

A Very Short Probability Aside

Bayesian Data Analysis

Steve Buyske

A short probability aside

Mostly to get used to the notation, here is how we would calculate the mean and variance for a distribution ([if the mean and variance exist](#))

- Mean

- For a discrete distribution,

$$E(X) = \sum_{\text{all } x} x \text{Prob}(X = x),$$

- while for a continuous distribution we would write it as

$$E(X) = \int_{\text{all } x} xp(x) dx.$$

- Variance

- For a discrete distribution,

$$\text{Var}(X) = \sum_{\text{all } x} (x - E(X))^2 \text{Prob}(X = x),$$

- while for a continuous distribution we would write it as

$$\text{Var}(X) = \int_{\text{all } x} (x - E(X))^2 p(x) dx.$$

- The **median** and the **mode** of a distribution are also important in Bayesian statistics.
- The **median** is the point where 50% of the probability lies to either side of that point.
- The **mode** is the point corresponding to the maximum value of the distribution. In the Bayesian world, the mode of the posterior is often called the **maximum a posteriori**, or **MAP**.