integrated Curriculum Platform
- MATLAB is a state-of-the-art industry software