MATLAB에서 작업한 응용프로그램의 공유: App에서 부터 웹서비스까지

Application Engineer
엄 준 상
Application Deployment with MATLAB

MATLAB Author

Group Members

Organization

Suppliers

Clients

Collaborators
Application Deployment Process

Requirements

Research & Design

- Explore and discover
- Gain insight into problem
- Evaluate options, trade-offs

Test & Verification

Implementation

Algorithms and Applications for Desktop or Web

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

Embedded software and digital electronics

Verilog
PLC
FPGA
C/C++
VHDL
PAC
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 and latitude using a known formula
- Daily temperature variations are largely driven by solar radiation received at the surface
Desktop Applications – MATLAB App and Standalone Executable

Solar Analysis Application
Packaging and Sharing MATLAB Apps

- MATLAB apps
  - Interactive applications to perform technical computing tasks
  - Displayed in apps gallery

- Included in many MATLAB products

- Package your own app
  - Create single file for distribution and installation into gallery
  - Packaging tool:
    - Automatically includes all necessary files
    - Documents required products
Deploying Applications with MATLAB

1. MATLAB Application
2. MATLAB Compiler
3. End-User Machine
MATLAB Components – Add-In for Excel

Solar Analysis Spreadsheet

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

Run Analysis
Deploying MATLAB Components

- Create MATLAB application

- Build component
  - MATLAB Compiler™
  - MATLAB Builder™ JA
  - MATLAB Builder™ NE

- Deploy against MATLAB Compiler Runtime (MCR)
  - One per process
  - Loaded in-process
  - Single threaded
  - Thread safe
Web Deployment - MATLAB Builder NE

Energy Forecast Model
MATLAB Production Server™

- Directly deploy MATLAB programs into production
  - Centrally manage multiple MATLAB programs & MCR versions
  - Automatically deploy updates without server restarts

- Scalable & reliable
  - Service large numbers of concurrent requests
  - Add capacity or redundancy with additional servers

- Use with web, database & application servers
  - Lightweight client library isolates MATLAB processing
  - Access MATLAB programs using native data types
What is MATLAB Production Server?

- Enterprise class framework for running packaged MATLAB programs

- Server software
  - Manages packaged MATLAB programs & worker pool

- Runtime libraries
  - MATLAB Compiler™ Runtime (MCR)

- Lightweight client library (for .NET & Java)
  - Request MATLAB programs (functions)
MATLAB Production Server - Example

Web Applications
- web browser
- web services

Desktop Applications
- custom applications
- standard (Excel)

Batch Applications

MATLAB Compiler

Web Server

Application Server

MATLAB Production Server
- Asset Monitoring
- Energy Pricing
- Predictive Analytics

Database/Historian Server

MATLAB Compiler

Web Server

Application Server

Database/Historian Server
Web Application - MATLAB Production Server

Asset Allocation
Web Application - MATLAB Production Server

Asset Allocation

**Portfolio Performance & Simulation**

**HISTORY**

Historical performance of the chosen portfolio and, if specified, the initial portfolio over the past year. The maximum drawdown period is highlighted and its value shown above.

**SIMULATION**

This fan chart shows the percentiles of simulated returns for the portfolio. The dark line denotes the mean and each shaded bar a 10% percentile of probability.
Desktop Application
- MATLAB Production Server

Asset Allocation

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Min</th>
<th>Max</th>
<th>Init</th>
<th>Return</th>
<th>Std Dev</th>
<th>VaR</th>
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<tbody>
<tr>
<td>US Large Cap</td>
<td>0%</td>
<td>100%</td>
<td>20.00%</td>
<td>5.00%</td>
<td>21.37%</td>
<td>44.84%</td>
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<tr>
<td>US Small Cap</td>
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<td>100%</td>
<td>4.11%</td>
<td>1.80%</td>
<td>46.66%</td>
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<tr>
<td>US Corp. Bond</td>
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<td>4.98%</td>
<td>5.49%</td>
<td>7.81%</td>
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<tr>
<td>US HY Bond</td>
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<td>100%</td>
<td>11.76%</td>
<td>23.35%</td>
<td>42.16%</td>
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<tr>
<td>EAFE Equity</td>
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<td>100%</td>
<td>20.00%</td>
<td>7.80%</td>
<td>24.82%</td>
<td>50.00%</td>
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<tr>
<td>EM Equity</td>
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<td>100%</td>
<td>21.24%</td>
<td>34.36%</td>
<td>58.70%</td>
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<tr>
<td>US Treasury</td>
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<td>US REIT</td>
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<tr>
<td>US Commodity</td>
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</tbody>
</table>

Risk-Free Asset, Risk Proxy and Turnover

- Risk-free cash rate: 2%
- Minimum cash allocation: 10%
- Maximum cash allocation: 85%
- Risk Proxy: Standard Deviation
- Maximum Turnover: 200%

Efficient Frontier

Optimal Portfolios

Sharpe Ratios
Desktop Application - MATLAB Production Server

Asset Allocation

Selected Portfolio | 6

<table>
<thead>
<tr>
<th>Portfolio Composition</th>
<th>Portfolio Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Large Cap</td>
<td>Return 6.90%</td>
</tr>
<tr>
<td>US Small Cap</td>
<td>Std Dev 4.97%</td>
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<tr>
<td>US Corp. Bond</td>
<td>VaR 0.81%</td>
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<tr>
<td>US HY Bond</td>
<td>CVaR 1.11%</td>
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<tr>
<td>EAFE Equity</td>
<td>Sharpe 0.9867</td>
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<tr>
<td>EM Equity</td>
<td>Max DD 2.38%</td>
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<tr>
<td>US Treasury</td>
<td>Semi Dev 0.16%</td>
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<td>US REIT</td>
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</tbody>
</table>

Portfolio History

Portfolio Simulation
Deploying Algorithms and Applications

- Give MATLAB code to other users
  - MATLAB apps
  - MATLAB files

- Share applications with end users who do not need MATLAB
  - Stand-alone executables
  - Shared libraries
  - Software components

- Royalty-free distribution