# Exploring Data Structures and Performing Analysis

## 1. Overview

This guide provides essential MATLAB commands and best practices to explore, navigate, and analyze hierarchical data structures stored in .mat files. It covers:

* Loading and inspecting data
* Drilling down into structures, objects, and arrays
* Extracting key values
* Visualizing and interpreting the data
* Best practices for organizing exploration

## 2. Loading Data

#### Load a MATLAB .mat File Containing Experimental Data:

| load('yourfile.mat'); % Loads all variables into the workspace  whos % Lists variable names, types, and sizes |
| --- |

#### Load Only a Specific Variable

| load('yourfile.mat', 'variableName'); |
| --- |

## 3. Inspecting Top-Level Variables

Once the data is loaded, use these commands to explore its contents:

#### List All Variables

| whos % Displays details (size, type) of all variables |
| --- |

#### Display Variable Contents

| disp(variableName) % Prints contents if small  summary(variableName) % Provides a summary if applicable |
| --- |

#### Check Variable Type and Size

| class(variableName) % Returns the variable type  size(variableName) % Returns dimensions of arrays/matrices |
| --- |

## 4. Exploring Structures

#### Check Available Fields in a Structure

| fieldnames(structureName) % Lists all fields inside a structure |
| --- |

#### Display a Specific Field

| disp(structureName.fieldName) |
| --- |

#### Check Nested Structures

| fieldnames(structureName.fieldName) |
| --- |

#### Go Deeper Into Nested Structures

| disp(structureName.fieldName.subField) |
| --- |

#### Loop Through Fields in a Structure

| fields = fieldnames(structureName);  for i = 1:length(fields)  fprintf('Field %d: %s\n', i, fields{i});  disp(structureName.(fields{i}));  end |
| --- |

## 5. Exploring Objects (e.g., MaggotTrack, ExperimentSet)

#### Check Properties and Methods of an Object

| properties(objectName) % Lists properties  methods(objectName) % Lists methods |
| --- |

#### Inspect an Object's Data

| disp(objectName.PropertyName) |
| --- |

## 

## 6. Navigating Cell Arrays

#### Check Cell Array Size

| size(cellArray) |
| --- |

#### Access a Specific Cell

| cellArray{row, column} % Extracts the actual content inside the cell |
| --- |

#### List All Elements

| celldisp(cellArray) |
| --- |

## 

## 7. Extracting and Visualizing Data

#### Extract Data from Structure Fields into Arrays

| values = [structureName.fieldName]; |
| --- |

#### Plot a Simple Graph

| plot(values)  xlabel('X-axis label')  ylabel('Y-axis label')  title('Your Graph Title') |
| --- |

#### Plot a Polar Graph (For Directional Data)

| theta = deg2rad([structureName.angleField]);  magnitude = [structureName.valueField];  polarplot(theta, magnitude, '-o')  title('Polar Plot Example') |
| --- |

## 

## 8. Best Practices for Organizing Exploration

#### Option 1: Create a MATLAB Function for Data Exploration

| function exploreData(data)  % Check if data is a structure  if isstruct(data)  fields = fieldnames(data);  for i = 1:length(fields)  fprintf('Field %d: %s\n', i, fields{i});  disp(data.(fields{i}));  end  else  disp('Data is not a structure.');  end  end  Usage:  exploreData(analyzedData); |
| --- |

#### Option 2: Save Findings in a Log File

| fid = fopen('data\_log.txt', 'w');  fprintf(fid, 'Data Exploration Log:\n');  fields = fieldnames(analyzedData);  for i = 1:length(fields)  fprintf(fid, 'Field: %s\n', fields{i});  end  fclose(fid); |
| --- |

#### Option 3: Generate a PDF Report (Using MATLAB's Report Generator)

If you want a formatted PDF summary, you can use MATLAB's report generation tools:

| publish('yourScript.m', 'pdf'); |
| --- |

## 9. Summary

* Use whos and fieldnames() to navigate structures.
* Use loops to iterate through nested data.
* Extract values into arrays for visualization.
* Automate exploration with a function or logging.

This guide serves as a quick reference for navigating .mat files and understanding complex data structures efficiently.