

## Probability Spaces and Random Variables

### Sample Space $\Omega$

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

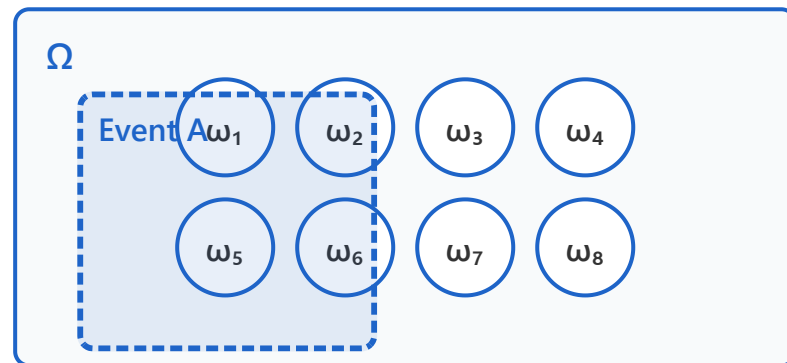
Function mapping outcomes to real numbers

### Types of Random Variables

#### Discrete RV

Countable values (coin flips, dice)

### Sample Space & Event Example



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

#### Outcomes

Heads

Tails



#### Values

1

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