"Credible Interval"

$$L(\underset{\sim}{x} \mid p) \propto p^{s}(1-p)^{n-s} = p^{\sum_{i=1}^{n} x_i}(1-p)^{n-\sum_{i=1}^{n} x_i}$$

$$\pi(p) \equiv \text{Beta}(a, b)$$

$$\pi(p \mid \underset{\sim}{x}) \equiv \text{Beta}\Big(\underbrace{a + \sum_{i=1}^{n} x_i}_{a_1},\ \underbrace{b + n - \sum_{i=1}^{n} x_i}_{b_1}\Big)$$

$$E[p \mid \underset{\sim}{x}] = \frac{a_1}{a_1+b_1}$$

$$= \frac{a + \sum_{i=1}^{n} x_i}{a + \cancel{\sum_{i=1}^{n}} x_i + b + n - \cancel{\sum_{i=1}^{n}} x_i} = \frac{a + \sum_{i=1}^{n} x_i}{a+b+n} = \underbrace{\left(\frac{a}{a+b}\right)}_{\text{Mean of Prior}} \underbrace{\frac{(a+b)}{(a+b+n)}}_{\omega} + \underbrace{\bar{X}}_{\text{Data Mean}} \underbrace{\frac{n}{(a+b+n)}}_{1-\omega}$$

$$V(p) = \frac{m(1-m)}{a+b+1}$$

If $a+b$ increases expert is more certain

If n increases data is more certain

$$V(\bar{X}) = \frac{p(1-p)}{n}$$