Data Analysis and Visualization with MATLAB

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Agenda

- Data Analysis with MATLAB

- Demo: Solar Radiation Estimation
  - Introduction to MATLAB environment
  - Building analysis routines
  - Creating documentation
  - Automating analysis for multiple files
  - Building graphical applications

- Summary
Data Analysis Tasks

Access
- Files
- Software
  - Code & Applications
- Hardware

Explore & Discover
- Data Analysis & Modeling
- Algorithm Development
  - For k=1:max
  - x = fft(dat)
  - y = 20*log1
- Application Development

Share
- Reporting and Documentation
- Outputs for Design

Deployment
- MATLAB
  - .NET
  - Excel
  - C/C++
  - Java
  - .dll

Automate
Demo: Solar Radiation Estimation

- **Goal:**
  - Estimate daily mean global solar radiation given low cost and easily obtained measurements

- **Approach:**
  - Process historical measurements
  - Develop and test predictive model
  - Document analysis in a report
  - Link analysis to Excel workbook
  - Extend analysis on multiple files
Modeling Global Solar Radiation

\[ R_s = a \left(1 + bH\right) \left(1 - e^{-c \Delta T^n}\right) \]

- \(R_s\): Solar Ratio (global solar radiation/ extraterrestrial solar radiation)
- \(H\): Relative humidity
- \(\Delta T\): \(T_{DailyMax} - T_{DailyMin}\)
- \(a, b, c, n\): Model coefficients

- Value of extraterrestrial solar radiation is calculated for a given day-of-year (ordinal date) and latitude using a known formula
- Daily temperature variations are largely driven by solar radiation received at the surface
Demo: Estimate Electricity Usage

Products Used
- MATLAB
- Statistics Toolbox
- Curve Fitting Toolbox
- MATLAB Compiler & Builder EX

Access
- Files
- Software
- Hardware
  - Code & Applications

Explore & Discover
- Data Analysis & Modeling
- Algorithm Development
- Application Development

Share
- Reporting and Documentation
  - PDF
  - .doc
  - .html
- Outputs for Design
- Deployment
  - MATLAB
  - .NET
  - Excel
  - .exe
  - C/C++
  - Java
  - .dll
Accessing Data from MATLAB

- **Files**
  - Excel, text, or binary
  - Multimedia, scientific
  - Web, XML

- **Applications and languages**
  - C/C++, Java, FORTRAN
  - COM, .NET, shared libraries
  - Databases

- **Measurement hardware**
  - Data acquisition hardware for signals or images
  - Stand-alone instruments and devices
Data Analysis and Visualization in MATLAB

**Data analysis**
- Manipulate, preprocess, and manage data
- Fast, accurate analysis with pre-built math and engineering functions

**Visualization**
- Built in graphics functions for engineering and science (2D, 3D, VolViz)
- Interactive tools to annotate and customize graphics
Expanding the Capabilities of MATLAB

MathWorks add-on tools for:
- Statistics and curve fitting
- Signal and image processing
- System identification and control system analysis
- Neural networks and fuzzy logic
- Optimization
- Model-based calibration and more …

Partner products for:
- Additional interfaces
- Domain-specific analysis
- Niche applications
Sharing Results from MATLAB

Access

- Automatically generate structured reports
  - Published MATLAB files
  - MATLAB Report Generator

Explore & Discover

- Feed your results into downstream design tools

Share

- Deploy applications to other environments
Deploying Applications with MATLAB

- Give MATLAB code to other users
- Share applications with end users who do not need MATLAB
  - Stand-alone executables
  - Shared libraries
  - Software components
Deploying Applications with MATLAB

1. MATLAB Application
2. MATLAB Compiler
3. MATLAB Compiler Runtime (MCR)

MATLAB Desktop
End-User Machine

Toolboxes
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Benefits of Using MATLAB

- Thousands of engineering, science, and math functions
- Extensive plotting capabilities
- Automation of custom analysis routines
- Integration with Excel and other environments
Learn More

MATLAB® is a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, you can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or Java.

You can use MATLAB for a range of applications, including signal processing and communications, image and video processing, control systems, test and measurement, computational finance, and computational biology. More than a million engineers and scientists in industry and academia use MATLAB, the language of technical computing.

Explore MATLAB Capabilities

- Numeric Computation
  - Use built-in mathematical functions in MATLAB to solve science and engineering problems.
- Data Analysis and Visualization
  - Explore, visualize, and model your data with MATLAB.
- Programming and Algorithm Development
  - Create and optimize algorithms using the high-level language and development tools in MATLAB.
- Application Development and Deployment
  - Develop and share MATLAB applications as code, executable, or software components.

http://www.mathworks.com/company/events/webinars/wbnr37971.html