Tutorial 3, Feb 9, 2024

Probability Review

Definition

Exponential Distribution Family: The exponential family of distributions over x, a vector or scalar that can be discrete or continuous, is

$$p(x|\boldsymbol{\eta}) = h(x)g(\boldsymbol{\eta})e^{\boldsymbol{\eta}^T u(x)}$$

where $\boldsymbol{\eta}$ is a parameter of the distribution, $u(x)$ is a sufficient statistic, and $g(\boldsymbol{\eta})$ is a normalization term.

- Exponential distribution family includes many standard distributions
  - e.g. Bernoulli, bi/multinomial, Poisson, Gaussian, beta/Dirichlet, etc
  - Distributions in this family share important properties such as having conjugate priors
- e.g. Bernoulli: $p(x|\mu) = \mu^x(1-\mu)^{1-x}$
  - In this case, $h(x) = 1, u(x) = x, \eta = \ln \dfrac{\mu}{1-\mu}$