Univariate Distribution

$\alpha = 0, a = 1$, $b = n$

$a = 0$, $b = n$

$a = b = 1$

$n = n_1, a = n_2$

$b = n_3$

Zipf(α, n) — Discrete uniform(a, b) R, V — Rectangular(n) V — Beta-binomial(a, b, n) — Negative hypergeometric(n_1, n_2, n_3)

$n \to \infty$

$A(c) = -\log(1 - c)$

$A(c) = e^c, \mu = c$

$p \sim$ beta

$p = n_1/n_3$, $n_3 \to \infty$, $n_1 \to \infty$, $n_2 = n$

Zeta(α) — Logarithm(c) — Power series$(c, A(c))$ — Poisson(μ) C — Hypergeometric(n_1, n_2, n_3)

$\mu \sim$ gamma

$\mu = np$, $n \to \infty$

$A(c) = (1 - c)^{-x}$, $c = 1 - p$

$\sigma^2 = \mu$, $\mu \to \infty$

$p = n_1/n_3, n = n_2, n_3 \to \infty$

Beta-Pascal(n, a, b) — Gamma-Poisson(α, β) — Binomial(n, p) C_p — Bernoulli(p) M, P, X

$\alpha = (1 - p)/p$, $\beta = n$

$n \to \infty$

$\mu = np$, $\sigma^2 = np(1 - p)$, $n \to \infty$

$\beta = 0$

$\sum X_i$ (iid)

$n = 1$

$p \sim$ beta

$\mu = n(1 - p), n \to \infty$

$\mu = np$, $n \to \infty$

Geometric(p) F, M, V — Pascal(n, p) C_p — Normal(μ, σ^2) L — Polya(n, p, β) — Gamma-normal(μ, α, β)

$n = 1$

$\sum X_i$ (iid)

$\beta = 1$

$(X - \mu)/\sigma$

$\mu + \sigma X$

$\log X$

$\sigma \sim$ inverted gamma

Discrete Weibull(p, β) V — Standard normal — Noncentral beta(β, γ, δ)

$\mu = 0, \sigma = 1$

$\mu = \alpha\beta$, $\sigma^2 = \alpha^2\beta$, $\beta \to \infty$

e^X

Log normal(α, β) P

$\beta = \gamma = \infty$

$\dfrac{X_1}{X_2}$

$\sum X_i^2/\sigma^2$

$\sum \left(\dfrac{X_i - \mu}{\sigma}\right)^2$

(iid)

$\beta \to \infty$

$\delta \to 0$

Arctangent(λ, ϕ) S, V — $|X|$ — Noncentral chi-square(n, δ) C — Log gamma(α, β) — Generalized gamma(α, β, γ)

zero truncate

$\sum X_i^2$

$\log X$

$\gamma = 1$

$\dfrac{X_1}{X_1 + X_2}$

Hyperbolic-secant V — $\lambda \to \infty$ — Chi(n) — Inverted gamma(α, β) — Gamma(α, β) C_α, S — Beta(β, γ)

Inverse Gaussian(λ, μ) $L_{\lambda_i/(\mu_i^2 a_i)}$

$1/X$

$\beta = \gamma = 1$

$\log |X|/\pi$

$\sqrt{X}$

$\delta = 0$

$n = 2\beta$

X_1/X_2, $\alpha = 1$

$\dfrac{X}{1 - X}$

$\beta = \gamma = \frac{1}{2}$

Cauchy(a, α) C, I, S, V — $\mu = 1$ — $\lambda(X - \mu)^2/(\mu^2 X)$ — $2X/\alpha$ — $n = 2\beta$ — $\beta = n$ — Inverted beta(β, γ) — Arcsin V

$a = 0$, $\alpha = 1$

$a + \alpha X$

$n \to \infty$

Standard Wald(λ) S

$\dfrac{X_1/n_1}{X_2/n_2}$

Chi-square(n) C

$\alpha = 2$

n even

Makeham(δ, κ, γ)

Standard Cauchy I, S, V — t(n) — $\alpha = 2$ — $2X/\alpha$ — Hypoexponential$(\vec{\alpha})$ C — Erlang(α, n) S — $X_{(r)}$

$n = 1$

X^2

$\vec\alpha = \alpha$

$\dfrac{n_1 X}{n_2 \to \infty}$

$n = 2$

$\sum X_i$

$n = 1$

$\sum X_i$ (iid)

$\beta = r$

$\gamma = n - r + 1$

$\gamma = 0$

Gompertz(δ, κ) V

$\delta = 0$

$\dfrac{2}{\alpha} \sum X_i$ (iid)

$\alpha = 1, X_1/X_2$

$\beta = 1$

$\dfrac{\log[1 - (\log X)(\log \kappa)/\delta]}{\log \kappa}$

Noncentral t(n, δ) — F(n_1, n_2) I — Mixture — Exponential(α) F, M, S, V — Logistic-exponential(α, β) S, V — Exponential power(λ, κ) V

$\gamma = 0$

$\log\left[1 + (X/(1-X))^{1/\kappa}\right]/\lambda$

$[\log(1 - \log(1 - X))/\lambda]^{1/\kappa}$

Doubly noncentral t(n, δ, γ) — Hyperexponential$(\vec\alpha)$ — $\alpha = 1$, $\kappa \to 0$ — $|X|$, $\alpha_1 = \alpha_2$ — $n(1 - X_{(n)})$, $n \to \infty$

$\vec\alpha = \alpha$

$-\alpha \log X$

$\delta \to 0$

$\delta = \kappa \to 0$, $\alpha = 1/\gamma$

Muth(κ) — Error(a, b, c) S — Standard uniform V — $X_{(n)}$ — Minimax(β, γ) M_β, V

Noncentral F(n_1, n_2, δ) — IDB(δ, κ, γ) — X^2 — $X_1 - X_2$ — $\alpha_1 = \alpha_2$ — $c = 2$, $b = \alpha/2$ — $a = 0$ — $X^{1/\beta}$ — $\gamma = 1$

$\gamma \to 0$

$\delta = 2/\alpha$, $\gamma = 0$

$\sqrt{X}$

Laplace(α_1, α_2) V

$\beta = 1$

Standard power(β) V, X

Doubly noncentral F$(n_1, n_2, \delta, \gamma)$ — Rayleigh(α) M, S, V — Pareto(λ, κ) M, V — $a = 0$, $b = 1$ — $a + (b - a)X$ — $\alpha = 1$ — Power(α, β) S, V, X_α

$\beta = 1$

$\log(X/\lambda)$

$\lambda X^{-1/\kappa}$

$X_1 - X_2$

Standard triangular V

Properties:
- C: Convolution
- F: Forgetfulness
- I: Inverse
- L: Linear combination
- M: Minimum
- P: Product
- R: Residual
- S: Scaling
- V: Variate generation
- X: Maximum

$L \Rightarrow C$
$L \Rightarrow S$
$F \Rightarrow R$

Relationships:
- → Special cases
- → Transformations
- --→ Limiting
- ⋯→ Bayesian

$\beta = 2$

$X^{1/\beta}$

$\dfrac{1}{\lambda}\left(\dfrac{1 - X}{X}\right)^{1/\kappa}$

$\lfloor 10^X \rfloor$

$a = -1$, $b = 1$, $m = 0$

$n = 1$

$a = 1/2$, $b = 1$

$n = 1$, $\kappa \to 0$

Weibull(α, β) M_β, S, V — Log logistic(λ, κ) I, S, V — Benford V — TSP(a, b, m, n) V — Uniform(a, b) R, V

$\log X$

$\gamma = 0$

$X + \delta$

$\kappa = 1$

$\kappa = 1$

$\log X$

$n = 2$

von Mises (κ, μ) S

Extreme value(α, β) V, M_β — Lomax(λ, κ) V

Generalized Pareto(δ, κ, γ) — Logistic(λ, κ) S, V — Triangular(a, b, m) V — Kolmogorov-Smirnov(n) V_{1-4}

Genealogy of the INCERTO

Legend:
- Mathematics
- Philosophy
- Social Science
- Legal Theory
- Real World

Little overlap

No overlap between skepticism and fat tails

SKEPTICAL EMPIRICAL TRADITION (Philosophy)

Montaigne (essay method)

Pyrrho of Ellis and the "Applied" Pyrrhonians
Asymmetric Medicine: Menodotus of Nicomedia.
Sextus Empiricus, Aenesidemus
of Knossos, Antiochus of Laodicea,
Herodotus of Tarsus,...
Algazel
Algazelist School (Nicolas d'Autrecourt, etc.)

ACADEMIA
Carneades
...Cicero

FAT TAILS (Mathematics)

Pareto, Lévy (I)
Mandelbrot (I)
Polya, Feller
Zolotarev, Taqqu
Samorodnisky

Almost no Overlap between **LDT** and **Fat Tails** (Cramér condition for exponential moments)

Extreme Value Theory

Modern PROBLEM of INDUCTION
Simon Foucher
Bayle, Huet, Hume, Mill, Russel, Ayer, Goodman...

Negative Empiricism
Brochard-Favier-Popper

Probability in Epistemology
Bayes, Peirce, Ramsey, Carnap, Levi, Kyburgh, Jeffreys, ...

Hayek Shackle

Complexity Theory
Econophysics

Gnedenko, Resnick Embrechts, Balkema de Haan, Picklands, Falk, ...

RUIN PROBLEMS/ LARGE DEVIATIONS THEORY

Paul Lévy (II), Mandelbrot (II)

Loss Models / INSURANCE (I)

CONVERGENCE LAWS
De Moivre, Markov Bienaymé, Chebychev, Bernstein, Kolmogorov, Luzhin, Berry, Esseen, Petrov, Nagaev brothers, Mikosch

Cramer, Lundberg, Denbo, Zeitouni, Varadhan, etc.

Overlap limited to psych of induction, machine learning

Black Swan (Anti)Fragility

Heuristics and Biases/ Decision Theory /Psychology of Probability

ETHICS

STOCHASTIC PROCESSES

Economics of Uncertainty

Knightian "Uncertainty"

Agency Problem, INSURANCE (II)

Skin In The Game

Contract Theory scholastics: Pierre de Jean Olivi and modern

Real Options

Mathematical Finance / Derivative Theory/ Stochastic Calculus

No overlap between Heuristics and Biases and Fat Tails

FAT TONYISM
Real World Trader Lore

No overlap between Real Options and 1) fragility, 2) fat tails,3) skepticism...

"Knightian uncertainty" isolated mathematically and philosophically from traditions (skepticism & fat tails)

Little overlap between convergence laws (**LLN**) and the philosophical problem of induction

No overlap between concavity/fragility and both contract and decision theory

No overlap between economics of uncertainty and fat tails/skepticism/ induction

No overlap in literature between the world of ideas and FAT TONYISM except some treatments of ecological uncertainty