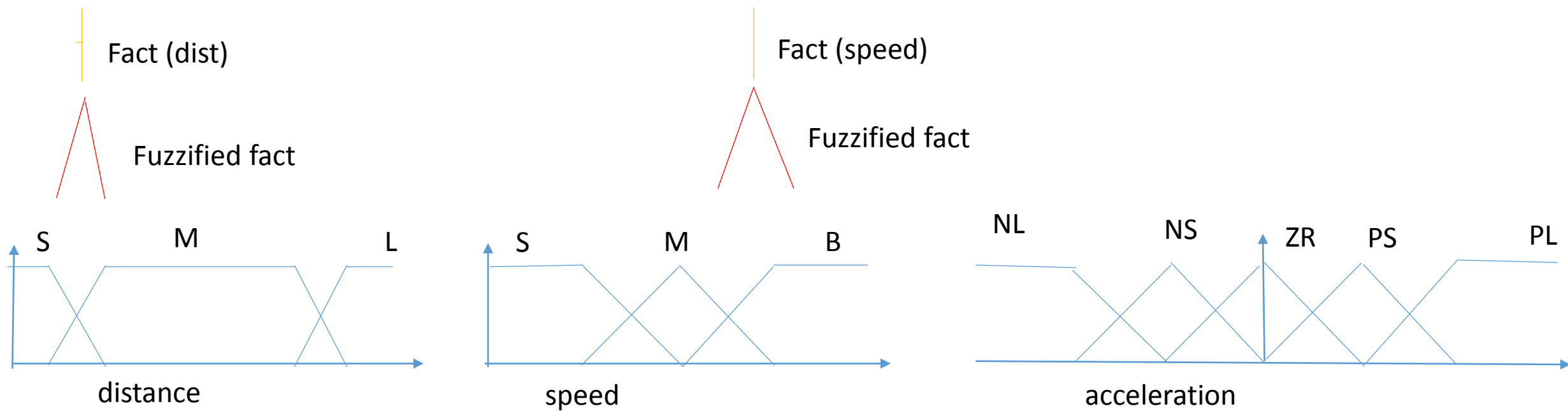# Fuzzy inference

A complete example of fuzzy inference

The problem

- We want to control the acceleration of a vehicle (e.g. a train)
- We determine its acceleration, as a function of the distance to the next station and of its current speed:
  - acceleration=f(distance, speed)
- Instead of formulae for function f, we use fuzzy IF-THEN rules, where
- "distance", "speed" and "acceleration" are fuzzy variables
- The current value for distance and speed are the *fact*
- The inference process is shown next:

R1	IF distance is Small (S) AND speed is Small (S) THEN acceleration is zero (ZR)	
R2	IF distance is Small (S) AND speed is Medium (M) THEN acc is Negative Small (NS)	X
R3	IF distance is Small (S) AND speed is Big (B) THEN acc is Negative Large (NL)	X
R4	IF distance is Medium (M) AND speed is Small (S) THEN acc is Positive Small (PS)	
R5	IF distance is Medium (M) AND speed is Medium (M) THEN acc is Zero (ZR)	X
R6	IF distance is Medium (M) AND speed is is Big (B) THEN acc is Negative Small (NS)	X
R7	IF distance is Large (L) AND speed is Small (S) THEN acc is Positive Large (PL)	
R8	IF distance is Large (L) AND speed is Medium (M) THEN acc is Positive Small (PS)	
R9	IF distance is Large (L) AND speed is Small (S) THEN acc is Zero (ZR)	

Active rules

$\alpha 1 = \max_x \min(\mu_A(x), \mu_A'(x))$

min

$\alpha 2$

$\alpha = \min(\alpha 1, \alpha 2)$

$B' = \min(\alpha, B)$

$\min(\mu_A(x), \mu_A'(x))$

$\min(\mu_A(x), \mu_A'(x))$

min

min

min

$MAX(B'_i)$

COG

cc = - 3.5 m/s²