Mamdani FLC for Braking System

Python and MATLAB implementation of a Mamdani Fuzzy Logic Controller for a car braking system. Done by **V. Aananth (106118103)** and **Madhav Aggarwal (106118053)**. The code is contained in the `python/` and `MATLAB/` folders respectively.

Running the code

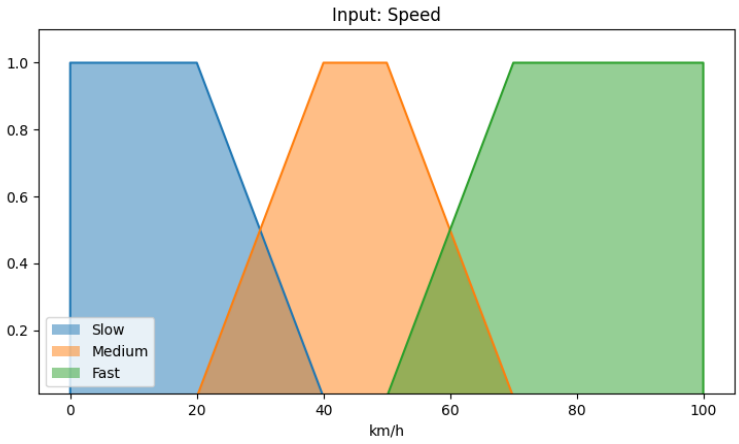
1. Python
    - Navigate to `python/` folder.
    - Run `python3 braking_system.py` .
2. MATLAB
    - Import `matlab/braking_system.fis` using `readfis` or `Fuzzy Logic Designer` .
    - Evaluate using `evalfis` .

Implementation

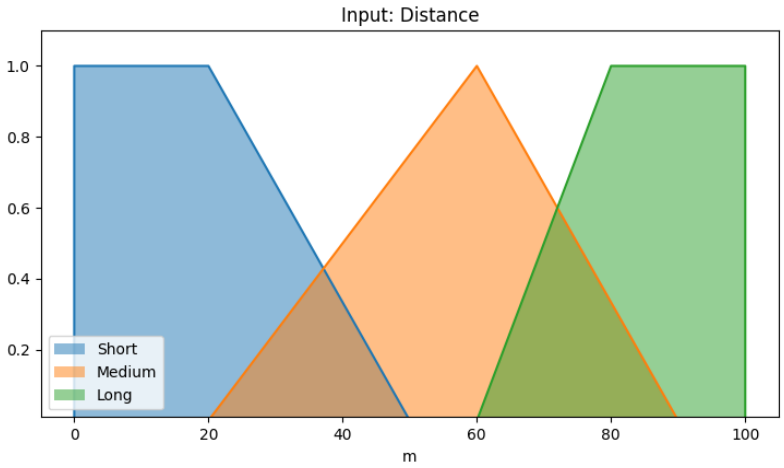
Following are the membership functions used to define the various inputs and output to the Mamdani Fuzzy Logic Controller. Centroid / Center of Gravity method was used for defuzzification to find the output.

Inputs

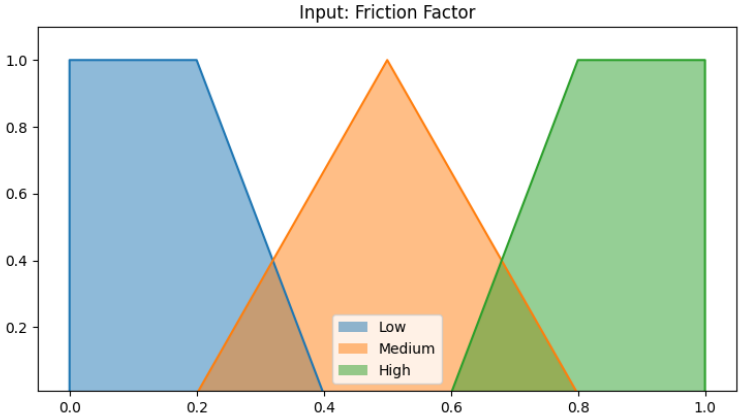
1. Speed of the vehicle (km/h)



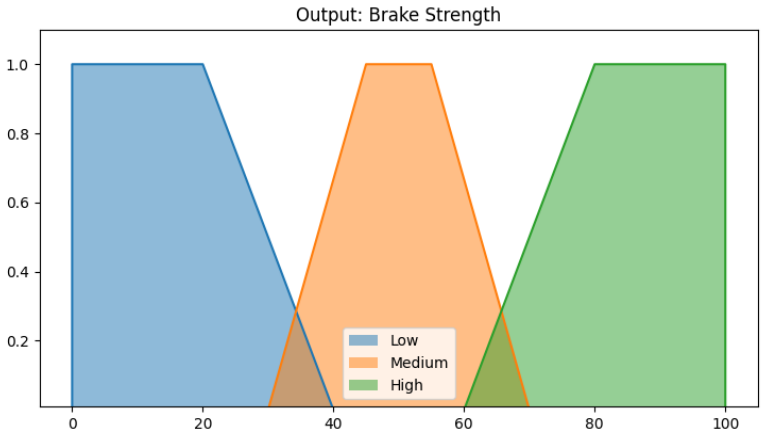
2. Distance from obstacle (m)



3. Friction between vehicle and road



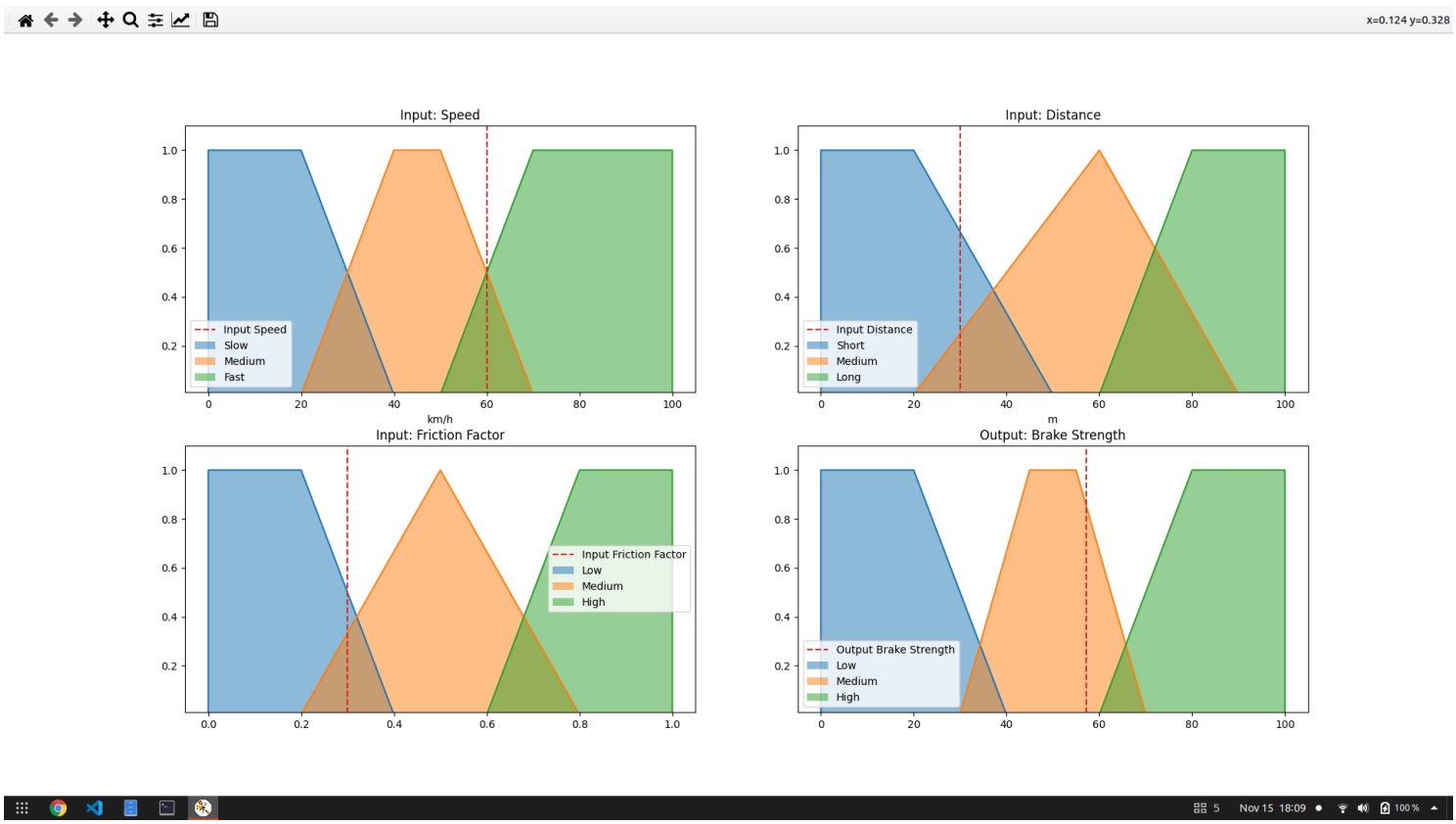
Output - Braking Strength

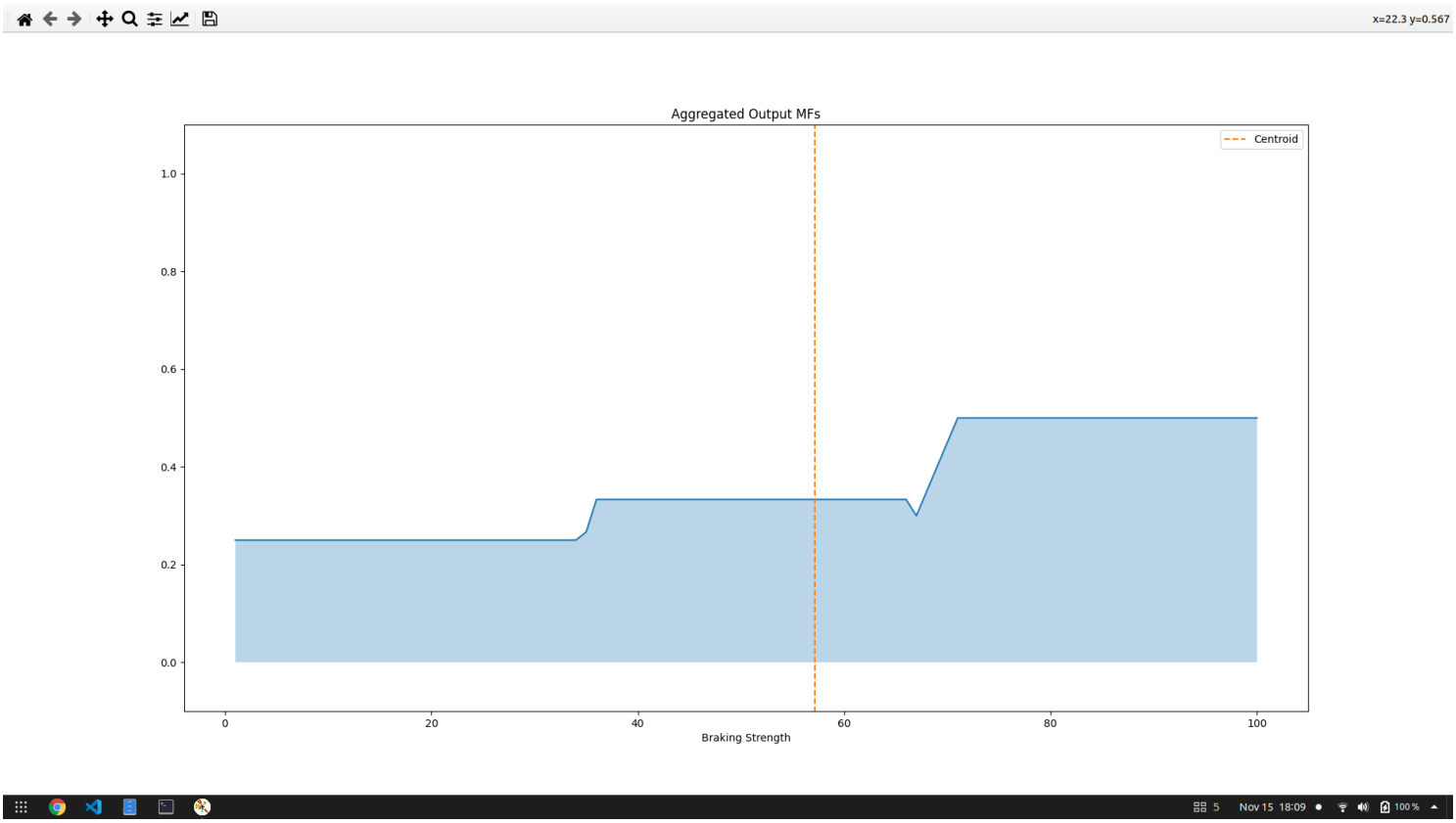


Sample IO

Python

```
aananth@aananth-G7-7588:~/dev/fuzzy_braking_system/python$ \
> python3 braking_system.py
Enter Speed (1 - 100): 60
Enter Distance (1 - 100): 30
Enter Friction factor (0 - 1): 0.3
Output Brake Strength is 57.16245318352059
aananth@aananth-G7-7588:~/dev/fuzzy_braking_system/python$
```





MATLAB

Command Window

```
>> braking_system

braking_system =

  mamfis with properties:

                    Name: "braking_system"
                 AndMethod: "min"
                  OrMethod: "max"
          ImplicationMethod: "min"
          AggregationMethod: "max"
      DefuzzificationMethod: "centroid"
                  Inputs: [1×3 fisvar]
                 Outputs: [1×1 fisvar]
                   Rules: [1×27 fisrule]
    DisableStructuralChecks: 0

        See 'getTunableSettings' method for parameter optimization.

>> input = [60 30 0.3]

input =

   60.0000   30.0000    0.3000

>> brake_strength = evalfis(braking_system, input)

brake_strength =

   57.7558
```