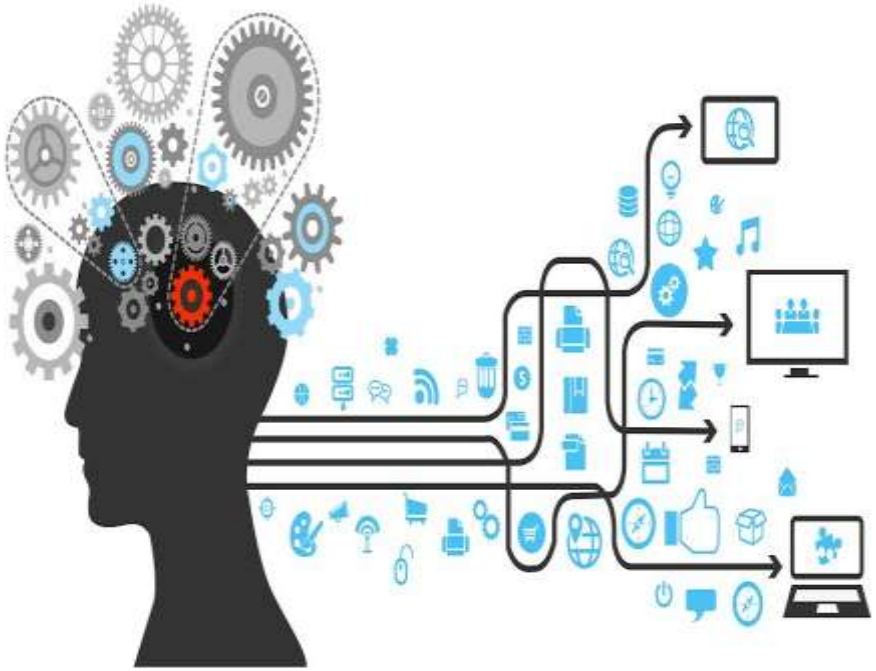
RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

06 EE 7 12 1 Soft Computing Techniques



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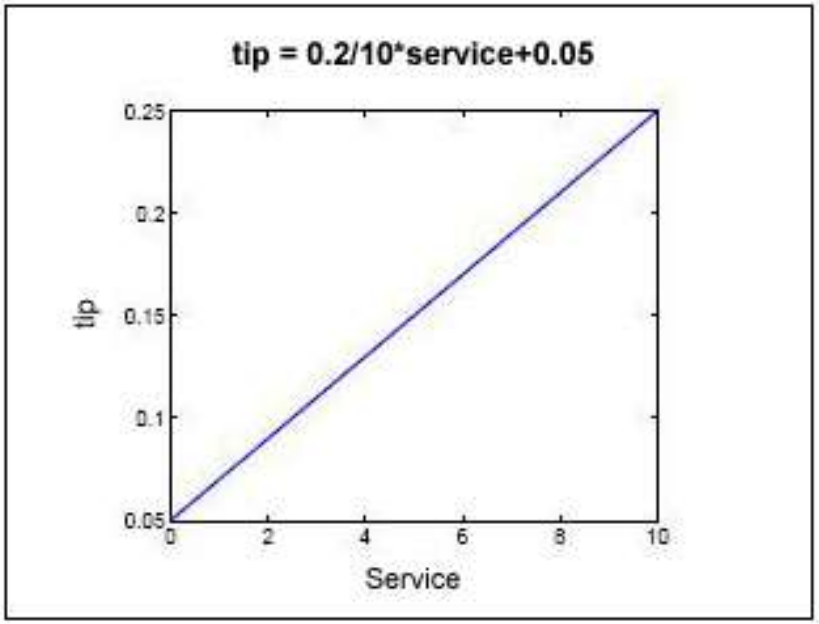
Module II

- Mamdani Technique- Example

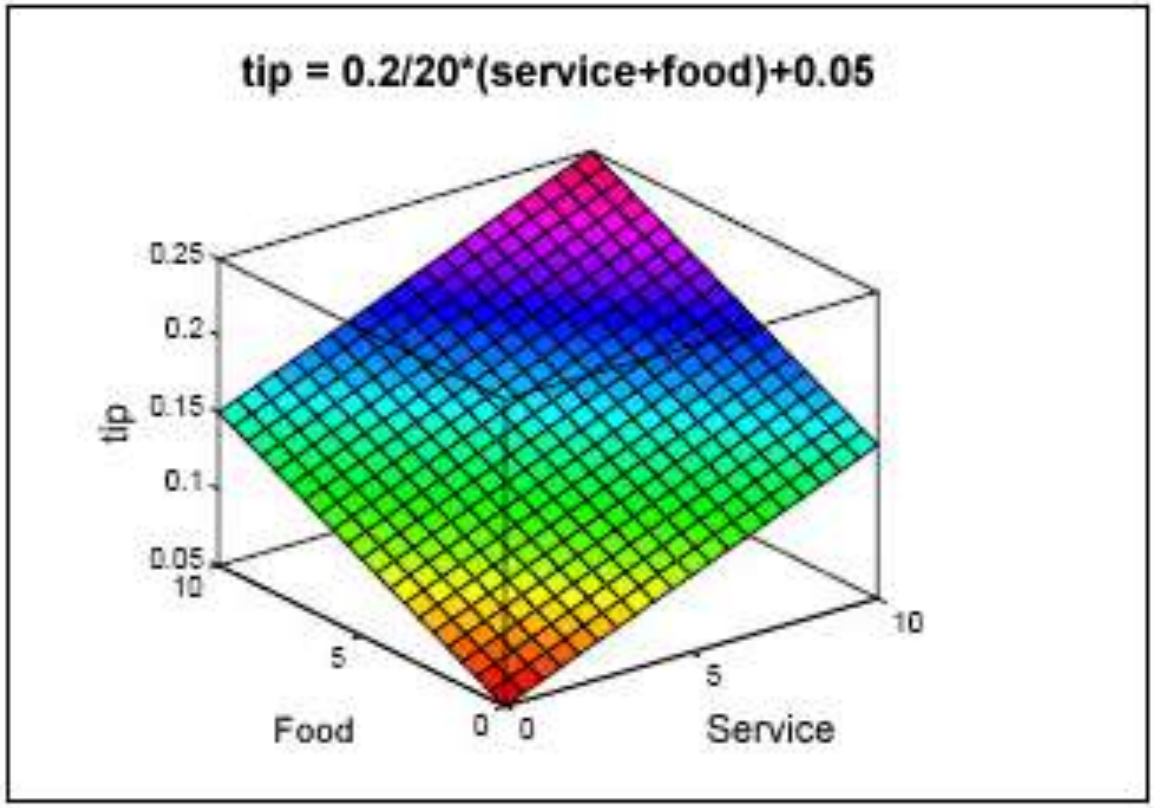
Tipping Problem-Classical Approach

- *Given a number between 0 and 10 that represents the quality of service at a restaurant, what should the tip be?*
- Service is rated on a scale from 0 to 10 (where 10 is excellent), so the tip might go from 5% if the service is poor to 25% if the service is excellent. We can use the following linear relation:

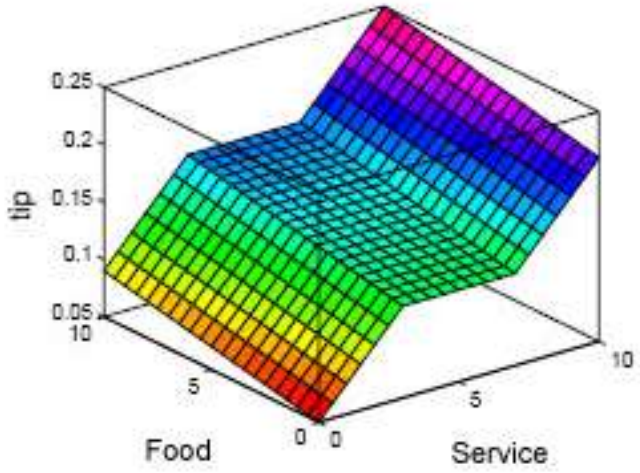


Tipping Problem-Classical Approach

- We need to add a new variable called *food* to the previous formula, thus obtaining the following results:



Tipping Problem-Classical Approach

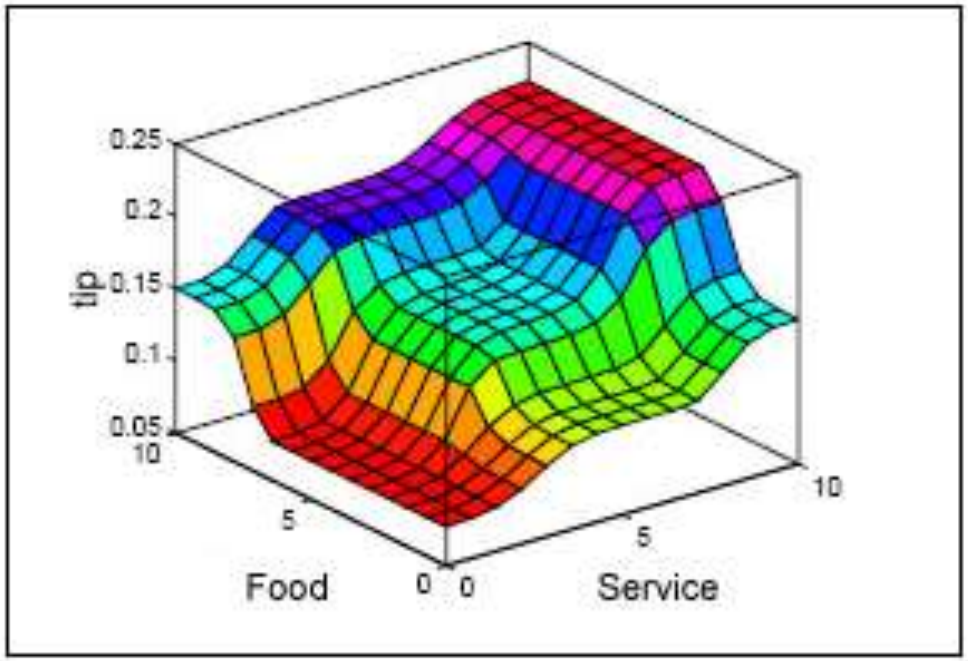



```
servRatio=0.8;

if service<3,
   tip=((0.1/3)*service+0.05)*servRatio+
        + (1-servRatio)*(0.2/10*food+0.05);
elseif service<7,
   tip=(0.15)*servRatio+
        + (1-servRatio)*(0.2/10*food+0.05);
else
   tip=((0.1/3)*(service-7)+0.15)*servRatio+
        + (1-servRatio)*(0.2/10*food+0.05);

end
```

Tipping Problem-Fuzzy Approach

- *If service is poor or food is bad, then tip is cheap*
- *If service is good, then tip is average*
- *If service is excellent or food is delicious, then tip is generous*

A graphical representation of the problem using a fuzzy logic model is shown



Mamdani's Technique

Step 1: Evaluate the antecedent for each rule.

Step 2: Obtain each rule's conclusion.

Step 3: Aggregate conclusions.

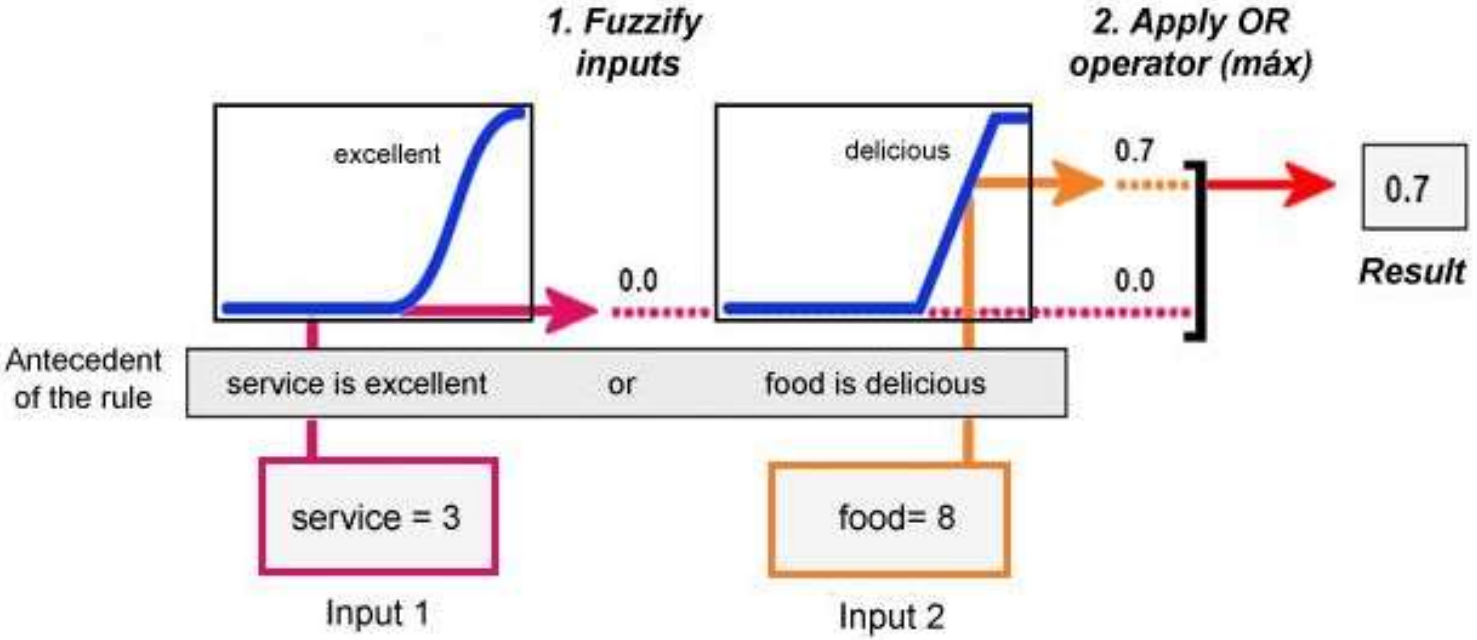
Step 4: Defuzzification.

Summary/Conclusions

Mamdani's Technique

- **Step 1. Evaluate the antecedent for each rule**

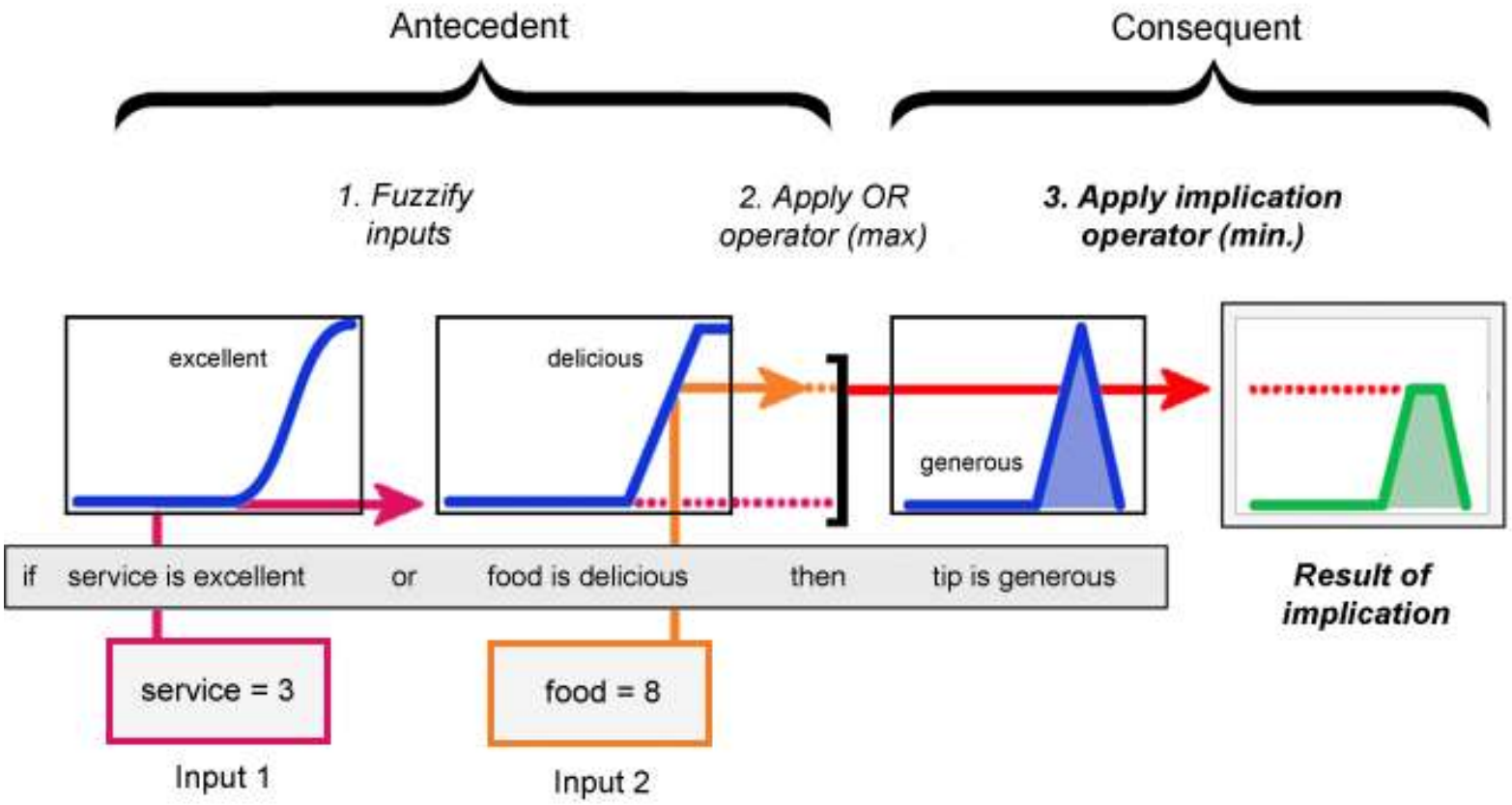
Given the inputs (crisp values) we obtain their membership values. This process is called 'fuzzification'. If the antecedent of the rule has more than one part, a fuzzy operator (t-norm or t-conorm) is applied to obtain a single membership value.



Mamdani's Technique

- **Step 2. Obtain each rule's conclusion**

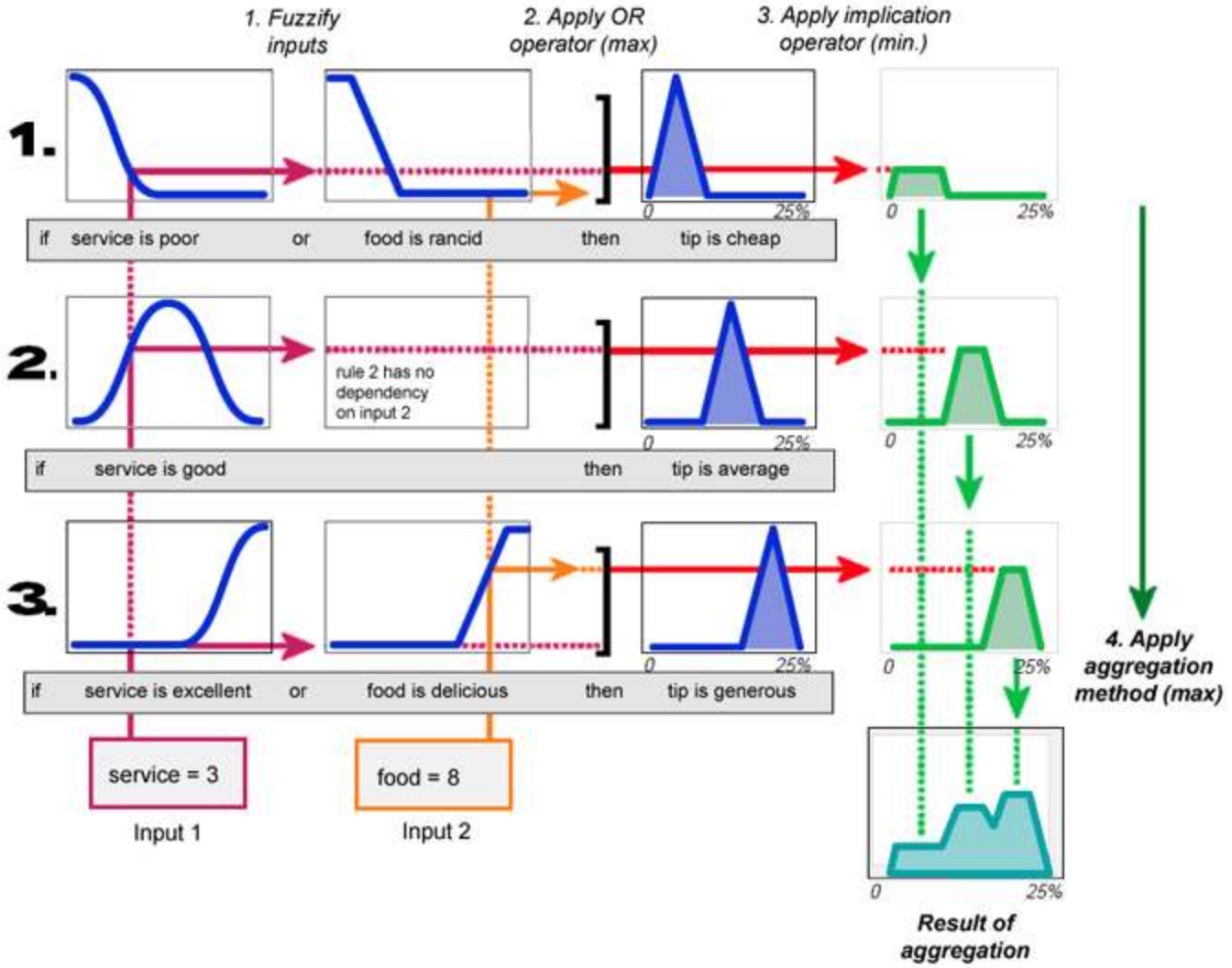
Given the cosequent of each rule (a fuzzy set) and the antecedent value obtained in step 1, we apply a fuzzy implication operator to obtain a new fuzzy set.



Mamdani's Technique

- **Step 3. Aggregate conclusions**

Combine the outputs obtained for each rule in step 2 (conclusion) into a single fuzzy set, using a fuzzy aggregation operator.

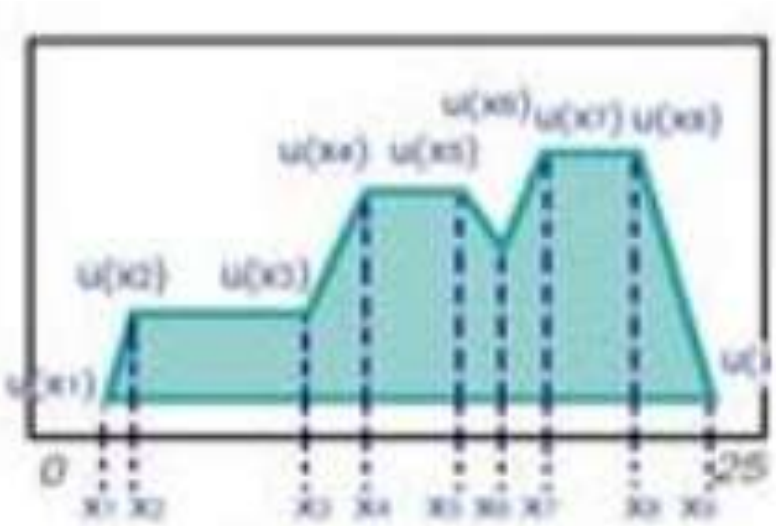


Mamdani's Technique

- **Step 4. Defuzzification**

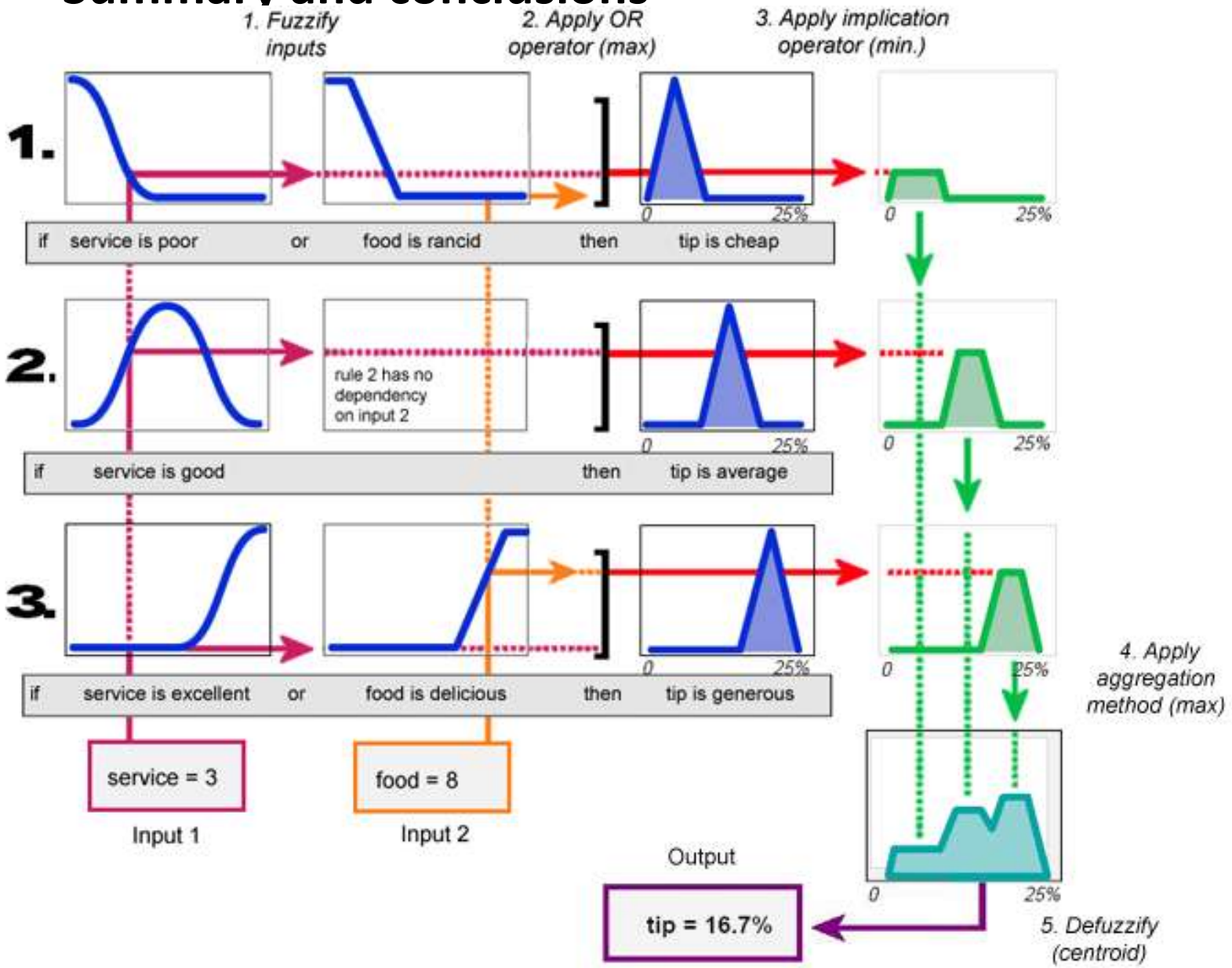
What we want to know is how much tip we should give. So, we need to transform the fuzzy set we obtained in step 3 into a single numerical value. One of the most popular defuzzification methods is the centroid, which returns the center of the area under the fuzzy set obtained in step 3

$$g = \frac{\sum_{i=1}^{9} x_i \cdot \mu(x_i)}{\sum_{i=1}^{9} \mu(x_i)} = 16{,}7$$



Mamdani's Technique

- **Summary and conclusions**



Thank You