Commonly Used Distributions

The following table gives commonly used families of probability models.

Distribution	Density
Bern(θ)	$f(y\|\theta) = \theta^y(1-\theta)^{1-y}$
Bin(n, θ)	$f(y\|\theta) = \binom{n}{y}\theta^y(1-\theta)^{n-y}$
Beta(a, b)	$p(\theta) = \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)}\theta^{a-1}(1-\theta)^{b-1}I_{(0,1)}(\theta)$
$U(0,1)$	$p(\theta) = I_{(0,1)}(\theta)$
Pois(θ)	$f(y\|\theta) = \theta^y e^{-y}/y!$
Exp(θ)	$f(y\|\theta) = \theta e^{-\theta y} I_{(0,\infty)}(y)$
Gamma(a, b)	$p(\theta) = [b^a/\Gamma(a)]\theta^{a-1}e^{-b\theta}I_{(0,\infty)}(\theta)$
$\chi^2(n)$	Same as Gamma($n/2, 1/2$)

$Weib(\alpha, \theta)$ $f(y|\theta) = \theta \alpha y^{\alpha - 1} \exp(-\theta y^{\alpha}) I_{(0,\infty)}(\theta)$

$N(\theta, 1/\tau)$ $f(y|\theta, \tau) = (1/\sqrt{2\pi\tau}) \exp\left[-\tau(y - \theta)^2/2\right]$

$t(n, \theta, \sigma)$ $f(y|\theta) = \left[1 + (y - \theta)^2/n\sigma^2\right]^{(n+1)/2}$

$\times \Gamma[(n + 1)/2]/\Gamma(n/2)\sigma\sqrt{n\pi}$

Cauchy(θ) same as $t(1, \theta, 1)$

Dirichlet(a_1, a_2, a_3) $p(\theta) = \frac{\Gamma(a_1+a_2+a_3)}{\Gamma(a_1)\Gamma(a_2)\Gamma(a_3)}$

$\times \theta_1^{a_1 - 1} \theta_2^{a_2 - 1} (1 - \theta_1 - \theta_2)^{a_3 - 1}$

$\times I_{(0,1)}(\theta_1) I_{(0,1)}(\theta_2) I_{(0,1)}(1 - \theta_1 - \theta_2)$