abaisero.sty

Andrea Baisero

August 27, 2024

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	$\mathcal{X}^+ \doteq \bigcup_{k=1}^\infty \mathcal{X}^k$
softmax	`\softmax`	a.k.a. logsumexp, realsoftmax[1]	$\operatorname{softmax}(x_1, \ldots, x_n) \doteq \log \sum_i \exp(x_i)$
softmin	`\softmin`		$\operatorname{softmin}(x_1, \ldots, x_n) \doteq -\log \sum_i \exp(-x_i)$
softargmax	`\softargmax`	a.k.a. softmax[1]	$\operatorname{softargmax}(x_1, \ldots, x_n)_i \doteq \frac{\exp(x_i)}{\sum_k \exp(x_k)}$
sign	`\sign`		$x = \operatorname{sign} x \cdot \lvert x \rvert$
supp	`\supp`	support operator	$\operatorname{supp}(f) \doteq \{x \mid f(x) \neq 0\}$

[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 [linalg]

Symbol	Command	Description	Example
diag	`\diag`		
rank	`\rank`		
tr	`\trace`		$\operatorname{tr}(M) \doteq \sum_{i=1}^{n} M_{ii}$
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`		$\operatorname{argmax}_a Q^\pi(s, a)$
argmin	`\argmin`		$\theta^* \doteq \operatorname{argmin}_\theta \mathcal{L}(\theta)$
*	`\opt`	Optimality superscript	$\pi^*(s) = \operatorname{argmax}_a Q^*(s, a)$
stop	`\stopg`	Stop-gradient operator	$\nabla_x \operatorname{stop}\left[f(x)\right] = 0$

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	$\mathbb{E}\left[f(x)\right] = \sum_x \Pr(x) f(x)$
$\mathbb{I}$	`\Ind`	Indicator function	$\Pr(x = 0) = \mathbb{E}\left[\mathbb{I}\left[x = 0\right]\right]$
KL	`\KL`	KL-divergence	$\operatorname{KL}\left(p \mid\mid q\right) \doteq \mathbb{E}_{x \sim p}\left[\log p(x) - \log q(x)\right]$
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	

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	
D	`\dfn`	Dynamics function	
G	`\gfn`	Generative function	
O	`\ofn`	Observation function	
R	`\rfn`	Reward function	
T	`\tfn`	Transition function	
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
$\bar{x}$	`\joint{x}`	Joint formatting (redefinable)	
$\bar{\mathcal{A}}$	`\jaset`	Joint action set	
$\bar{\mathcal{O}}$	`\joset`	Joint observation set	
$\bar{\mathcal{H}}$	`\jhset`	Joint history set	
$\bar{a}$	`\ja`	Joint action	$\bar{a} \in \bar{\mathcal{A}}$
$\bar{o}$	`\jo`	Joint observation	$\bar{o} \in \bar{\mathcal{O}}$
$\bar{h}$	`\jh`	Joint history	$\bar{h} \in \bar{\mathcal{H}}$
$\bar{\pi}$	`\jpolicy`	Joint policy	$\bar{\pi}(\bar{h}, \bar{a}) \doteq \prod_i \pi_i(h_i, a_i)$
$Q^{\bar{\pi}}$	`\jqpolicy`	Q joint-policy values	
$V^{\bar{\pi}}$	`\jvpolicy`	V joint-policy values	
$A^{\bar{\pi}}$	`\japolicy`	A joint-policy values	
$U^{\bar{\pi}}$	`\jupolicy`	U joint-policy values	
$B_{\bar{\pi}}$	`\jbpolicy`	Joint policy Bellman operator	
$B_{\bar{\mu}}$	`\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
†	`\D`	Dagger superscript	
$^{(k)}$	`\iter{k}`	Superscript indicating iteration	

Option [utils]

Symbol	Command	Description	Example
$\boxed{}$	`\phantomeq`	The width of an =, for alignment purposes (bounding box shown)	