Symbols and notation

Notation	*Meaning*
$\mathbb{N}$	The natural numbers $\{1, 2, 3, ...\}$.
$\mathbb{R}$	The real numbers.
$\mathbb{R}_{>0}$	The positive real numbers.
$\mathbb{R}_{\geq x}$	The real numbers greater than or equal to $x \in \mathbb{R}$.
$\#S$	The cardinality of a set S.
$A \times B$	The Cartesian product of two sets A and B, i.e. the set $\{(a, b) \mid a \in A,\ b \in B\}$.
$\mathbb{R}^d$	d-dimensional real space.
$A \subseteq B$	A is an improper subset of B.
$A \subsetneq B$	A is a proper subset of B.
$\mathbb{I}\{\cdot \in S\}$	The indicator function of a set S.
$\operatorname{int}\{S\}$	The interior of a subset S of the standard topological space $\mathbb{R}$.
$\phi(A)$	The image of a real-valued function $\phi : X \to Y$ is $\phi(A) := \{\phi(a) : a \in A \subseteq X\}$.
$\phi^{-1}(B)$	The pre-image of a real-valued function $\phi : X \to Y$ is $\phi(A) := \{x \in X : \phi(x) \in B \subseteq Y\}$.
$\log(\cdot)$	The natural logarithmic function: $\mathbb{R}_{>0} \to \mathbb{R}$.
$\phi(x) \propto \tilde{\phi}(x)$	A real-valued function $\phi : \mathbb{R} \to \mathbb{R}$ is proportional to $\tilde{\phi}(x)$, if $\exists$ a constant $c \in \mathbb{R}$ such that $\phi(x) = c \cdot \tilde{\phi}(x)$, $\forall x \in \mathbb{R}$.
$\phi_2 \circ \phi_1(x)$	The composition of two real-valued function $\phi_1, \phi_2 : \mathbb{R} \to \mathbb{R}$ is $\phi_2 \circ \phi_1(x) := \phi_2(\phi_1(x))$, $\forall x \in \mathbb{R}$.
$\boldsymbol{x}, \boldsymbol{X}$	Real-valued vectors in $\mathbb{R}^n$, where $n \in \mathbb{N}$.
$\mathbf{A}$	Real-valued matrix in $\mathbb{R}^{n \times m}$, where $m, n \in \mathbb{N}$.
A^T	The transpose of some real-valued matrix $A \in \mathbb{R}^{n \times m}$, where $m, n \in \mathbb{N}$.
X	Real-valued random variable $X : \Omega \subseteq \mathbb{R} \to \mathbb{R}$ defined on probability measure space $(\Omega, \mathcal{B}(\Omega), \mathbb{P})$, with realization x.
$\boldsymbol{X}$	Real-valued n-dimensional random vector $\boldsymbol{X} : \Omega \subseteq \mathbb{R}^n \to \mathbb{R}^n$ defined on probability measure space $(\Omega, \mathcal{B}(\Omega), \mathbb{P})$, with realization $\boldsymbol{x}$.
f_X	The probability density function (PDF) of a random variable X.
$f_{\boldsymbol{X}}$	The joint PDF of a random vector $\boldsymbol{X}$.
F_X	The cumulative distribution function (CDF) of a random variable X.
$F_{\boldsymbol{X}}$	The joint CDF of a random vector $\boldsymbol{X}$.
$\mathbb{E}_{f_X}[g(X)]$	The expectation of the random variable $g(X)$ with PDF f_X, where g is a real-valued function.
$\mathbb{E}_{f_{\boldsymbol{X}}}[g(\boldsymbol{X})]$	The expectation of the random vector $g(\boldsymbol{X})$ with PDF $f_{\boldsymbol{X}}$, where g is a real-valued function.

$\mathrm{Var}_{f_X}[g(X)]$	The variance of the random variable $g(X)$ with PDF f_X, where g is a real-valued function.
$\mathrm{Var}_{f_{\boldsymbol{X}}}[g(\boldsymbol{X})]$	The variance of the random vector $g(\boldsymbol{X})$ with PDF $f_{\boldsymbol{X}}$, where g is a real-valued function.
$Supp(f)$	The support of a real-valued function $f : X \subseteq \mathbb{R}^n \to \mathbb{R}$ is $\{\boldsymbol{x} \in X \ : \ f(\boldsymbol{x}) \neq 0\}$.
$X \sim f_X$	The random variable X is distributed according to PDF f_X.
$f_X \overset{d}{=} g_X$	Two PDFs of a random variable X are equivalent.
$X_n \xrightarrow{d} X$	A sequence of real-valued random variables $X_1, ..., X_n$ converges almost surely if $\mathbb{P}\left(\{\omega \in \Omega : \lim_{n\to\infty} X_n(\omega) = X(\omega)\}\right) = 1$. This is convergence is denotes by $X_n \xrightarrow{d} X$
$F_n(x) \xrightarrow{d} F(x)$	A sequence of real-valued random variables $X_1, ..., X_n$ with CDFs F_i, for $i \in \{1, ..., n\}$, converges in distribution if $\lim_{n\to\infty} F_n(x) = F(x)$. This is convergence is denotes by $F_n(x) \xrightarrow{d} F(x)$.
$\mathrm{Bern}(p)$	The Bernoulli distribution with success probability $p \in [0,1]$. The corresponding PMF $f : \{0,1\} \to [0,1]$ is defined by $f(x) = p \cdot \mathbb{I}\{x = 1\} + (1-p) \cdot \mathbb{I}\{x = 0\}$.
$\mathrm{Unif}(a,b)$	The continuous uniform distribution over the interval $[a,b] \subsetneq \mathbb{R}$, $a < b$. The corresponding PDF $f : [a,b] \to \{0, \frac{1}{b-a}\}$ is defined by $f(x) = \frac{1}{b-a}\mathbb{I}\{x \in [a,b]\}$.
$\mathcal{N}(\mu, \sigma^2)$	The normal/Gaussian distribution with mean $\mu \in \mathbb{R}$ and variance $\sigma^2 \in \mathbb{R}_{>0}$. The corresponding PDF $f : \mathbb{R} \to \mathbb{R}_{>0}$ is defined by $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\{-\frac{(x-\mu)^2}{2\sigma^2}\}$.
$\mathcal{T}f_X(\boldsymbol{\theta}, a)$	The truncated distribution with parameters $\boldsymbol{\theta} \in \mathbb{R}^k$ by $a \in \mathbb{R}$. The corresponding truncated PDF $\mathcal{T}f_X : \mathbb{R}_{\geq a} \to \mathbb{R}$ is $\mathcal{T}f_X(x) = \left[\int_a^\infty f_X(x)\,dx\right]^{-1} \cdot \mathbb{I}\{x \geq a\} \cdot f_X(x)$.
$\mathrm{Cauchy}(x_0, \gamma)$	The Cauchy distribution with location parameter $x_0 \in \mathbb{R}$ and scale parameter $\gamma \in \mathbb{R}$.
$\mathrm{Expo}(\lambda)$	The exponential distribution with rate parameter $\lambda \in \mathbb{R}_{>0}$. The corresponding PDF $f : \mathbb{R} \to \mathbb{R}_{>0}$ is defined by $f(x) = -\lambda e^{-\lambda x} \cdot \mathbb{I}\{x \geq 0\}$.
$\mathrm{Beta}(\alpha, \beta)$	The beta distribution with shape parameters $\alpha, \beta \in \mathbb{R}_{>0}$.
$\mathrm{Gamma}(\alpha, \beta)$	The gamma distribution with shape parameter $\alpha \in \mathbb{R}_{>0}$ and rate/scale parameter $\beta \in \mathbb{R}_{>0}$. The corresponding PDF $f : \mathbb{R} \to \mathbb{R}_{>0}$ is defined by $f(x) = \frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x} \cdot \mathbb{I}\{x > 0\}$.
$\mathrm{Weib}(\alpha, \beta)$	The Weibull distribution with shape parameter $\alpha \in \mathbb{R}_{>0}$ and scale parameter $\beta \in \mathbb{R}_{>0}$. The corresponding PDF $f : \mathbb{R} \to \mathbb{R}_{>0}$ is defined by $f(x) = \frac{\alpha}{\beta^\alpha} x^{\alpha-1} e^{-(x/\beta)^\alpha} \cdot \mathbb{I}\{x \geq 0\}$.