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Fuzzy Inference System

The fuzzy inference system is the key unit of a fuzzy logic system that has decision making as its primary job. Use the "IF ... THEN" rules along with the "OR" or "AND" connectors to draw essential decision rules.

Characteristics of the fuzzy inference system

- The FIS output is always a fuzzy set, regardless of its input, which can be fuzzy or sharp.
- A fuzzy output is required when used as a controller.
- A defuzzification unit would be there with FIS to convert fuzzy variables to sharp variables.

Methods of FIS

Following are the two important methods of FIS, having different consequent of fuzzy rules −

- Mamdani Fuzzy Inference System
- Takagi-Sugeno Fuzzy Model (TS Method)

Comparison between the two methods.

- **Outgoing membership function:** The main difference between them is based on the outgoing membership function. Sugeno's exit membership functions are linear or constant.
- **Aggregation and defuzzification procedure:** The difference between them also lies in the consequence of fuzzy rules and, due to the same, their aggregation and defuzzification procedure also differs.
- **Mathematical rules:** There are more mathematical rules for the Sugeno rule than for the Mamdani rule.
- **Adjustable Parameters:** The Sugeno controller has more adjustable parameters than the Mamdani controller.

Analysis of COVID diagnose using FIS:

1. Mamdani Fuzzy Inference System

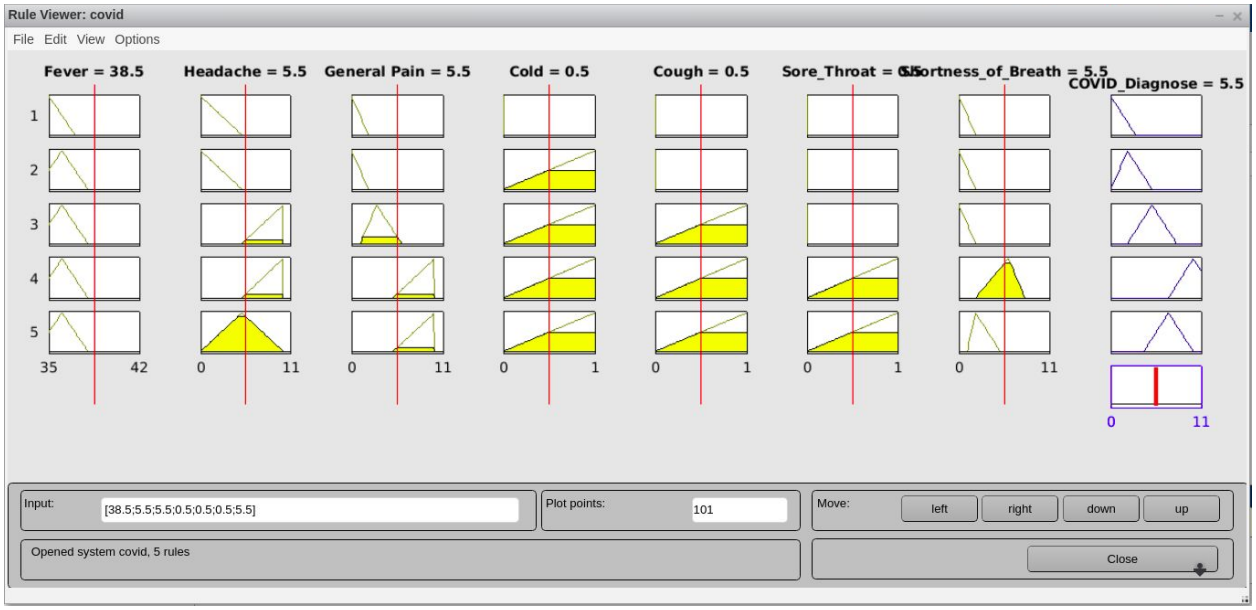

Fig: Rules for Mamdani Fuzzy Inference System

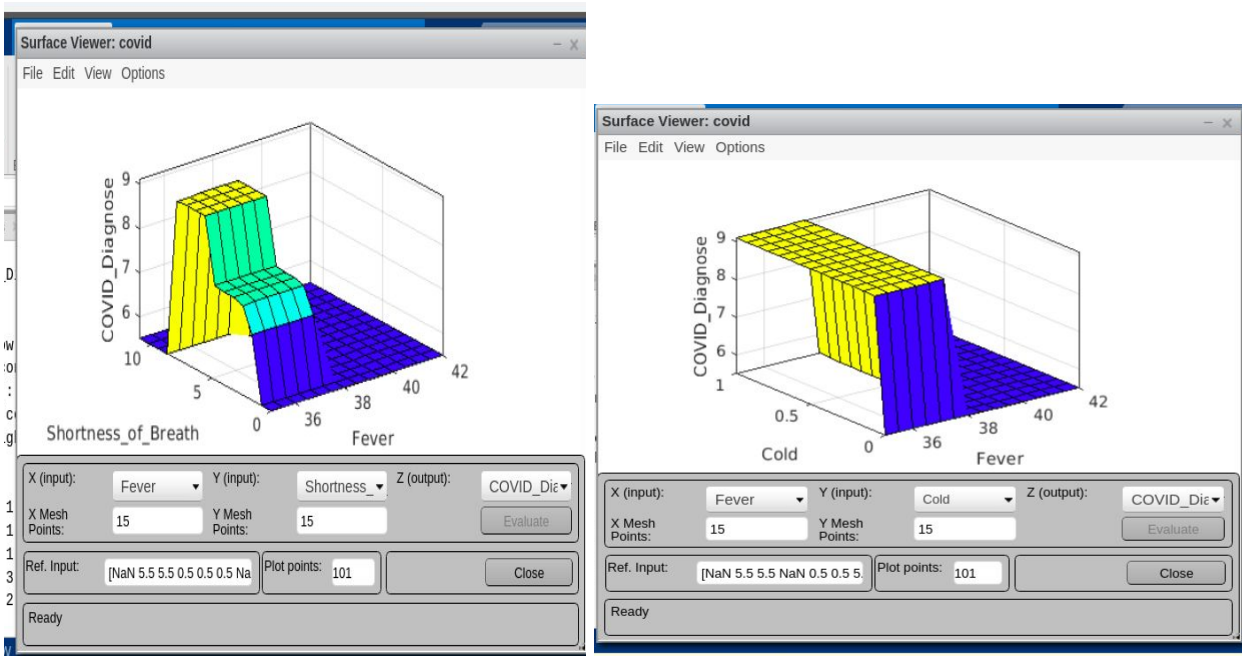

Fig: Surface view for Mamdani Fuzzy Inference System

2. Takagi-Sugeno Fuzzy Model (TS Method)

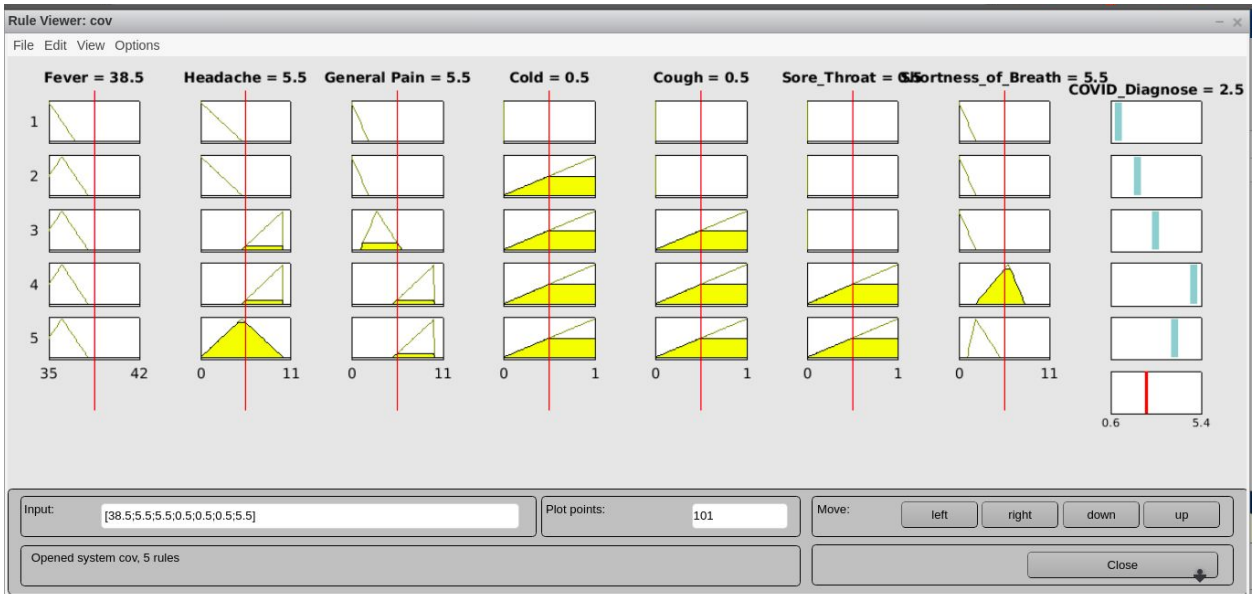

Fig: Rules for Takagi-Sugeno Fuzzy Model (TS Method)

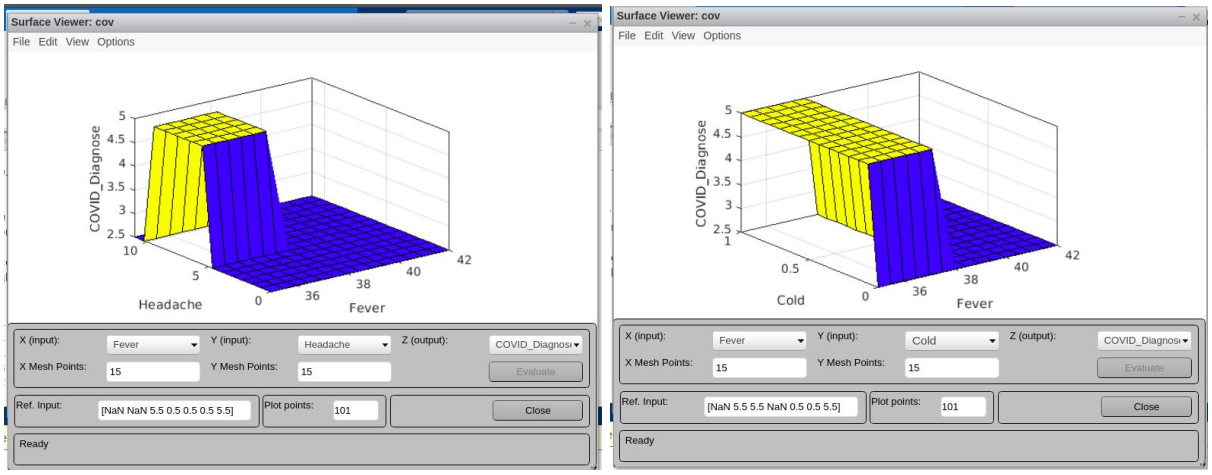

Fig: Surface view for Takagi-Sugeno Fuzzy Model (TS Method)