Fuzzy Control

Distance-Speed control of Car

This is an introduction of Fuzzy control to absolute beginners in form of a simple project.
Traditional logic assumes binary truth values (0 or 1). However Fuzzy Logic treats the truth values as a spectrum with weights attached to each value. Consider for example 2 cars A and B driving collinearly. Car A is of interest to us and is behind B. If we were to gauge whether A is close to B or it is far, by traditional binary logic we would set a threshold for 'closeness' or 'farness'. Say the mean distance between A and B is 10m and we say that A is close to B if the distance between them is less than 2m. So, for all values of distances between 0-8m, A is far from B. This method is particularly futile if we were to decide with what speed A should drive at arbitrary instances. Fuzzy Logic comes to our rescue!

We take the distance between A and B as the input and the output is the speed of A.
The following (triangular) input membership functions are created:

Close	0 0 2
Moderate	1.5 5 7
Far	6.5 10 10

The output (triangular) membership functions are:

Slow	0 0 5
Moderate	4.5 7 14
Fast	13.5 20 20

The mamdani rule base is set as:
1) If distance is close, speed is slow.
2) If distance is moderate then speed is moderate.
3) If distance is far then speed is Fast.

Note: This is a very simple implementation of fuzzy logic that aims to make the user to get acquainted with Fuzzy Toolbox in MATLAB and understand how a rule base can be formed. To understand Fuzzy logic and its concepts before doing this hands on, check out the links in the separate file. Also, the entire code is attached as a '.fis' file. Download it and open with MATLAB and check out the instructions to execute.