abaisero.sty

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1 Options

Options are processes left-to-right. If no options are provided, or none are enabled by the end of the processing, then by default they are all considered to be enabled.

Option	Description
`all`	Enable all commands
`(no-)math`	Disable/enable mathematical commands
`(no-)linalg`	Disable/enable linear algebra commands
`(no-)optim`	Disable/enable optimization commands
`(no-)stats`	Disable/enable statistics commands
`(no-)dists`	Disable/enable distributions commands
`(no-)ml`	Disable/enable machine learning commands
`(no-)rl`	Disable/enable reinforcement learning commands
`(no-)marl`	Disable/enable multi-agent reinforcement learning commands
`(no-)theorem`	Disable/enable theorem commands
`(no-)misc`	Disable/enable miscellanea commands

2 Commands

Option [math]

Symbol	Command	Description	Example
$\mathbb{N}$	\naturalset	the set of natural numbers	$\mathbb{N} \doteq \{1, 2, 3, \ldots\}$
$\mathbb{Z}$	\integerset	the set of integer numbers	$\mathbb{Z} \doteq \{0, 1, -1, 2, -3, \ldots\}$
$\mathbb{R}$	\realset	the set of real numbers	$\sqrt{2} \in \mathbb{R}$
$*$	\kstar	the Kleene star operator	$\mathcal{X}^* \doteq \bigcup_{k=0}^{\infty} \mathcal{X}^k$
$+$	\kplus	the Kleene plus operator	$\mathcal{X}^+ \doteq \bigcup_{k=1}^{\infty} \mathcal{X}^k$
$\mathcal{P}$	\powerset	power set	$\mathcal{P}(\mathcal{X}) \doteq \left\{ \hat{\mathcal{X}} \mid \hat{\mathcal{X}} \subseteq \mathcal{X} \right\}$
$\mathbb{I}$	\Ind	Indicator function	$\Pr(x = 0) = \mathbb{E}\left[\mathbb{I}\left[x = 0\right]\right]$
$[\![\cdot]\!]$	\iverson{\cdot}	Iverson brackets	$[\![x \geq 0]\!]$ maps x to binaries
softmax	\softmax	a.k.a. logsumexp, realsoftmax[1]	$\mathrm{softmax}(x_1, \ldots, x_n) \doteq \log \sum_i \exp(x_i)$
softmin	\softmin		$\mathrm{softmin}(x_1, \ldots, x_n) \doteq -\log \sum_i \exp(-x_i)$
softargmax	\softargmax	a.k.a. softmax[1]	$\mathrm{softargmax}(x_1, \ldots, x_n)_i \doteq \frac{\exp(x_i)}{\sum_k \exp(x_k)}$
sign	\sign		$x = \mathrm{sign}\, x \cdot \lvert x \rvert$
supp	\supp	support operator	$\mathrm{supp}(f) \doteq \{x \mid f(x) \neq 0\}$

Option [linalg]

Symbol	Command	Description	Example
diag	\diag		
rank	\rank		
tr	\trace		$\mathrm{tr}(M) \doteq \sum_{i=1}^{n} M_{ii}$
col	\colspace		
ker	\nullspace	Nullspace (a.k.a kernel) of a linear mapping	
span	\spanspace		
$\top$	\T	Transpose superscript	symmetric $M \implies M = M^\top$
-1	\I	Inverse superscript	invertible $M \implies MM^{-1} = I$
$+$	\PI	Pseudo-inverse superscript	$MM^+M = M$
$-\top$	\IT	Inverse transpose superscript	$M^{-\top} = (M^{-1})^\top = (M^\top)^{-1}$
$+\top$	\PIT	Pseudo-inverse transpose superscript	$M^{+\top} = (M^+)^\top = (M^\top)^+$

Option [optim]

Symbol	Command	Description	Example
argmax	\argmax		$\mathrm{argmax}_a\, Q^\pi(s, a)$
argmin	\argmin		$\theta^* \doteq \mathrm{argmin}_\theta\, \mathcal{L}(\theta)$
$*$	\opt	Optimality superscript	$\pi^*(s) = \mathrm{argmax}_a\, Q^*(s, a)$
stop	\stopg	Stop-gradient operator	$\nabla_x \mathrm{stop}\left[f(x)\right] = 0$

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[1] The functions that in this document are called "softmax" and "softargmax" are poorly and inaccurately named in the broader math and ML fields (see https://en.wikipedia.org/wiki/Softmax_function and https://en.wikipedia.org/wiki/LogSumExp). Rather than stick to the more common naming conventions, I opt to rename the functions more accurately to appropriately reflect their actual properties. In any document where I would use these functions, I would need to define them anyway, so the risk of misunderstandings are minimal.

Option [stats]

Symbol	Command	Description	Example
$\perp$	\indep	Independence	$X \perp Y \mid Z$
do	\causaldo	Pearl's *do* operator	$\Pr(Y \mid \operatorname{do}(X = x)) \neq \Pr(Y \mid X = s)$
$\mathbb{C}$	\Cov	Covariance	$\mathbb{C}(x, y) = \mathbb{E}\left[xy\right] - \mathbb{E}\left[x\right]\mathbb{E}\left[y\right]$
$\mathbb{H}$	\Ent	Entropy	$\mathbb{H}[x] = -\mathbb{E}\left[\log\Pr(x)\right]$
$\mathbb{E}$	\Exp	Expectation	$\mathbb{E}\left[f(x)\right] = \sum_x \Pr(x)f(x)$
KL	\KL	KL-divergence	$\mathrm{KL}\left(p \mid\mid q\right) \doteq \mathbb{E}_{x \sim p}\left[\log p(x) - \log q(x)\right]$
D_{KL}	\DKL	KL-divergence (alternative)	
$\mathbb{I}$	\MI	Mutual Information	
$\mathbb{B}$	\Bias	Bias	$\mathbb{B}\left[\hat{f}(x)\right]$ is the bias of estimator $\hat{f}$
$\mathbb{V}$	\Var	Variance	$\mathbb{V}\left[\hat{f}(x)\right] = \mathbb{E}\left[\hat{f}(x)^2\right] - \mathbb{E}\left[\hat{f}(x)\right]^2$

Option [dists]

Symbol	Command	Description	Example
Categorical	\Categorical	Categorical	
Dirichlet	\Dirichlet	Dirichlet	
Geometric	\Geometric	Geometric	
Normal	\Normal	Normal	
Uniform	\Uniform	Uniform	

Option [ml]

Symbol	Command	Description	Example
$\mathcal{D}$	\data	Data set	$\mathcal{D} \doteq \{(x_i, y_i)\}_{i=1}^{N}$
$\mathcal{L}$	\loss	Loss function	$\mathcal{L}(\theta; x, y) = \frac{1}{2}\|y - f(x; \theta)\|^2$
nll	\nll	Neg-log-likelihood	$\mathrm{nll}(x) \doteq -\log\Pr(x)$
MSE	\mse	Mean-squared-error	
$\rightsquigarrow$	\trainedto	Model is trained to approximate some value	$\hat{V}(s) \rightsquigarrow V^{\pi}(s) \overset{\text{hope}}{\Longrightarrow} \hat{V}(s) \approx V^{\pi}(s)$

Option [rl]

Symbol	Command	Description	Example
$\mathcal{A}$	`\aset`	Action set	
$\mathcal{B}$	`\bset`	Belief set	
$\mathcal{H}$	`\hset`	History set	
$\mathcal{O}$	`\oset`	Observation set	
$\mathcal{R}$	`\rset`	Reward set	
$\mathcal{S}$	`\sset`	State set	
ε	`\nohistory`	Empty history	
π	`\policy`	policy	
Q^π	`\qpolicy`	Q policy values	
Q^μ	`\qpolicy[\mu]`	Q policy values w/ optional argument	
$\hat{Q}$	`\qmodel`	Parametric model	
V^π	`\vpolicy`	V policy values	
V^μ	`\vpolicy[\mu]`	V policy values w/ optional argument	
$\hat{V}$	`\vmodel`	Parametric model	
A^π	`\apolicy`	A policy values	
A^μ	`\apolicy[\mu]`	A policy values w/ optional argument	
$\hat{A}$	`\amodel`	Parametric model	
U^π	`\upolicy`	U policy values	
U^μ	`\upolicy[\mu]`	U policy values w/ optional argument	
$\hat{U}$	`\umodel`	Parametric model	
B_π	`\bpolicy`	Policy Bellman operator	
B_μ	`\bpolicy[\mu]`	Policy Bellman operator w/ optional argument	

Option [marl]

Symbol	Command	Description	Example
$\boldsymbol{x}$	`\joint{x}`	Joint formatting (redefinable)	
$\boldsymbol{\mathcal{A}}$	`\jaset`	Joint action set	
$\boldsymbol{\mathcal{O}}$	`\joset`	Joint observation set	
$\boldsymbol{\mathcal{H}}$	`\jhset`	Joint history set	
$\boldsymbol{A}, \boldsymbol{a}$	`\jA, \ja`	Joint action	$\boldsymbol{A} = \boldsymbol{a} \in \boldsymbol{\mathcal{A}}$
$\boldsymbol{O}, \boldsymbol{o}$	`\jO, \jo`	Joint observation	$\boldsymbol{O} = \boldsymbol{o} \in \boldsymbol{\mathcal{O}}$
$\boldsymbol{H}, \boldsymbol{h}$	`\jH, \jh`	Joint history	$\boldsymbol{H} = \boldsymbol{h} \in \boldsymbol{\mathcal{H}}$
$\boldsymbol{b}$	`\jb`	Joint belief	$\boldsymbol{b} \colon \boldsymbol{\mathcal{H}} \to \Delta\mathcal{S}$
$\boldsymbol{\pi}$	`\jpolicy`	Joint policy	$\boldsymbol{\pi}(\boldsymbol{h}, \boldsymbol{a}) \doteq \prod_i \pi_i(h_i, a_i)$
$Q^{\boldsymbol{\pi}}$	`\jqpolicy`	Q joint-policy values	
$V^{\boldsymbol{\pi}}$	`\jvpolicy`	V joint-policy values	
$A^{\boldsymbol{\pi}}$	`\japolicy`	A joint-policy values	
$U^{\boldsymbol{\pi}}$	`\jupolicy`	U joint-policy values	
$B_{\boldsymbol{\pi}}$	`\jbpolicy`	Joint policy Bellman operator	
$B_{\boldsymbol{\mu}}$	`\bpolicy[\joint\mu]`	Joint policy Bellman operator w/ optional argument	

Option [theorem]

Symbol	Command	Description	Example
	\begin{definition}, \end{definition}		
	\begin{assumption}, \end{assumption}		
	\begin{example}, \end{example}		
	\begin{axiom}, \end{axiom}		
	\begin{conjecture}, \end{conjecture}		
	\begin{proposition}, \end{proposition}		
	\begin{lemma}, \end{lemma}		
	\begin{theorem}, \end{theorem}		
	\begin{corollary}, \end{corollary}		
	\begin{generalization}, \end{generalization}		

Option [misc]

Symbol	Command	Description	Example
$\dagger$	\D	Dagger superscript	
(k)	\iter{k}	Superscript indicating iteration	

Option [utils]

Symbol	Command	Description	Example
⬚	\phantomeq	The width of an =, for alignment purposes (bounding box shown)	