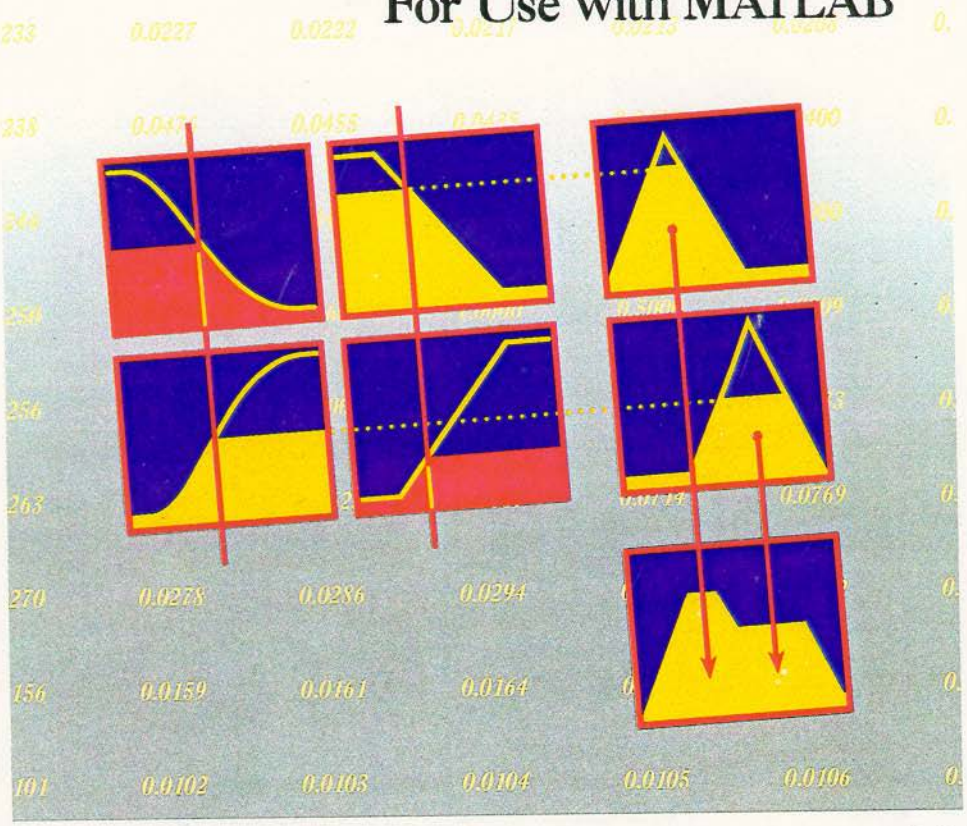
Fuzzy Logic
TOOLBOX

For Use with MATLAB®



J.-S. Roger Jang
Ned Gulley

The MATH WORKS Inc.

1 Introduction

Fuzzy logic is all about the relative importance of precision: How important is it to be exactly right when a rough answer will do? All books on fuzzy logic begin with a few good quotes on this very topic, and this is no exception. Here is what some clever people have said in the past:

Precision is not truth.
—Henri Matisse

Sometimes the more measurable drives out the most important.
—René Dubos

Vagueness is no more to be done away with in the world of logic than friction in mechanics.
—Charles Sanders Peirce

I believe that nothing is unconditionally true, and hence I am opposed to every statement of positive truth and every man who makes it.
—H. L. Mencken

So far as the laws of mathematics refer to reality, they are not certain. And so far as they are certain, they do not refer to reality.
—Albert Einstein

As complexity rises, precise statements lose meaning and meaningful statements lose precision.
—Lotfi Zadeh

There are also some pearls of folk wisdom that echo these thoughts:

Don't lose sight of the forest for the trees.

Don't be penny wise and pound foolish.

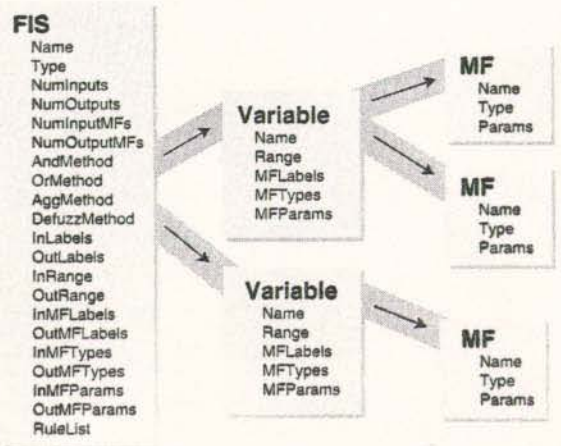
M-file or MEX-file?

There are two different functions (`evalfis.m` and `evalfis.mex`) that can do the actual fuzzy inference for a given set of inputs, though only one of them is used at any given time. One is an M-file and the other is a MEX-file, and they return exactly the same result. The MEX-file is much much faster, but if you are curious about how the algorithms are implemented, you may want to inspect or even modify the M-file. As long as it is on the MATLAB path, `evalfis.mex` will be used preferentially to `evalfis.m`. Every time `evalfis.mex` is called it builds a data structure in memory, performs the FIS evaluation, and destroys the data structure. You cannot access this data structure directly.

The FIS Matrix

The FIS matrix is the MATLAB object that contains all the fuzzy inference system information. This matrix is stored inside each GUI tool. Access functions such as `getfis` and `setfis` make it easy to examine and modify its structure. The access functions are also important because they protect you from any changes to the data structure in future versions of the toolbox. The data structure may change, but the access functions will continue to work as before.

All the information for a given fuzzy inference system is contained in the FIS matrix, including variable names, membership function definitions, and so on. This object can itself be thought of as a hierarchy of other objects, as shown in the diagram below:



Since MATLAB deals only with matrices of double precision floating point numbers, the FIS matrix is exactly that. The information is ar-

surfview

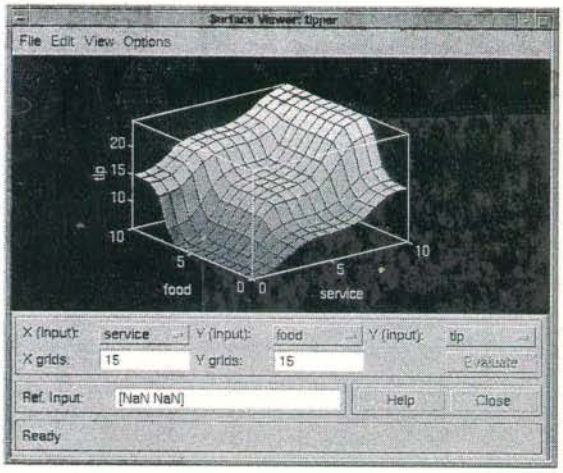
Purpose

Output surface viewer.

Synopsis

```
surfview(a)
```

Description



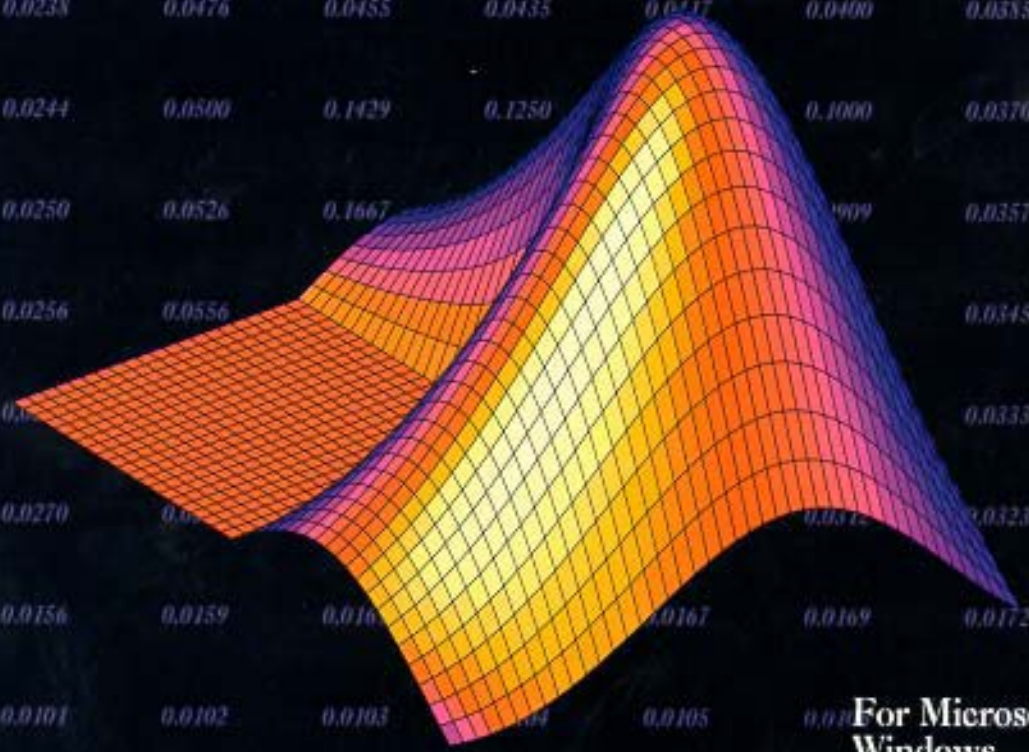
The Surface Viewer is a GUI tool that lets you examine the output surface of a fuzzy inference system for any one or two inputs. Since it does not alter the fuzzy system or its associated FIS matrix in any way, it is a read-only editor. Using the pop-up menus, you select which input variables you want to form the two input axes (X and Y) as well the output variable that you want to form the output (or Z) axis. Then push the **Evaluate** button to perform the calculation and plot the output surface.

By clicking on the plot axes and dragging the mouse, you can actually manipulate the surface so that you can view it from different angles.

If there are more than two inputs to your system, you must supply, in the reference input section the constant values associated with any unspecified inputs.

MATLAB®

High-Performance Numeric Computation and Visualization Software



For Microsoft Windows

MATLAB Notebook Suite User's Guide

The MATH WORKS Inc.

B

Notebook M-files

This appendix lists the M-files in the `\toolbox\wintools` directory.

`edit.m` Opens the Matrix Editor.

- `edit x` Opens the matrix `x` in the Matrix Editor. If `x` does not exist in the workspace, MATLAB creates a new 5 by 5 matrix of zeros. If `x` is an M-file, it is opened in a text editor.
- `edit` Opens the Matrix Editor for a new 5 by 5 matrix called `untitled`.

`nbhelp.m` Views the Notebook help file.

`notebook.m` Opens the Notebook.

- `notebook name` Opens the M-book `name.doc` in the Notebook.
- `notebook` Opens the Notebook and creates a new M-book called `Document1`.

`path2rc.m` Saves the current MATLAB path in the `matlabrc.m` file.

`pathtool.m` Opens the MATLAB Path Manager.

`workspac.m` Opens the MATLAB Workspace Browser.