

# Different parametrizations for the beta distribution

Emanuele

*[2022-12-10 Sat]*

The beta distribution is  $\frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)}\theta^{a-1}(1-\theta)^{b-1}$ , for  $a, b > 0$ . Its mean is  $\mu = \frac{a}{a+b}$  and its variance is  $\sigma^2 = \frac{ab}{(a+b)^2(a+b+1)}$ .

If one knows the mean and the variance of a beta then it is possible to recover the  $a, b$  parameters as  $a = \mu(\frac{\mu(1-\mu)}{\sigma^2} - 1)$  and  $b = (1-\mu)(\frac{\mu(1-\mu)}{\sigma^2} - 1)$ .

Sometimes the beta distribution is parametrized by mean and dispersion ( $\phi = \frac{1}{a+b+1}$ ) instead of mean and variance. In this case one has  $a = \frac{\mu(1-\phi)}{\phi}$  and  $b = \frac{(1-\mu)(1-\phi)}{\phi}$ .