Probability Distributions Cheat Sheet

Alireza Miraliakbar

Spring 2024

Continuous Distributions

Normal (Gaussian) Distribution

Description: Described by its mean (μ) and standard deviation (σ), and has the classic "bell curve" shape.

PDF: $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

Mean: μ

Variance: σ^2

Figure Placeholder

Exponential Distribution

Description: Models the time between events in a Poisson point process, i.e., events occur continuously and independently at a constant average rate.

PDF: $f(x;\lambda) = \lambda e^{-\lambda x}$ for $x \geq 0$

Mean: $\frac{1}{\lambda}$

Variance: $\frac{1}{\lambda^2}$

Figure Placeholder

Discrete Distributions

Bernoulli Distribution

Description: Models a single trial with two possible outcomes (success with probability p and failure with probability $1-p$).

PMF: $P(X = k) = p^k(1-p)^{1-k}$ for $k \in \{0, 1\}$

Mean: $\mu = p$

Variance: $\sigma^2 = p(1-p)$

Figure Placeholder

Binomial Distribution

Description: Models the number of successes in a fixed number of independent Bernoulli trials, each with the same probability of success.

PMF: $P(X = k) = \binom{n}{k} p^k(1-p)^{n-k}$ for $k = 0, 1, ..., n$

Mean: $\mu = np$

Variance: $\sigma^2 = np(1-p)$

Figure Placeholder