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

Implementation

Test & Verification

Algorithms and Applications for Desktop or Web
- MATLAB
- Excel
- .NET
- C/C++
- Java
- .dll

Embedded software and digital electronics
- Verilog
- .PLC
- FPGA
- C/C++
- VHDL
- .PAC
Modeling Global Solar Radiation

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

- \( R_s \): 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 Desktop
2. MATLAB Compiler
3. .exe

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

```csharp
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

// MATLAB Builder NE data API
using MathWorks.MATLAB.NET.Arrays;

// MATLAB Builder NE Web Figure
using MathWorks.MATLAB.NET.WebFigure;

// MATLAB Builder NE Generated
using EnergyModelStateless;

class Default
{
    private EnergyModel deployed;
    private double[] Day = null;
    private double[] Hour = null;
    private double[] Month = null;
    private double[] Holiday = null;

    public partial class _Default
    { ...
```
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)

- Application Server

- Batch Applications

- Web Server

- Database/Historian Server

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

- Desktop Applications

- Batch Applications

- Web Applications
Web Application - MATLAB Production Server

Asset Allocation
Web Application - MATLAB Production Server

Asset Allocation

Portfolio Performance & Simulation

Asset Allocation Results

Portfolio Composition & Metrics

Allocation

USLargeCap
USSmallCap
USMidCap
USOther
USIntl
EMLargeCap
EMSmallCap
EMMidCap
EMOther
EMIntl
Cash

Metrics

Expected Return
5.22%
Expected Std. Deviation
6.25%
Expected Sharpe Ratio
0.7000
Single-period 99% VaR
0.86%
Single-period 99% CVaR
1.00%
Historic Semi-deviation
0.11%
Historic Max Drawdown
2.68%

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.

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
Desktop Application
- MATLAB Production Server

Asset Allocation

Selected Portfolio

Portfolio Composition

Portfolio Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>6.90%</td>
</tr>
<tr>
<td>Std Dev</td>
<td>4.97%</td>
</tr>
<tr>
<td>VaR</td>
<td>0.81%</td>
</tr>
<tr>
<td>CVaR</td>
<td>1.11%</td>
</tr>
<tr>
<td>Sharpe</td>
<td>0.9867</td>
</tr>
<tr>
<td>Max DD</td>
<td>2.38%</td>
</tr>
<tr>
<td>Semi Dev</td>
<td>0.16%</td>
</tr>
</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