

Probability Spaces and Random Variables

Sample Space Ω

Set of all possible outcomes

Event A

Subset of sample space

$$A \subseteq \Omega$$

Probability Measure P

$$P(A) \in [0, 1]$$

$$P(\Omega) = 1$$

Random Variable X

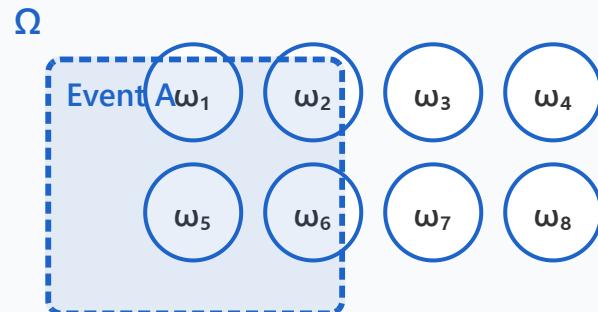
Function mapping outcomes to real numbers

Types of Random Variables

Discrete RV

Countable values (coin flips, dice)

Sample Space & Event Example



Random Variable X: $\Omega \rightarrow \mathbb{R}$

Outcomes	Values
Heads	1
Tails	0

$$\text{CDF: } F(x) = P(X \leq x)$$

Cumulative distribution function

Continuous RV

Uncountable values (heights, temps)

ML Application

Foundation for modeling uncertainty in regression