Comparative Analysis of Mamdani and Sugeno Fuzzy Intelligent System

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1. **Dataset:**
   a. **Input:**

VARIABLES	ATTRIBUTES		
COUGH	NONE	MILD	PERSISTENT
FEVER	NONE	MILD	HIGH
BREATHING PROBLEM	NONE	OCCASSIONALY	PERSISTENT

   b. **Output:**

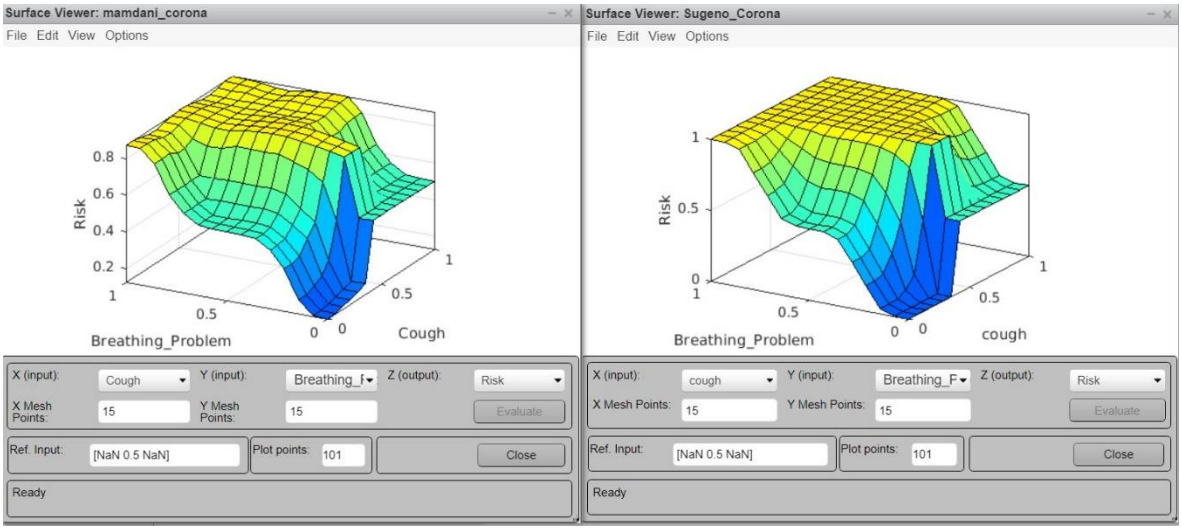
VARIABLES	ATTRIBUTES		
RISK (Person Having Corona)	LOW	MEDIUM	HIGH

   c. **Membership Function:** **Trapezoidal**

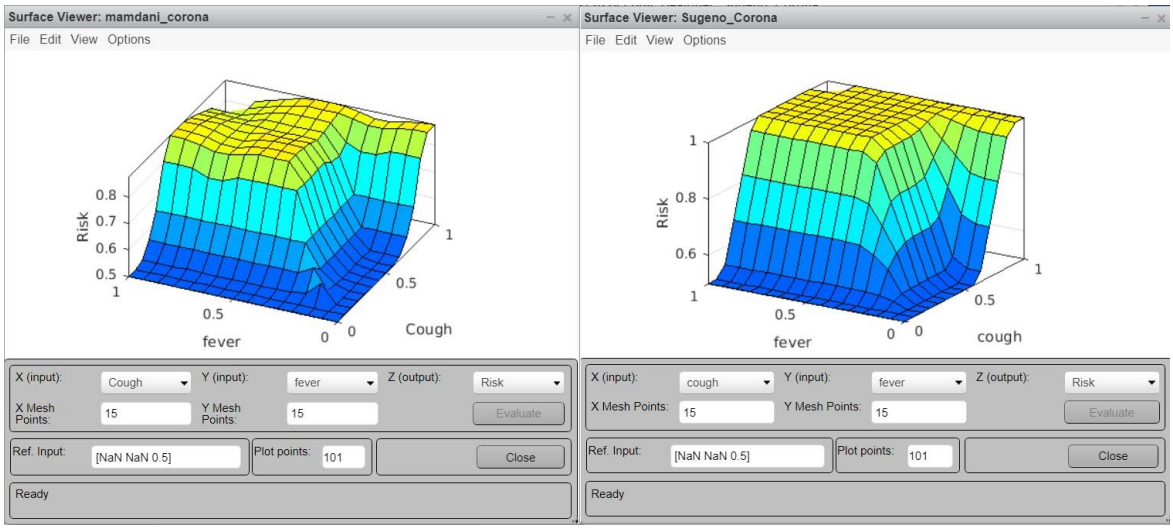
2. **Rules:**

1. If (cough is None) and (fever is none) and (Breathing_Problem is None) then (Risk is low)
2. If (cough is mild) and (fever is none) and (Breathing_Problem is None) then (Risk is low)
3. If (cough is None) and (fever is mild) and (Breathing_Problem is None) then (Risk is low)
4. If (cough is None) and (fever is high) and (Breathing_Problem is None) then (Risk is low)
5. If (cough is None) and (fever is high) and (Breathing_Problem is None) then (Risk is medium)
6. If (cough is None) and (fever is high) and (Breathing_Problem is occasionally) then (Risk is medium)
7. If (cough is None) and (fever is high) and (Breathing_Problem is Persistent) then (Risk is high)
8. If (cough is None) and (fever is mild) and (Breathing_Problem is occasionally) then (Risk is medium)
9. If (cough is None) and (fever is mild) and (Breathing_Problem is Persistent) then (Risk is high)
10. If (cough is mild) and (fever is none) and (Breathing_Problem is occasionally) then (Risk is medium)
11. If (cough is mild) and (fever is none) and (Breathing_Problem is Persistent) then (Risk is high)
12. If (cough is mild) and (fever is mild) and (Breathing_Problem is occasionally) then (Risk is high)
13. If (cough is mild) and (fever is mild) and (Breathing_Problem is Persistent) then (Risk is high)
14. If (cough is mild) and (fever is high) and (Breathing_Problem is occasionally) then (Risk is high)
15. If (cough is mild) and (fever is high) and (Breathing_Problem is Persistent) then (Risk is high)
16. If (cough is persistent) and (fever is none) and (Breathing_Problem is None) then (Risk is low)
17. If (cough is persistent) and (fever is mild) and (Breathing_Problem is None) then (Risk is medium)
18. If (cough is persistent) and (fever is none) and (Breathing_Problem is occasionally) then (Risk is high)
19. If (cough is persistent) and (fever is none) and (Breathing_Problem is Persistent) then (Risk is high)
20. If (cough is persistent) and (fever is mild) and (Breathing_Problem is Persistent) then (Risk is high)
21. If (cough is persistent) and (fever is high) and (Breathing_Problem is Persistent) then (Risk is high)
22. If (cough is persistent) and (fever is mild) and (Breathing_Problem is occasionally) then (Risk is high)

3. **Resultant Surface:**
    a. Cough vs Breathing Problem Vs Risk



    b. Cough vs Fever vs Risk



4. **Results and Observation:**
    a. **We Tested Both Model on some test data, following is result we got:**

cough	fever	Breathing Problem	OUTPUT	
			Mamdani	Sugeno
0.5	0.5	0.5	0.88	1.00
0.7	0.2	0.7	0.55	0.83
0.9	0.8	0.1	0.50	0.50
0.1	0.9	0.3	0.45	0.38
0.1	0.1	0.2	0.14	0.00

    b. **Following is our observation:**

Mamdani FIS	Sugeno FIS
Output Membership Function is present	Output Membership Function is not required
Non-Continuous Surface	**Continuous Surface**
Expressive power and Interpretable rule consequents (as we can see in our result**)**	Loss of interpretability (as output is constant rather than fuzzy)

5. **Conclusion:**
Both FIS have there own advantages and limits, sugeno is better regarding computation cost but Mamdani is better for interpreting more correctly as compared to sugeno.