MATLAB EXPO 2016
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등록 하기 matlabexpo.co.kr
센서 데이터 애플리틱스를 위한 신호처리 및 머신러닝 기법

이웅재 부장
Application Engineering Group

Ryan.Lee@mathworks.com
Sensor Analytics and Edge Node Development
Key topics

- Signal Processing methods (e.g. digital filtering, spectral analysis)
- Machine Learning algorithms (e.g. classification)
- MATLAB environment “enablers” (e.g. language, visualization, Apps, documentation)
- Flow from predictive algorithms to embedded implementation (e.g. DSP system simulation, automatic code generation)
Sensor Analytics Workflow

Acquire:
- Data Acquisition Toolbox
- Instrument Control Toolbox
- Hardware Support Packages (XX)
- Database Toolbox
- ThingSpeak

Analysis:
- Simulink
- Signal Processing Toolbox
- DSP System Toolbox

Analytics:
- MATLAB
- Stats & Machine Learning TB
- Neural Networks Toolbox

Deployment:
- MATLAB Coder
- Simulink Coder
- Embedded Coder
- MATLAB Compiler
- MATLAB Production Server
Signal analysis for classification
Application examples

- Mobile sensing
- Structural health monitoring (SHM)
- Fault and event detection
- Automated trading
- Radar post-processing
- Advanced surveillance
- …
Example: Human Activity Analysis and Classification

Dataset courtesy of:
Davide Anguita, Alessandro Ghio, Luca Oneto, Xavier Parra and Jorge L. Reyes-Ortiz.
http://archive.ics.uci.edu/ml/datasets/Human+Activity+Recognition+Using+Smartphones
Sensor Data Analytics Workflow – the bigger picture

- Domain knowledge
- Open-ended problem
- Long discovery cycles

- Built-in algorithms
- Concise code (54 lines for 66 features!)
- Apps and visualisation accelerate insight
Sensor Data Analytics Workflow – the bigger picture

- Different tools and environments
- Disconnect between hardware and analysis
- Inefficiencies in data sharing

- MATLAB Connects to DAQ interfaces and sensors directly. E.g.
  - Android Sensor Support
  - iPhone and iPad Sensor Support
Sensor Data Analytics Workflow – the bigger picture

- Signal analysis vs. on-line DSP
- From Machine Learning theory to pre-trained, low-footprint classifiers
- MATLAB vs. C/C++
- Streaming algorithms, data sources and visualization for System modelling and simulation
- Automatic code generation
Leverage Built-in Algorithms, Apps, and Technologies

- **Signal Processing Toolbox™**
  Built-in algorithms and Apps to process and analyse signals

- cheby2
- filter
- rms
- pwelch
- periodogram
- xcov
- findpeaks
- ...
Leverage Built-in Algorithms, Apps, and Technologies

- Signal Processing Toolbox™
- **Parallel Computing Toolbox™**
  Accelerate computationally and data-intensive problems using multicore processors, GPUs and computer clusters
Leverage Built-in Algorithms, Apps, and Technologies

- Signal Processing Toolbox™
- Parallel Computing Toolbox™
- Statistics and Machine Learning Toolbox™
  Functions and apps to describe, analyze, and model data. Regression, clustering and classification algorithms to draw inferences from data and build predictive models.
Leverage Built-in Algorithms, Apps, and Technologies

- Signal Processing Toolbox™
- Parallel Computing Toolbox™
- Statistics and Machine Learning Toolbox™
- Neural Network Toolbox™
  Functions and apps to design, train, visualize, and simulate neural networks

```
>> nprtool
>> patternnet
```
Leverage Built-in Algorithms, Apps, and Technologies

- Signal Processing Toolbox™
- Parallel Computing Toolbox™
- Statistics Toolbox™
- Neural Network Toolbox™
- DSP System Toolbox™

Streaming algorithms, data sources and visualization for system modelling and simulation

- BiquadFilter
- MatFileReader
- Autocorrelator
- SpectrumEstimator
- TimeScope
Leverage Built-in Algorithms, Apps, and Technologies

- Signal Processing Toolbox™
- Parallel Computing Toolbox™
- Statistics Toolbox™
- Neural Network Toolbox™
- DSP System Toolbox™
- MATLAB Coder™

Generate embeddable source C/C++ from MATLAB code

(Learn more: MATLAB to C Made Easy webinar)
Signal Processing and Machine Learning Techniques for Sensor Data Analytics

Summary

- Extensive set of de-facto standard functions for signal processing and machine learning
- Environment accelerates insight and automation: visualisation, apps, language, documentation
- Path to embedded products, from on-line simulation to automatic code generation