CS 344
Artificial Intelligence

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Fuzzy Inferencing

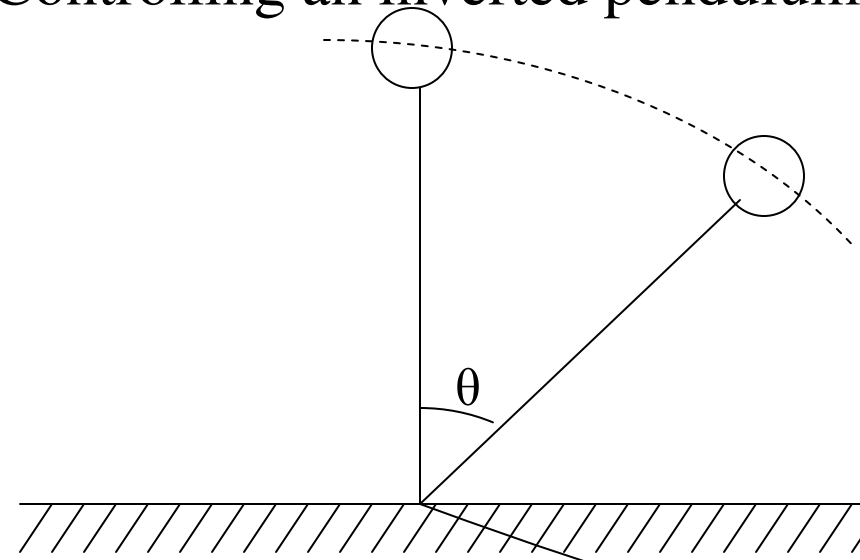
Core

The Lukasiewitz rule

$t(P \rightarrow Q) = \min[1, 1 + t(P) - t(Q)]$

An example

Controlling an inverted pendulum



$\dot{\theta} = d\theta / dt$ = angular velocity

Motor ← i=current

The goal: To keep the pendulum in vertical position ($\theta=0$) in dynamic equilibrium. Whenever the pendulum departs from vertical, a torque is produced by sending a current 'i'

Controlling factors for appropriate current

Angle θ, Angular velocity $\dot{\theta}$

<u>Some intuitive rules</u>

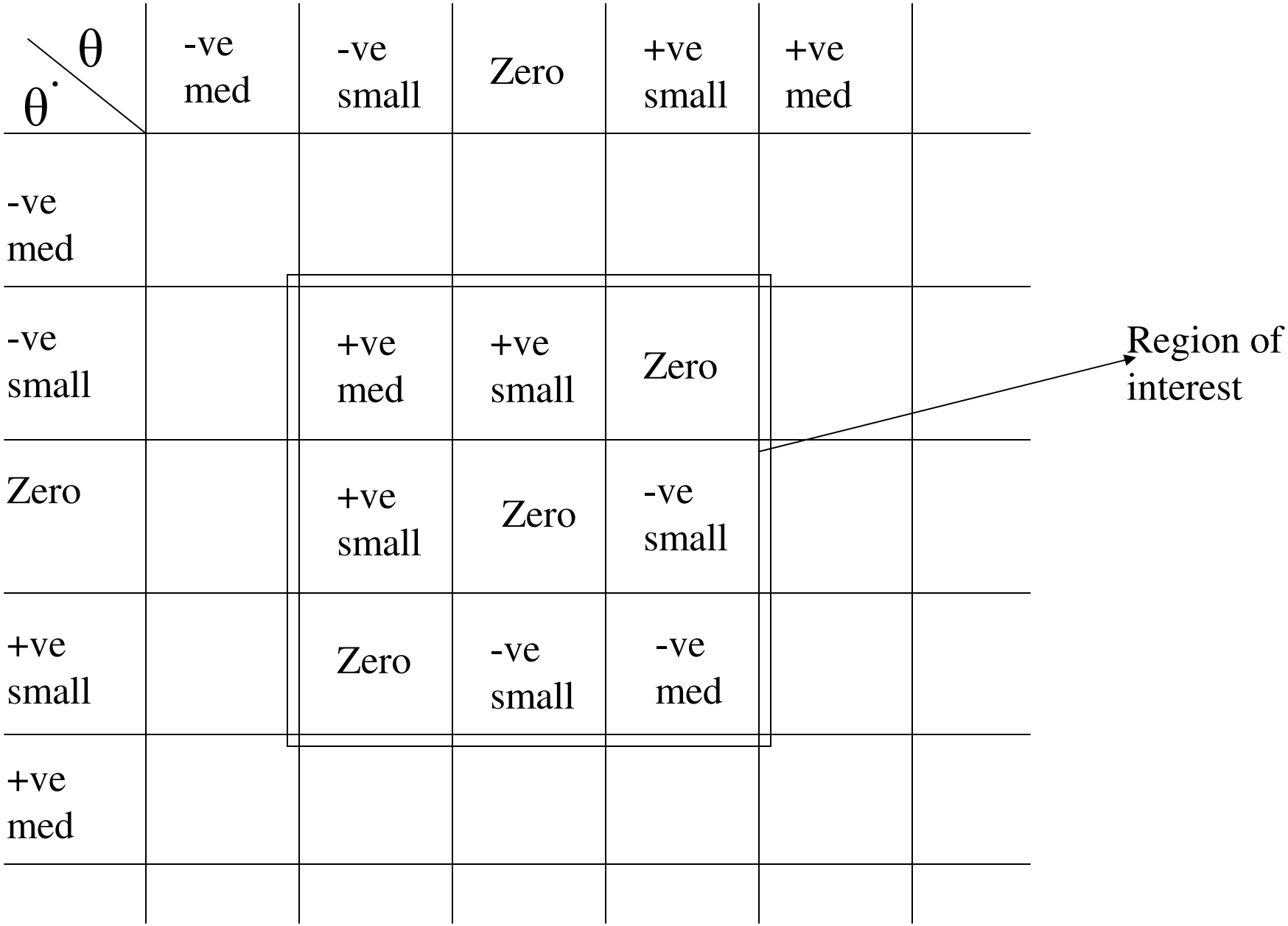
If θ is +ve small and $\dot{\theta}$ is –ve small

then current is zero

If θ is +ve small and $\dot{\theta}$ is +ve small

then current is –ve medium

Control Matrix



Each cell is a rule of the form

If θ is <> and $\dot{\theta}$ is <>

then i is <>

4 "Centre rules"

1. if θ = = Zero and $\dot{\theta}$ = = Zero then i = Zero

2. if θ is +ve small and $\dot{\theta}$ = = Zero then i is –ve small

3. if θ is –ve small and $\dot{\theta}$ = = Zero then i is +ve small

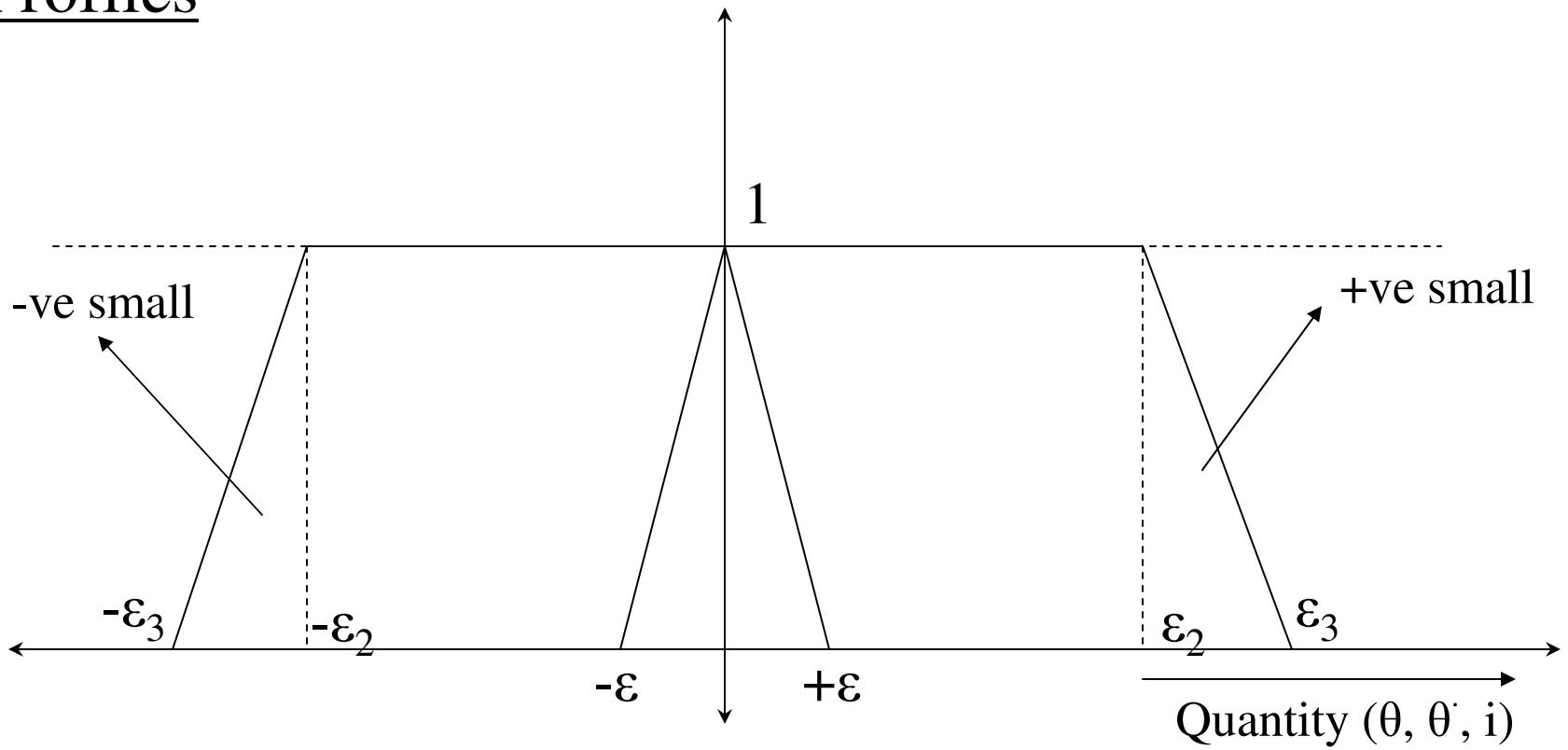
4. if θ = = Zero and $\dot{\theta}$ is +ve small then i is –ve small

5. if θ = = Zero and $\dot{\theta}$ is –ve small then i is +ve small

Linguistic variables

1. Zero
2. +ve small
3. -ve small

Profiles



Inference procedure

1. Read actual numerical values of θ and $\dot{\theta}$
2. Get the corresponding μ values μ_{Zero}, $\mu_{(+ve\ small)}$, $\mu_{(-ve\ small)}$. This is called FUZZIFICATION
3. For different rules, get the fuzzy I-values from the R.H.S of the rules.
4. "Collate" by some method and get ONE current value. This is called DEFUZZIFICATION
5. Result is one numerical value of 'i'.