Math macro command for latex support in markdown

Number and Arrays

command	visualization	comment	
`a`	a	A scalar	
`\va`	$\va$	A vector, additionally $\vzero, \vone, \vmu, \vnu, \vtheta$ for `\vzero, \vone, \vmu, \vnu, \vtheta`	
`\mA`	$\mA$	A matrix	
`\tA`	$\tA$	A tensor	
`\mI_n`	$\mI_n$	Identity matrix with n rows and n columns	
`\mI`	$\mI$	Identity matrix with dimensionality implied by context	
`\ve^{(i)}`	$\ve^{(i)}$	Standard basis vector $[0,\dots,0,1,0,\dots,0]$ with a 1 at position i	
`\text{diag}(\va)`	$\text{diag}(\va)$	A square, diagonal matrix with diagonal entries given by $\va$	
`\ra`	$\ra$	A scalar-valued random variable	
`\rva`	$\rva$	A vector-valued random variables	
`\rmA`	$\rmA$	A matrix-valued random varialbes	

Sets and Graphs

Command	Visualization	Comment
`\sA`	$\sA$	A set **Note**: the command covers `sA` to `sZ` but don't no `sE` since it's expectation
`\R`	$\R$	The set of real numbers
`{0, 1}`	${0, 1}$	The set containing 0 and 1
`{0, 1, \dots, n}`	${0, 1, \dots, n}$	The set of all integers between 0 and n
`[a, b]`	$[a, b]$	The real interval including a and b
`(a, b]`	$(a, b]$	The real interval excluding a but including b
`\sA \backslash \sB`	$\sA \backslash \sB$	Set subtraction, i.e., the set containing the elements of $\sA$ not in $\sB$
`\gG`	$\gG$	A graph

Indexing

Command	Visualization	Comment
`\eva_i`	$\eva_i$	Element i of vector $\va$, with indexing starting at 1
`\eva_{-i}`	$\eva_{-i}$	All elements of vector $\va$ except for element i
`\emA_{i,j}`	$\emA_{i,j}$	Element i, j of matrix $\mA$
`\mA_{i, :}`	$\mA_{i, :}$	Row i of matrix $\mA$
`\mA_{:, i}`	$\mA_{:, i}$	Column i of matrix $\mA$
`\etA_{i, j, k}`	$\etA_{i, j, k}$	Element (i, j, k) of a 3-D tensor $\tA$
`\tA_{:, :, i}`	$\tA_{:, :, i}$	2-D slice of a 3-D tensor
`\erva_i`	$\erva_i$	Element i of the random vector $\rva$

Linear Algebra Operators

Command	Visualization	Comment
`\mA^\top`	$\mA^\top$	Transpose of matrix $\mA$

Command	Visualization	Comment
`\mA^+`	$\mA^+$	Moore-Penrose pseudoinverse of $\mA$
`\mA \odot \mB`	$\mA \odot \mB$	Element-wise (Hadamard) product of $\mA$ and $\mB$
`\mathrm{det}(\mA)`	$\mathrm{det}(\mA)$	Determinant of $\mA$
`\sign(x)`	$\sign(x)$	Sign of a variable x
`\Tr \mA`	$\Tr(\mA)$	Trace of a matrix A

Calculus

Command	Visualization	Comment
`\diff y / \diff x`	$\diff y / \diff x$	Derivative of y with respect to x
`\frac{\partial y}{\partial x}`	$\frac{\partial y}{\partial x}$	Partial derivative of y with respect to x
`\nabla_\vx y`	$\nabla_\vx y$	Gradient of y with respect to $\vx$
`\nabla_\mX y`	$\nabla_\mX y$	Matrix derivatives of y with respect to $\mX$
`\nabla_\tX y`	$\nabla_\tX y$	Tensor containing derivatives of y with respect to $\tX$
`\frac{\partial f}{\partial \vx}`	$\frac{\partial f}{\partial \vx}$	Jacobian matrix $\mJ \in \R^{m\times n}$ of $f: \R^n \rightarrow \R^m$
`\nabla_\vx^2 f(\vx)\text{ or }\mH(f)(\vx)`	$\nabla_\vx^2 f(\vx)\text{ or }\mH(f)(\vx)$	The Hessian matrix of f at input point $\vx$
`\int f(\vx) d\vx`	$\int f(\vx) d\vx$	Definite integral over the entire domain of $\vx$
`\int_\sS f(\vx) d\vx`	$\int_\sS f(\vx) d\vx$	Definite integral with respect to $\vx$ over the set $\sS$

Probabilities

Command	Visualization	Comment
`\ra \bot \rb`	$\ra \bot \rb$	The random variables $\ra$ and $\rb$ are independent
`\ra \bot \rb \mid \rc`	$\ra \bot \rb \mid \rc$	They are conditionally independent given $\rc$

Command	Visualization	Comment
`P(\ra)`	$P(\ra)$	A probability distribution over a discrete variable
`p(\ra)`	$p(\ra)$	A probability distribution over a continuous variable, or a variable of unspecified type
`\ra \sim P`	$\ra \sim P$	Random variable $\ra$ has distribution P
`\E_{\rx \sim P} [ f(x) ] \text{ or } \E f(x)`	$\E_{\rx \sim P} [f(x)] \text{ or } \E f(x)$	Expectation of $f(x)$ with respect to $P(\rx)$
`\Var(f(x))`	$\Var(f(x))$	Variance of $f(x)$ under $P(\rx)$
`\Cov(f(x), g(x))`	$\Cov(f(x), g(x))$	Covariance of $f(x)$ and $g(x)$ under $P(\rx)$
`H(\rx)`	$H(\rx)$	Shannon entropy of the random variable $\rx$
`\KL(P \Vert Q)`	$\KL(P \Vert Q)$	Kullback-Leibler divergence of P and Q
`\mathcal{N}(\vx ; \vmu , \mSigma)`	$\mathcal{N}(\vx ; \vmu , \mSigma)$	Gaussian distribution over $\vx$ with mean $\vmu$ and covariance $\mSigma$

Functions

Command	Visualization	Comment
`f: \sA \rightarrow \sB`	$f: \sA \rightarrow \sB$	The function f with domain $\sA$ and range $\sB$
`f \circ g`	$f \circ g$	Composition of the functions f and g
`f(\vx ; \vtheta)`	$f(\vx ; \vtheta)$	A function of $\vx$ parametrized by $\vtheta$. Sometimes written as $f(\vx)$ to simplify notation
`\log x`	$\log x$	Natural logarithm of x
`\sigma(x)`	$\sigma(x)$	Logistic sigmoid, $\displaystyle \frac{1}{1 + \exp(-x)}$
`\zeta(x)`	$\zeta(x)$	Softplus, $\log(1 + \exp(x))$
`\Vert \vx \Vert_p`	$\Vert \vx \Vert_p$	L^p norm of $\vx$
`\Vert \vx \Vert`	$\Vert \vx \Vert$	L^2 norm of $\vx$
`x^+`	x^+	Positive part of x, i.e., $\max(0,x)$

Command	Visualization	Comment
`\bm{1}_\mathrm{condition}`	$\bm{1}_\mathrm{condition}$	Is 1 if the condition is true, 0 otherwise

Custom Commands special

Command	Visualization	Comment
`\bm{#1}`	$\bm{x}$	Bold symbol, e.g., $\boldsymbol{x}$
`\sign`	$\sign$	**operator**, Sign , sign
`\Tr`	$\Tr$	**operator** Trace, Tr
`\E`	$\E$	Expectation, $\mathbb{E}$
`\KL`	$\KL$	Kullback-Leibler divergence, D_KL
`\NormalDist`	$\NormalDist$	Gaussian distribution, $\mathcal{N}$
`\diag`	$\diag$	Diagonal matrix, diag
`\Ls`	$\Ls$	Loss function, $\mathcal{L}$
`\R`	$\R$	Real number set, $\mathbb{R}$
`\emp`	$\emp$	Empirical distribution, $\tilde{p}$
`\lr`	$\lr$	Learning rate, α
`\reg`	$\reg$	Regularization coefficient, λ
`\rect`	$\rect$	Rectifier activation, $\mathrm{rectifier}$
`\softmax`	$\softmax$	Softmax function, $\mathrm{softmax}$
`\sigmoid`	$\sigmoid$	Sigmoid function, σ
`\softplus`	$\softplus$	Softplus function, ζ
`\Var`	$\Var$	Variance, Var
`\standarderror`	$\standarderror$	Standard error, SE
`\Cov`	$\Cov$	Covariance, Cov
`\tran`	$\tran$	Transpose operator, $^\top$
`\inv`	$\inv$	Inverse operator, $^{-1}$
`\diff`	$\diff$	Differential operator, d

Reference

- Ian Goodfellow's ML book: https://github.com/goodfeli/dlbook_notation/blob/master/notation_example.pdf
- MathJax: https://docs.mathjax.org/en/latest/input/tex/macros.html

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