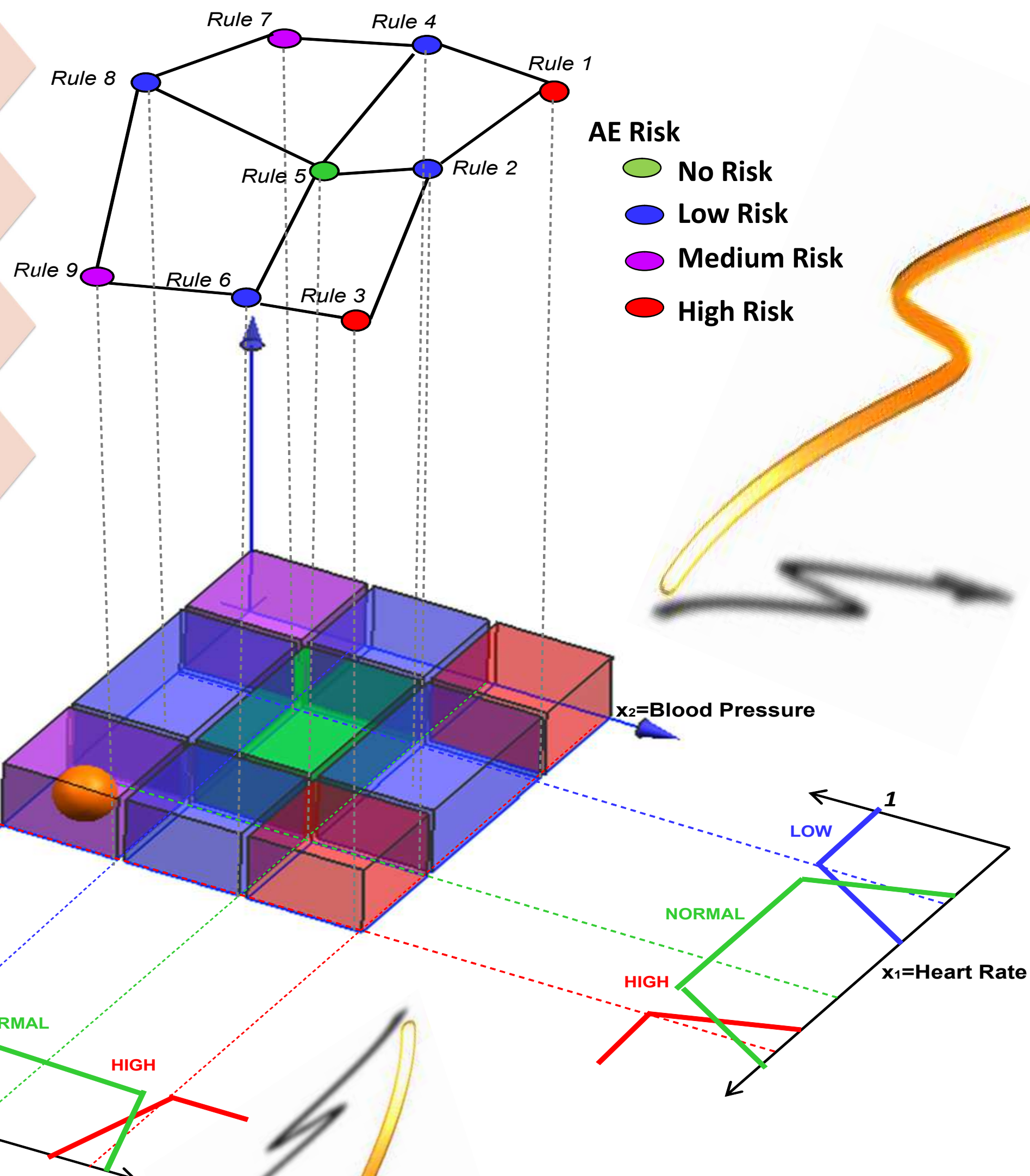


## PP09: Learning from critical values - adverse event identification and classification

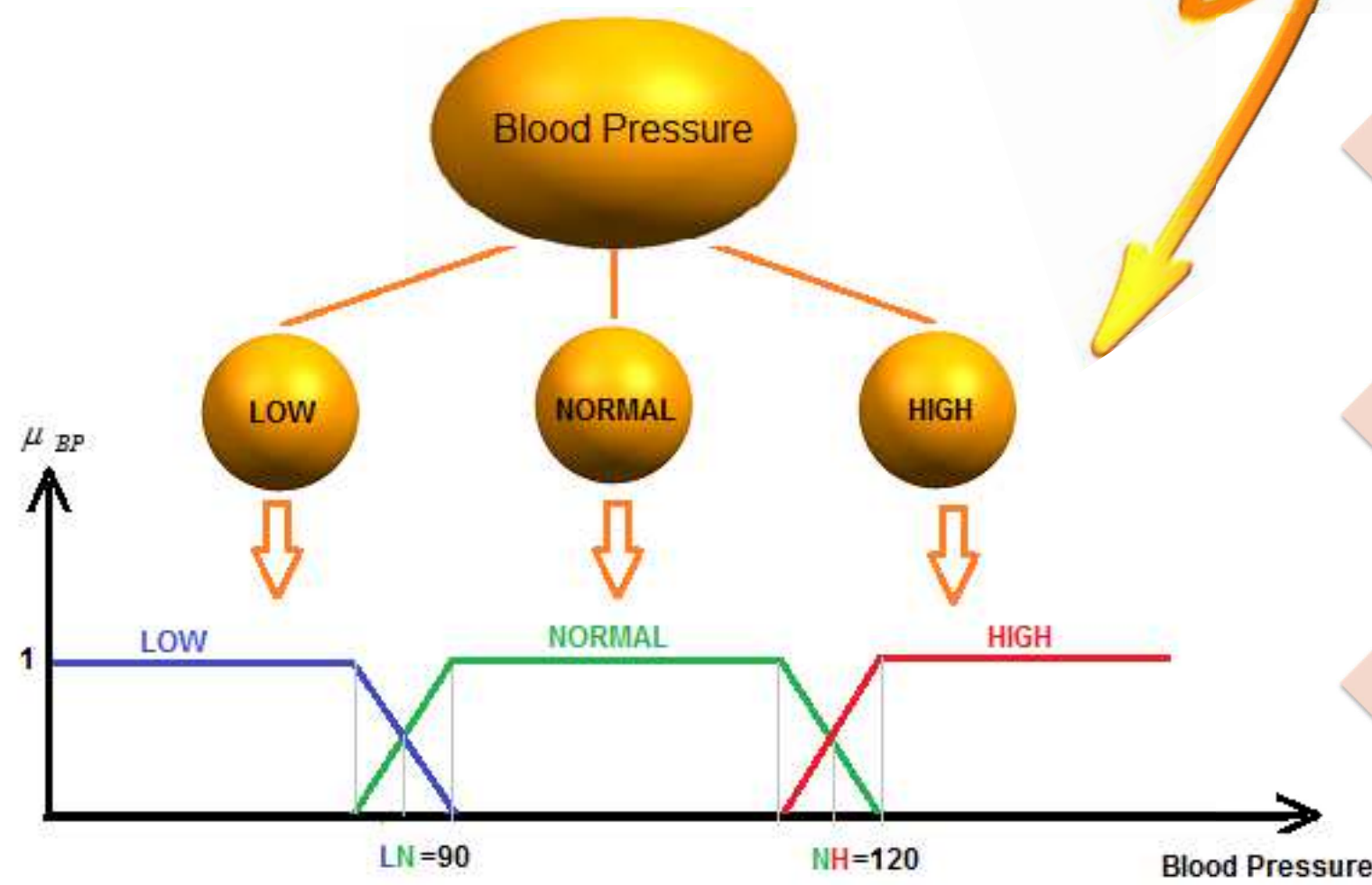
Milena Balcerzak & Edyta Winciorek

Rule base ← contains the set of fuzzy rules

- NO RISK**  
Rule 5  
If a patient has normal blood pressure and normal heart rate then there is no risk of adverse event.
- LOW RISK**  
Rule 2 or Rule 4 or Rule 6 or Rule 8  
If a patient has: (high blood pressure and normal heart rate) or (normal blood pressure and low heart rate) or (normal blood pressure and high heart rate) or (low blood pressure and normal heart rate) then there is a low risk of adverse event.
- MEDIUM RISK**  
Rule 7 or Rule 9  
If a patient has: (low blood pressure and low heart rate) or (low blood pressure and high heart rate) then there is medium risk of adverse event.
- HIGH RISK**  
Rule 1 or Rule 3  
If a patient has: (high blood pressure and low heart rate) or (high blood pressure and high heart rate) then there is high risk of adverse event.



Database (or dictionary) ← contains definitions of membership functions used in the fuzzy rules



Linguistic variables represent crisp information in a form and precision appropriate for the problem (usually in a form of word or sentence).

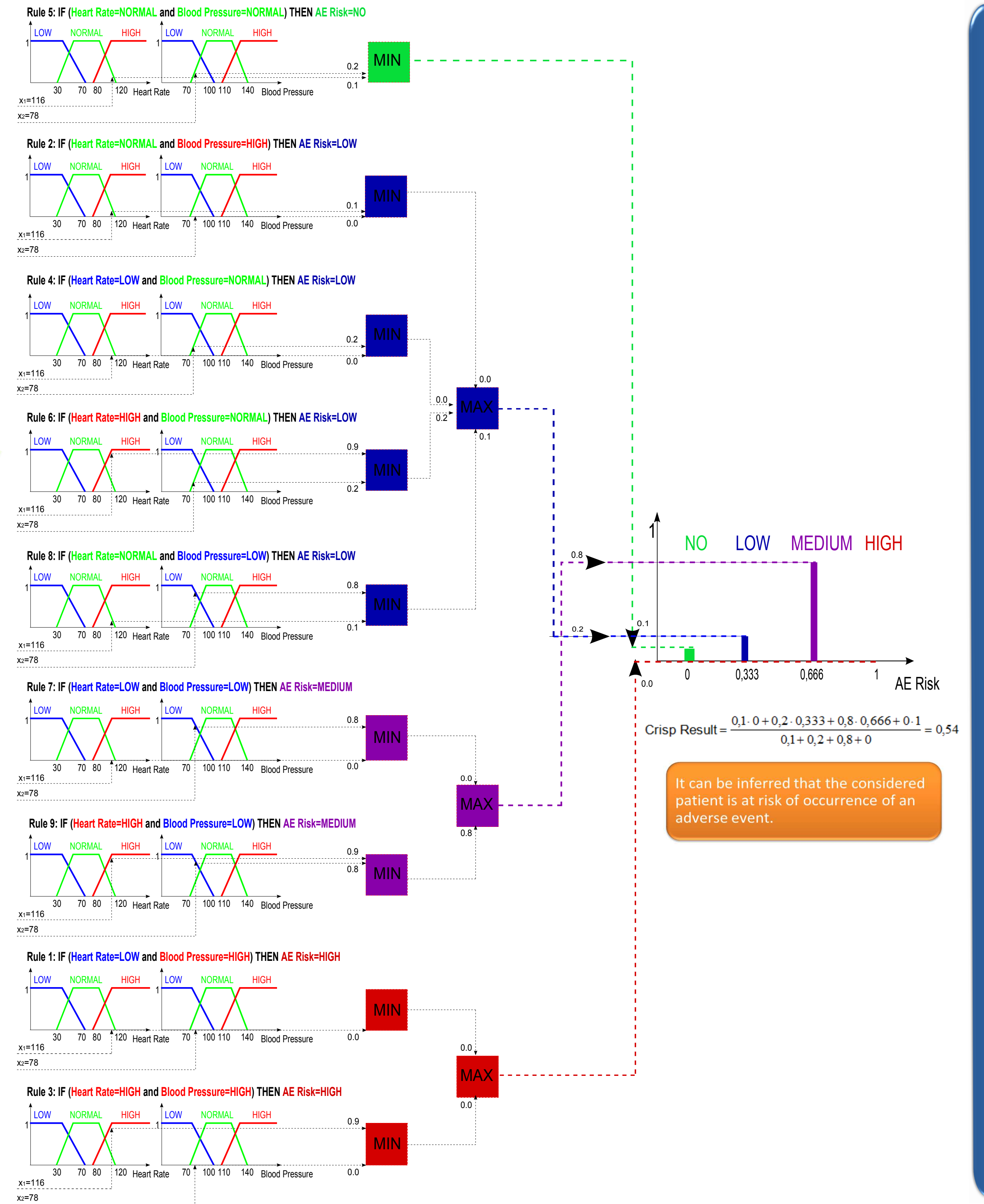
Linguistic Variables

Values for linguistic variable. For example, given bio-signal is a linguistic variable if its values are linguistic rather than numerical, i.e., low, normal, high.

Linguistic Labels

Fuzzy set theory permits the gradual assessment of the membership of elements to the given set; this is described with the aid of a membership function valued in the real unit interval [0, 1].

Membership Functions



Fuzzification

- Process of transforming crisp values into grades of membership for linguistic terms of fuzzy sets. The membership function is used to associate a grade to each linguistic term.

Inference

- Every rule has a weight (a number between 0 and 1), which is applied to the number given by the antecedent.
- After proper weighting has been assigned to each rule, the implication method is implemented. A consequent is a fuzzy set represented by a membership function, which weights appropriately the linguistic characteristics that are attributed to it.

Aggregation

- Because decisions are based on the testing of all of the rules in a Fuzzy Inference System, the rules must be combined in some manner in order to make a decision. Aggregation is the process by which the fuzzy sets that represent the outputs of each rule are combined into a single fuzzy set.

Defuzzification

- Transformation from a fuzzy set to a crisp number. The input for defuzzification process is a fuzzy set (the aggregated output fuzzy set) and the output is a single number.

A reasoning mechanism ← performs the inference procedure (derives a conclusion from facts & rules)