Data Analysis Tasks

Access
- Files
- Software
  - Code & Applications
- Hardware

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

Share
- Reporting and Documentation
- Outputs for Design
- Deployment

Automate

Files
Software
Hardware

Algorithm Development

For k=1:max
\[ x = \text{fft}(\text{data}) \]
\[ y = 20\cdot\log1 \]
Demo: Characterize Drug-Drug Interaction

**Goal:** Characterize the interaction between an opioid and a sedative
- synergistic or antagonistic?

Demo: Characterize Drug-Drug interaction

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- synergistic or antagonistic?

**Approach:**
- Develop drug interaction model
- Estimate interaction parameter, \( \alpha \)

\[
R = \frac{E_{\text{max}} \left( \frac{C_O}{EC50_O} + \frac{C_S}{EC50_S} + \alpha \cdot \frac{C_O}{EC50_O} \cdot \frac{C_S}{EC50_S} \right)^n}{1 + \left( \frac{C_O}{EC50_O} + \frac{C_S}{EC50_S} + \alpha \cdot \frac{C_O}{EC50_O} \cdot \frac{C_S}{EC50_S} \right)^n}
\]
Modeling Drug Interactions

- Determine minimal concentrations of opioid and sedative that produce effective anesthetic response

$$R = \frac{\left( \frac{C_o}{IC50_o} + \frac{C_s}{IC50_s} + \alpha \frac{C_o}{IC50_o} \frac{C_s}{IC50_s} \right)^n}{1 + \left( \frac{C_o}{IC50_o} + \frac{C_s}{IC50_s} + \alpha \frac{C_o}{IC50_o} \frac{C_s}{IC50_s} \right)^n}$$

$R$ : anesthetic response
$C_o$ : opioid concentration ($\mu$g/ml)
$C_s$ : sedative concentration ($\mu$g/ml)
$IC50_o, IC50_s, \alpha, n$ : model parameters
Demo: Characterize Drug-Drug Interaction
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  - Code: `for k=1:max
    x = fft(dat)
    y = 20*log1
  end`
- Application Development

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

Automate
Demo: Estimate Drug-Drug Interaction

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Products Used
- MATLAB
- Curve Fitting Toolbox

Code & Applications:
```
for k=1:max
    x = fft(dat);
    y = 20*log1;
```

MATLAB, Excel, C/C++, Java, .dll

Software
- MATLAB

Hardware
- MATLAB
- Excel
- C/C++
- Java
- .dll

Products:
- MATLAB
- Curve Fitting Toolbox
Accessing Data from MATLAB

- **Files**
  - Excel, text, or binary
  - Audio and video, image
  - Scientific formats and XML
Accessing Data from MATLAB

Access

- Applications and languages
  - C/C++, Java, FORTRAN
  - COM, .NET, shared libraries
  - Databases
    (Database Toolbox)

Explore & Discover

Share
Accessing Data from MATLAB

- Measurement hardware
  - Data acquisition hardware
    *(Data Acquisition Toolbox)*
  - Stand-alone instruments and devices
    *(Instrument Control Toolbox)*
Data Analysis and Visualization in MATLAB

- Built-in engineering and mathematical functions
  - Interpolation, filtering, smoothing, Fourier analysis
Data Analysis and Visualization in MATLAB

- Extensive plotting capabilities
  - 2-D, 3-D, and volume visualization
  - Tools for creating custom plots
Expanding the Capabilities of MATLAB

MathWorks add-on tools for:

- Math, statistics, and optimization
- Control system design and analysis
- Signal processing and communications
- Image processing and computer vision
- Parallel computing and more...
Sharing Results from MATLAB

- Automatically generate structured reports
  - Published MATLAB files
  - MATLAB Report Generator
- Feed your results into downstream design tools
- Deploy applications to other environments

Response Surface Analysis of Opioid-Sedative Combination Therapy

Contents
- Import data
- Characterize the response surfaces
- Post-process results
- Export Results

In this analysis, we will characterize the complete spectrum of interaction between 10 different pairs of opioids and sedatives. For each opioid-sedative pair, the dosage of both the drug was systematically varied, and the corresponding analgesic and sedative response was measured. In this example, we analyse the pain response measured using tibial pressure algometry.

Deploying Applications with MATLAB

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

1. MATLAB Desktop
2. MATLAB Compiler
3. End-User Machine

Toolboxes

MATLAB Application

.exe

MATLAB Compiler Runtime (MCR)