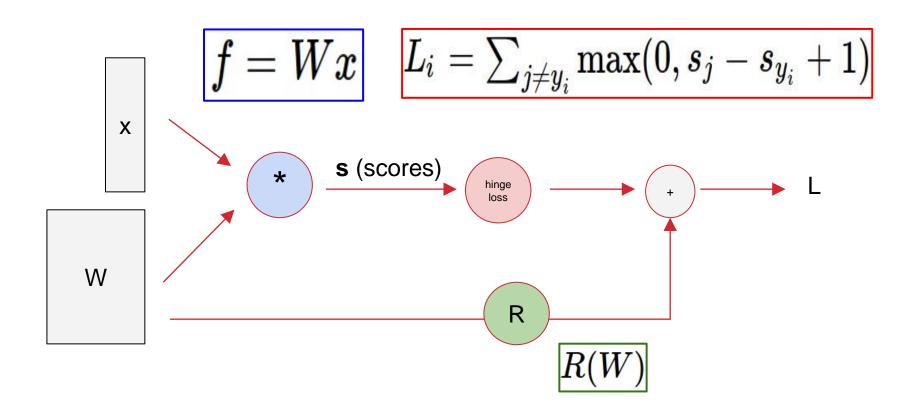
#### Redes Neurais e Deep Learning

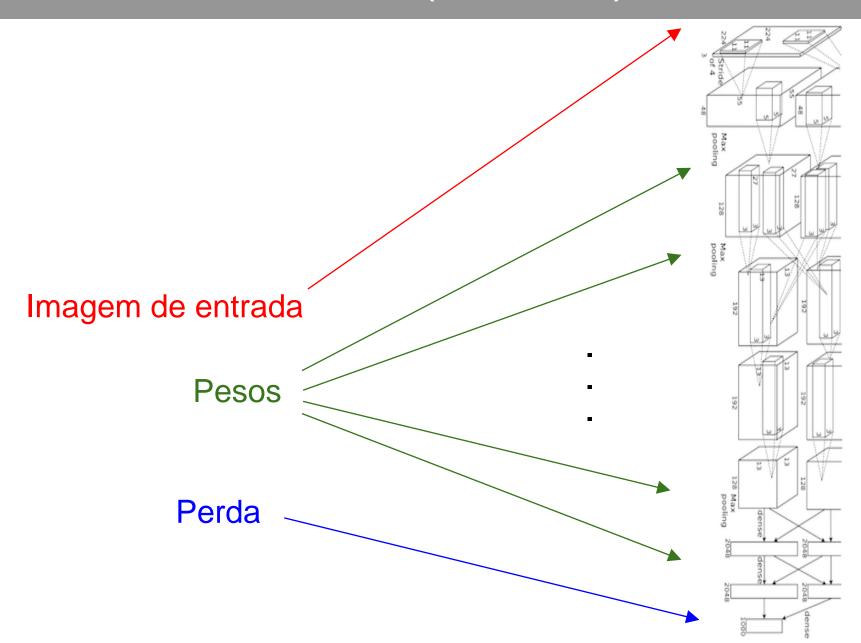
# PROPAGAÇÃO RETRÓGRADA

Zenilton K. G. Patrocínio Jr zenilton@pucminas.br

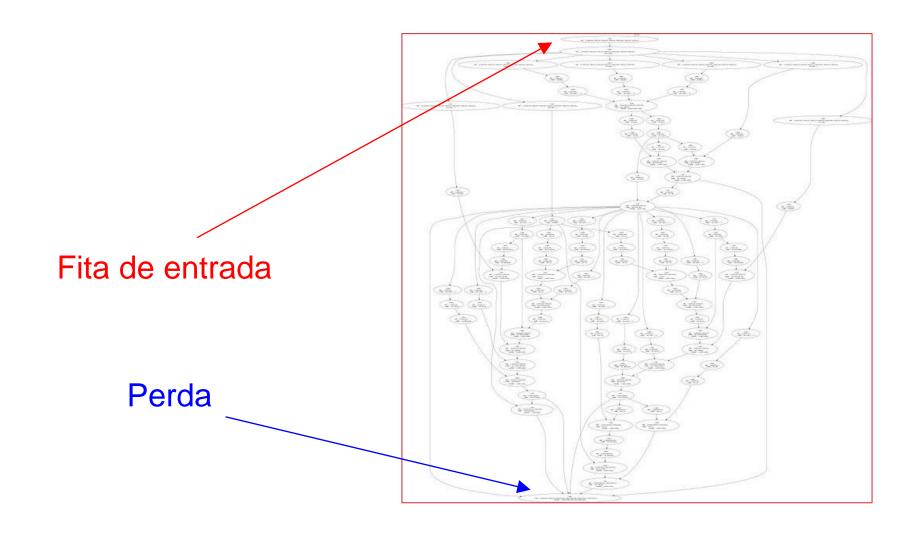
#### Grafo de Computação da Função de Perda



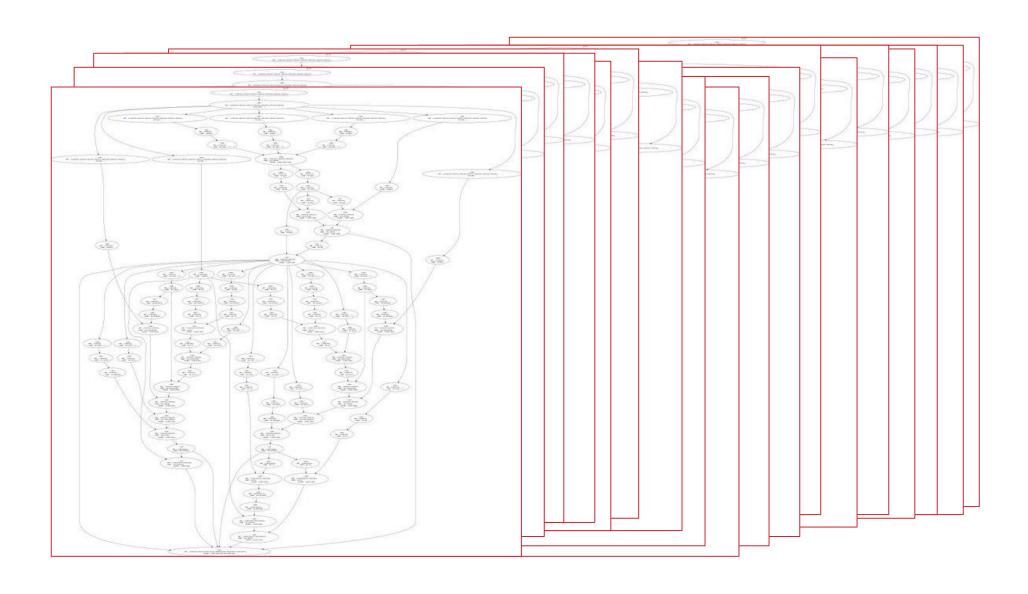
# Rede Convolucional (AlexNet)



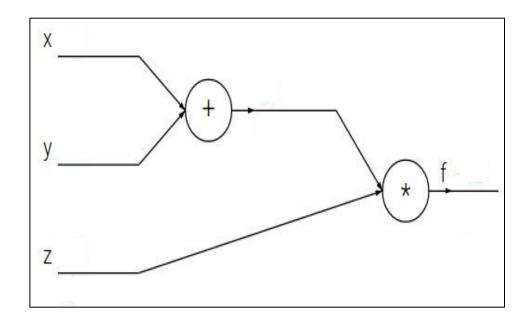
### Máquina Neural de Turing



### Neural Turing Machine



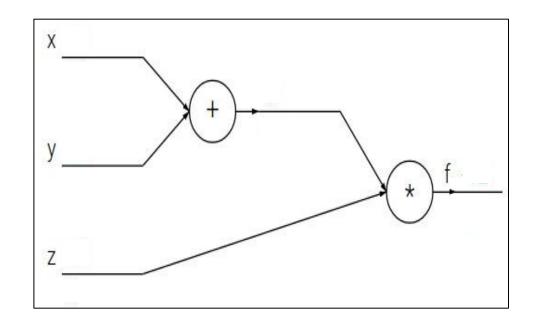
Seja 
$$f(x, y, z) = (x + y) \times z$$



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Então, pode-se dizer que

$$f(x, y, z) = g(h(x, y), z)$$

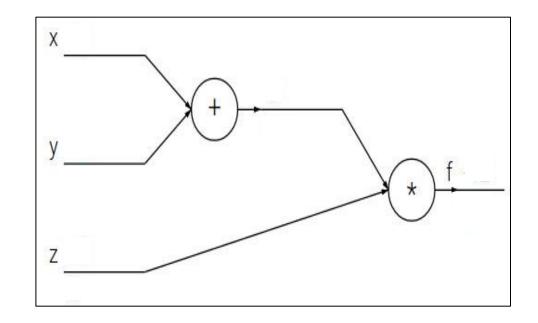


Seja 
$$f(x, y, z) = (x + y) \times z$$

Então, pode-se dizer que

$$f(x, y, z) = g(h(x, y), z)$$

em h(x,y) = x + y

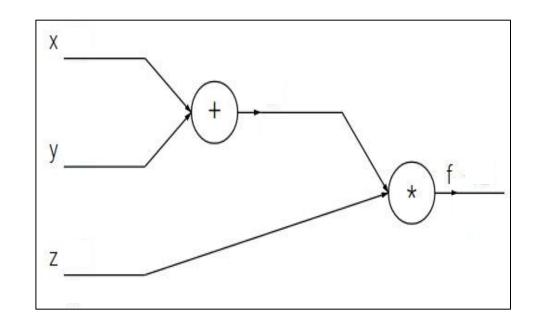


Seja 
$$f(x, y, z) = (x + y) \times z$$

Então, pode-se dizer que

$$f(x, y, z) = g(h(x, y), z)$$

em h(x,y) = x + y e  $g(a,b) = a \times b$ 



Seja 
$$f(x, y, z) = (x + y) \times z$$

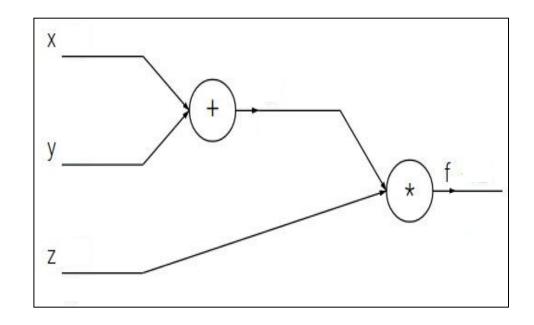
Então, pode-se dizer que

$$f(x, y, z) = g(h(x, y), z)$$

em 
$$h(x,y) = x + y$$
 e  $g(a,b) = a \times b$ 

Pela regra da cadeia, sabe-se que

$$\frac{df}{dx} = \frac{dg}{dh} \times \frac{dh}{dx}$$



Seja 
$$f(x, y, z) = (x + y) \times z$$

Então, pode-se dizer que

$$f(x, y, z) = g(h(x, y), z)$$

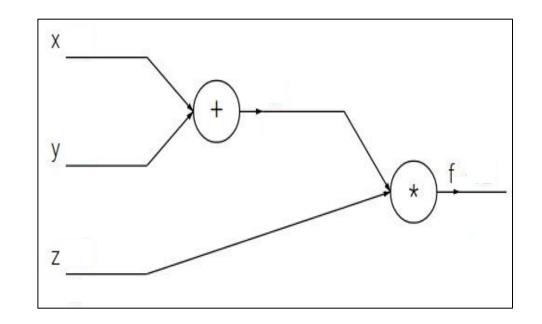
em 
$$h(x,y) = x + y$$
 e  $g(a,b) = a \times b$ 

Pela regra da cadeia, sabe-se que

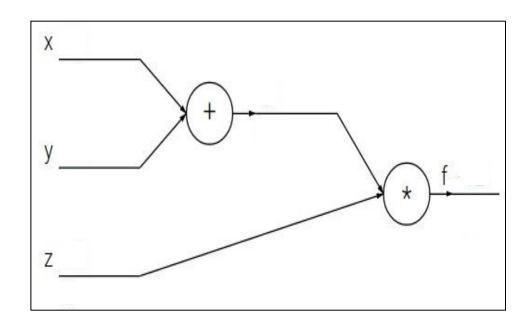
$$\frac{df}{dx} = \frac{dg}{dh} \times \frac{dh}{dx}$$

е

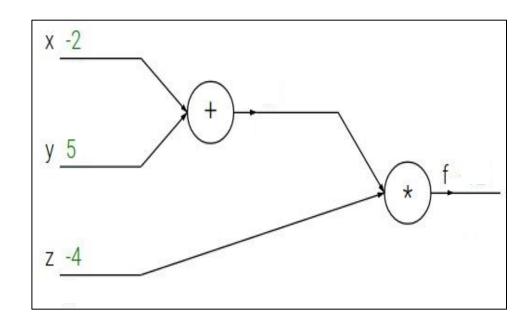
$$\frac{df}{dy} = \frac{dg}{dh} \times \frac{dh}{dy}$$



Seja 
$$f(x, y, z) = (x + y) \times z$$

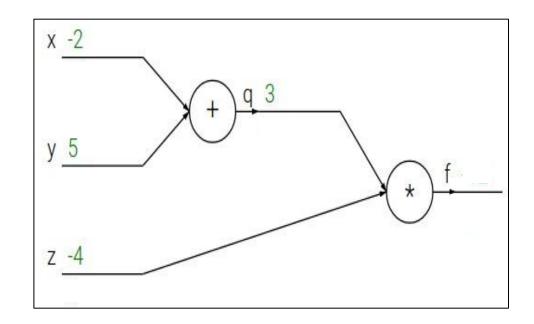


Seja 
$$f(x, y, z) = (x + y) \times z$$



Seja 
$$f(x, y, z) = (x + y) \times z$$

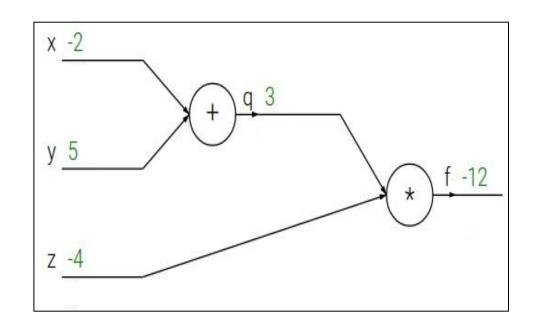
$$q = x + y$$



Seja 
$$f(x, y, z) = (x + y) \times z$$

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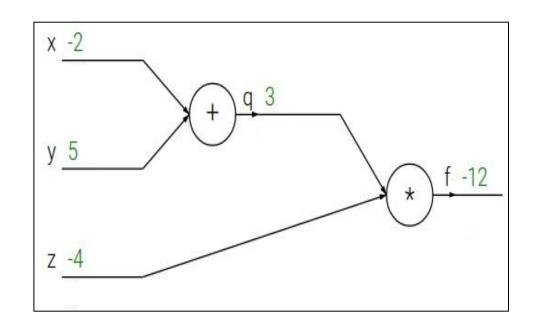
$$f = qz$$



Seja 
$$f(x, y, z) = (x + y) \times z$$

$$q=x+y \qquad rac{\partial q}{\partial x}=1, rac{\partial q}{\partial y}=1$$

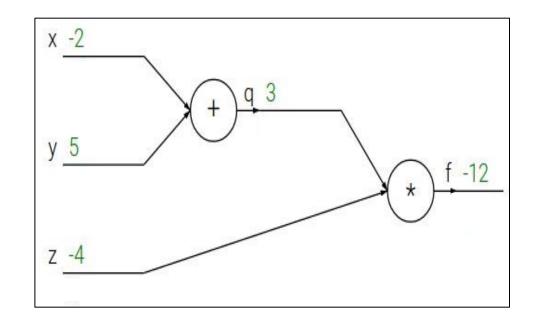
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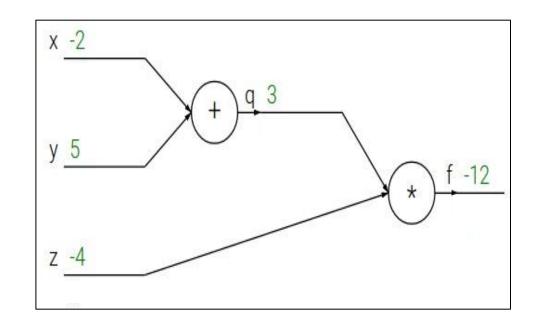


Seja 
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Por exemplo: x = -2, y = 5, z = -4

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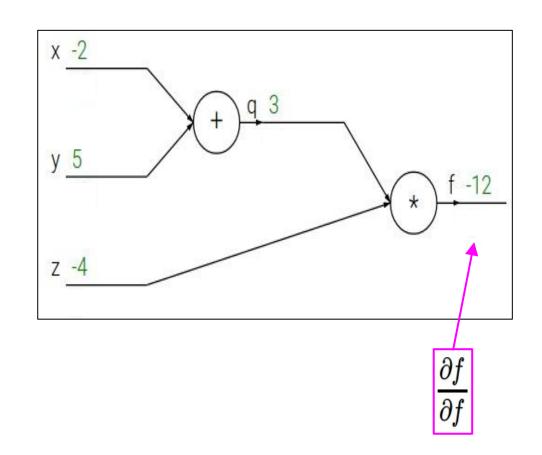


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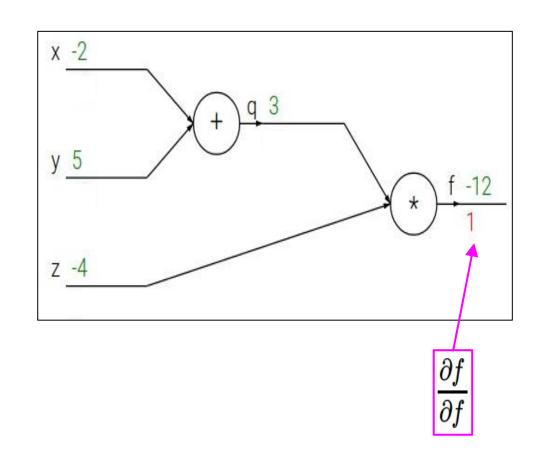


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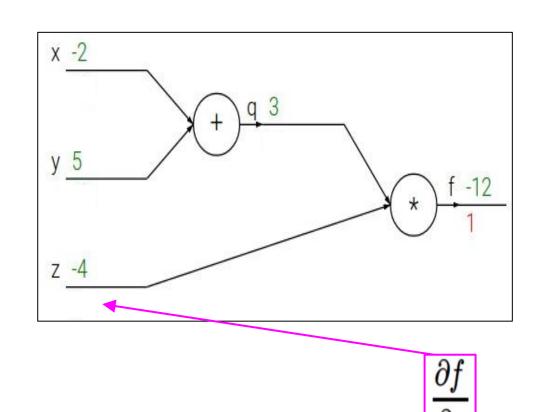


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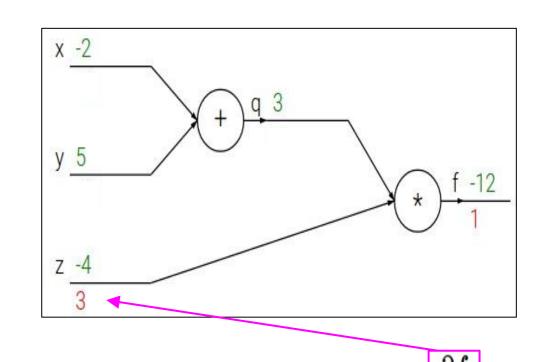


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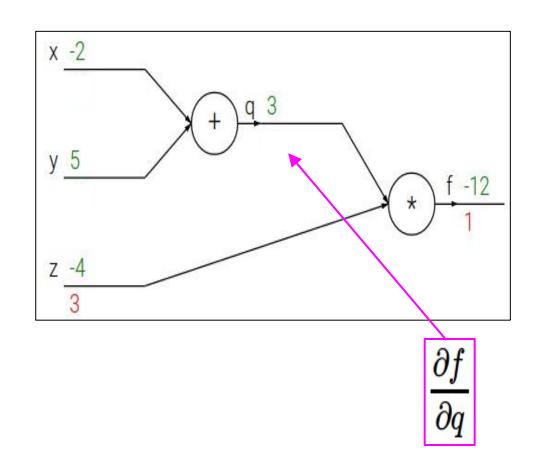


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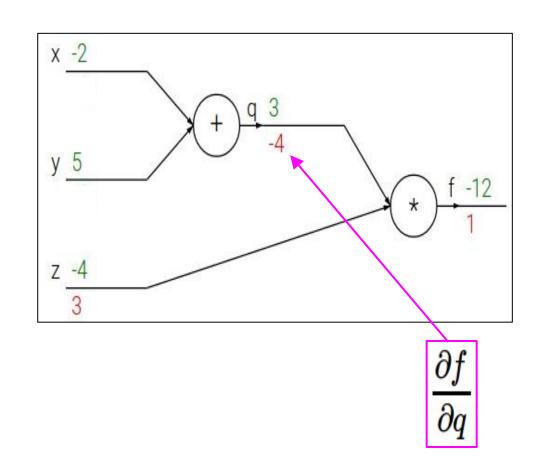


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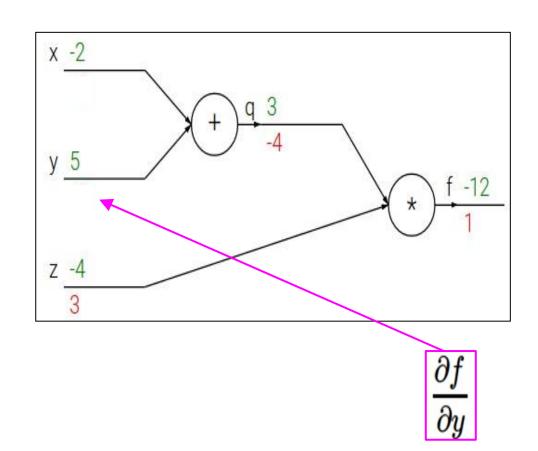


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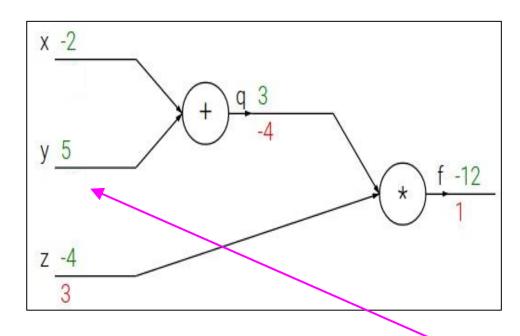
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Deseja-se:  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ ,  $\frac{\partial f}{\partial z}$ 



$$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial q} \frac{\partial q}{\partial y}$$



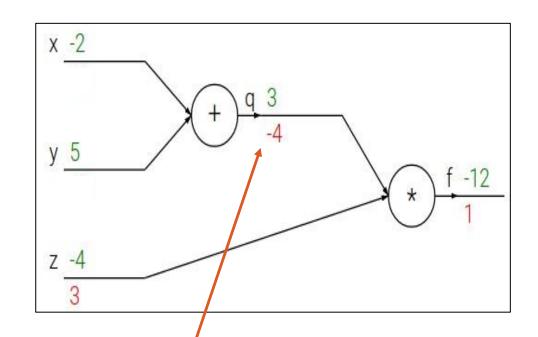
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$$\frac{\partial f}{\partial y} = \left(\frac{\partial f}{\partial q}\right) \frac{\partial q}{\partial y}$$

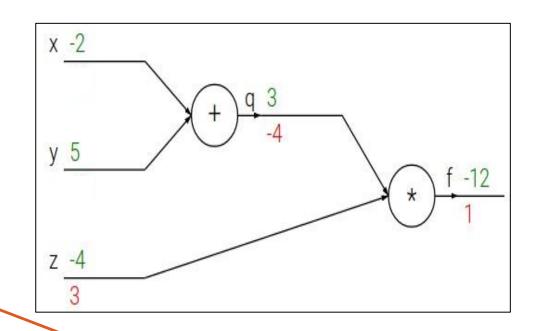
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$$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial q} \left( \frac{\partial q}{\partial y} \right)$$

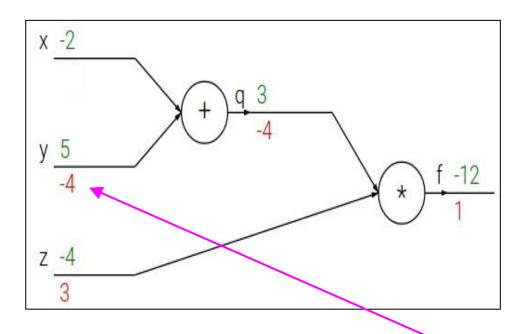
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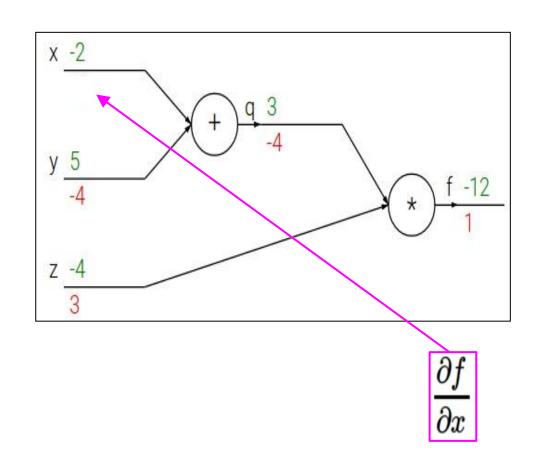


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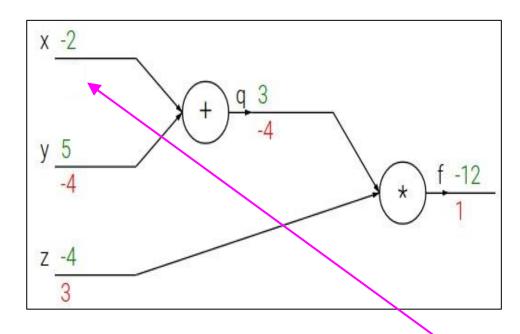
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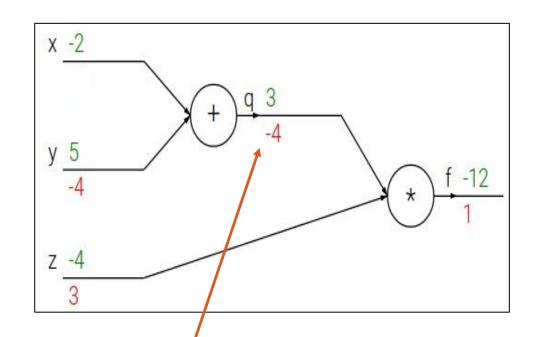
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Deseja-se:  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ ,  $\frac{\partial f}{\partial z}$ 



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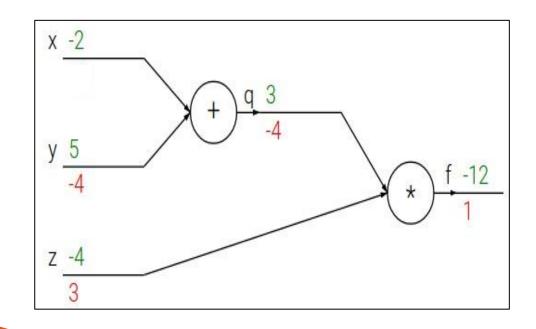
Seja 
$$f(x, y, z) = (x + y) \times z$$

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Deseja-se:  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ ,  $\frac{\partial f}{\partial z}$ 



$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial q} \left( \frac{\partial q}{\partial x} \right)$$

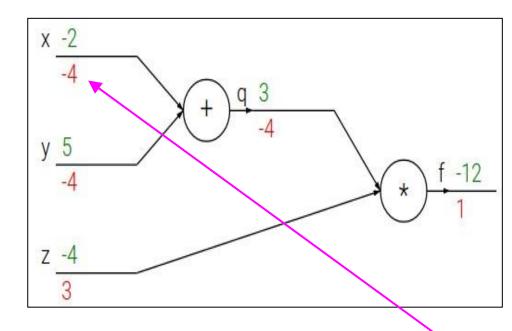
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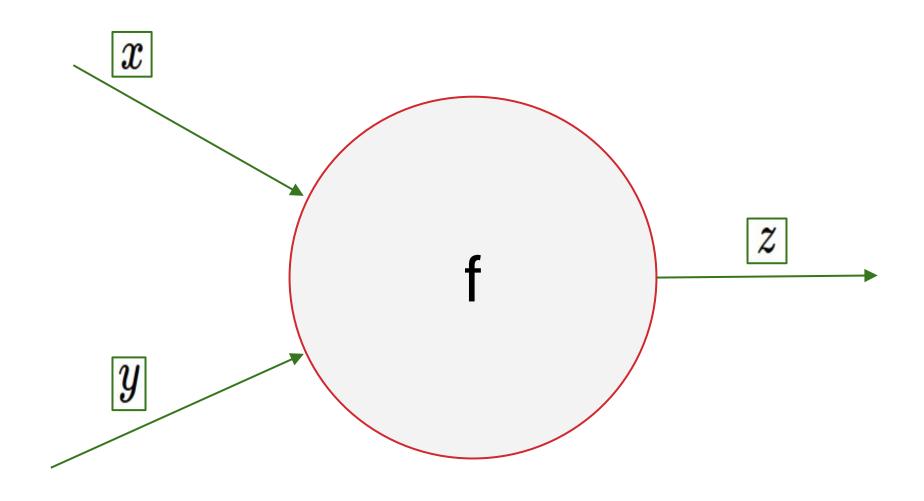
Deseja-se:  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ ,  $\frac{\partial f}{\partial z}$ 



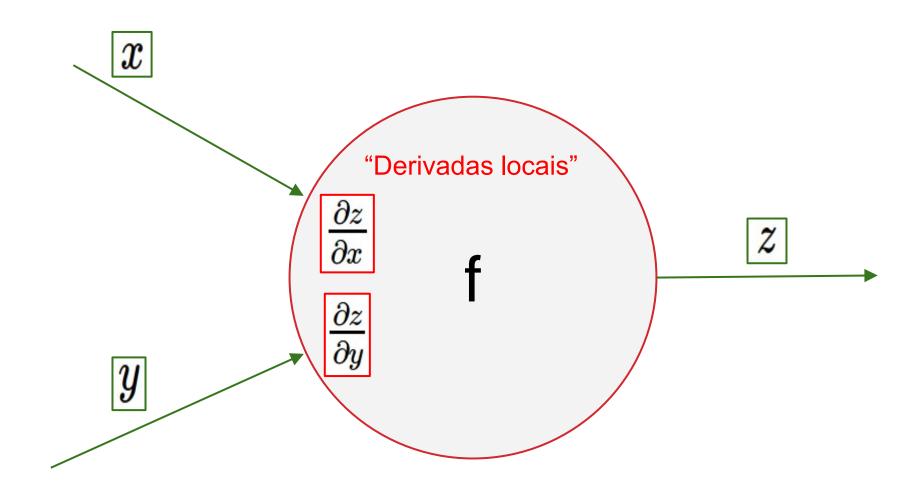
$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial q} \frac{\partial q}{\partial x}$$

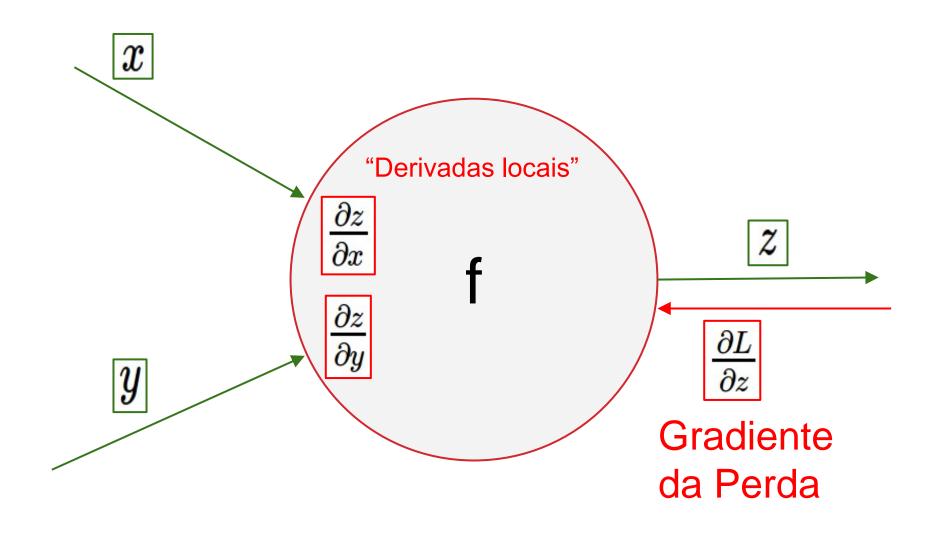


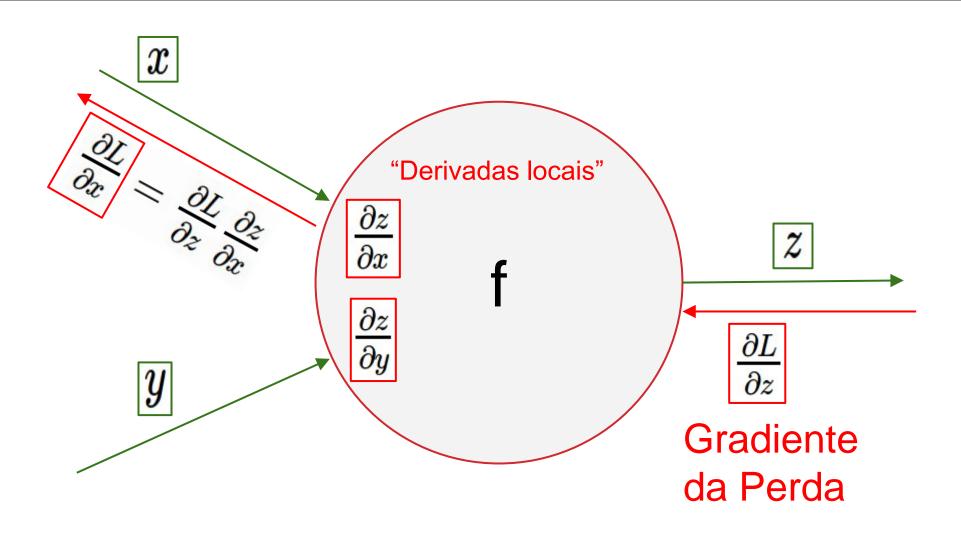
# Passo Retrógrado (Backward Pass)

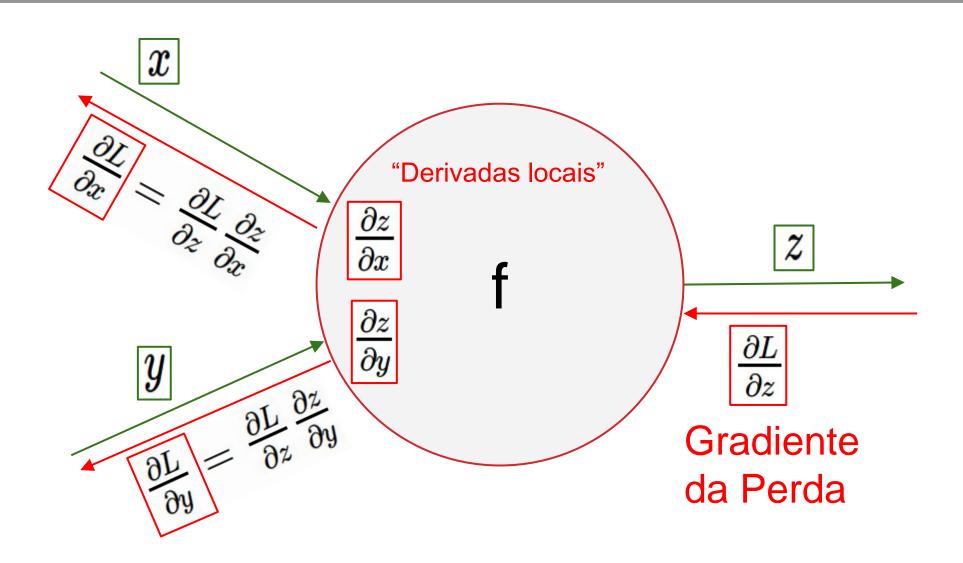


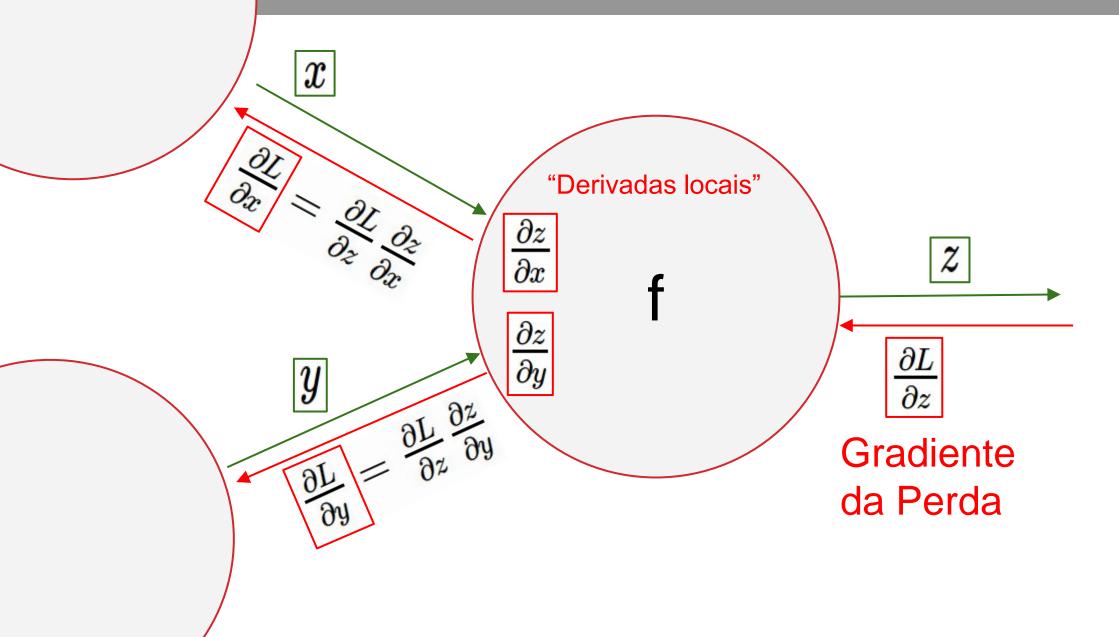
## Passo Retrógrado (Backward Pass)

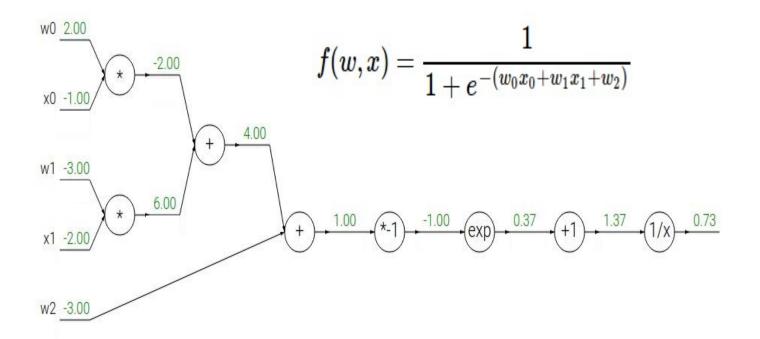


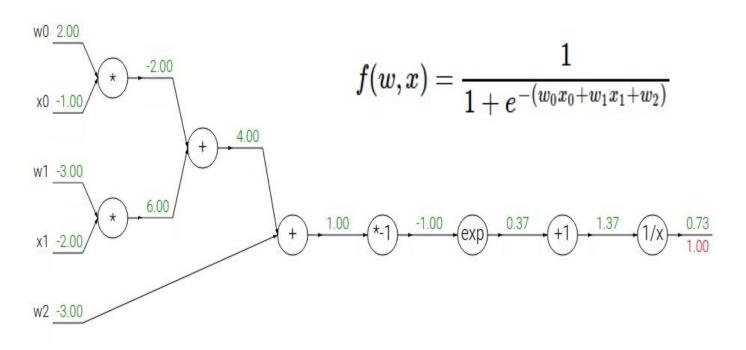




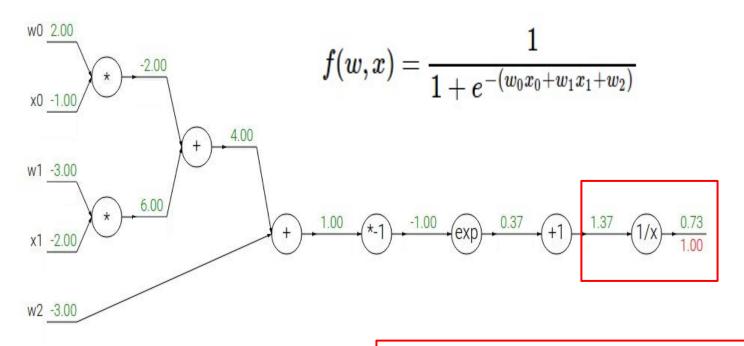






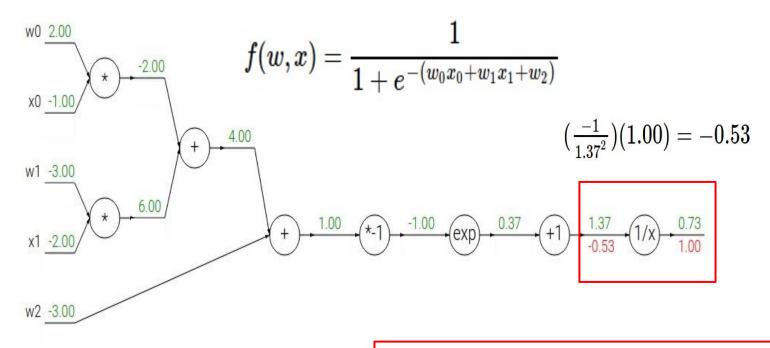


$$f(x) = e^x \qquad o \qquad rac{df}{dx} = e^x \qquad f(x) = rac{1}{x} \qquad o \qquad rac{df}{dx} = -1/x^2 \ f_a(x) = ax \qquad o \qquad rac{df}{dx} = a \qquad f_c(x) = c + x \qquad o \qquad rac{df}{dx} = 1$$



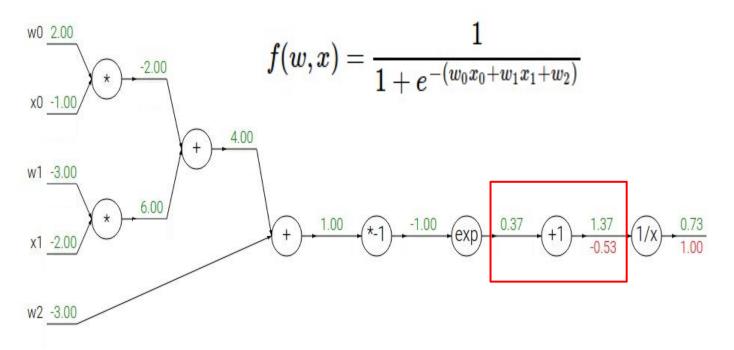
$$f(x)=e^x \qquad \qquad o \qquad \qquad rac{df}{dx}=e^x \ f_a(x)=ax \qquad \qquad o \qquad \qquad rac{df}{dx}=a$$

$$f(x)=rac{1}{x} \qquad \qquad 
ightarrow \qquad rac{df}{dx}=-1/x^2 \ f_c(x)=c+x \qquad \qquad 
ightarrow \qquad rac{df}{dx}=1$$

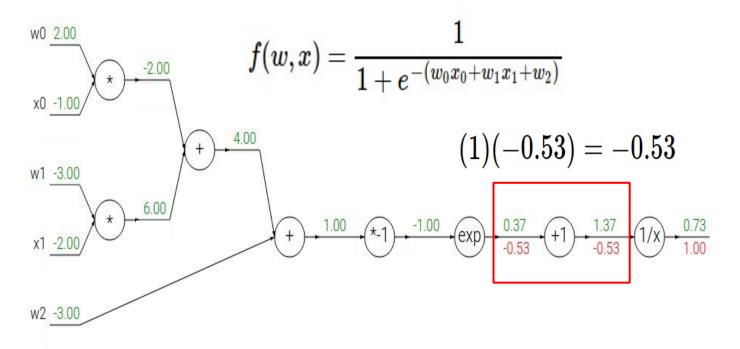


$$f(x) = e^x \qquad o \qquad rac{df}{dx} = e^x \ f_a(x) = ax \qquad o \qquad rac{df}{dx} = a$$

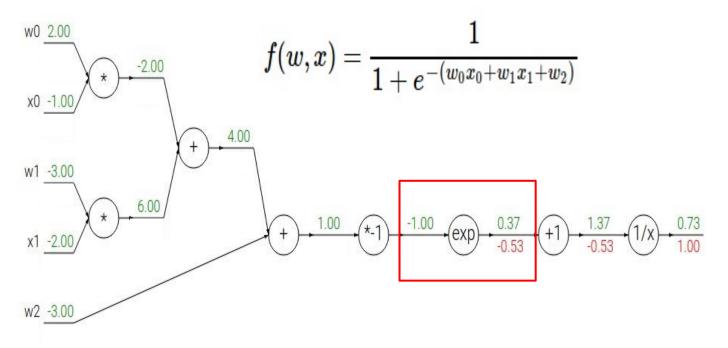
$$f(x)=rac{1}{x} \qquad \qquad \qquad \qquad rac{df}{dx}=-1/x^2 \ f_c(x)=c+x \qquad \qquad \qquad \qquad \qquad rac{df}{dx}=1$$



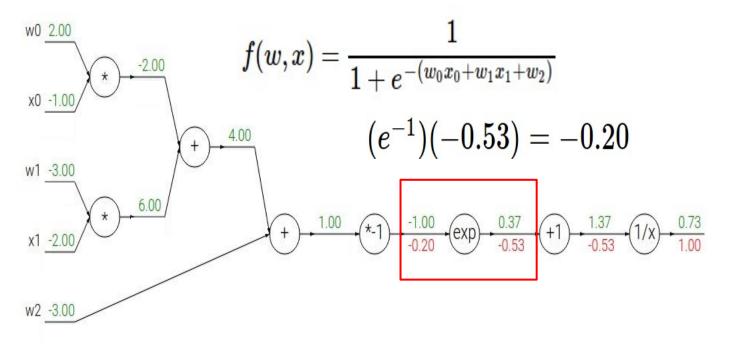
$$f(x) = e^x$$
  $o$   $\dfrac{df}{dx} = e^x$   $f(x) = \dfrac{1}{x}$   $o$   $\dfrac{df}{dx} = -1/x^2$   $f_a(x) = ax$   $o$   $\dfrac{df}{dx} = a$   $f_c(x) = c + x$   $o$   $\dfrac{df}{dx} = 1$ 



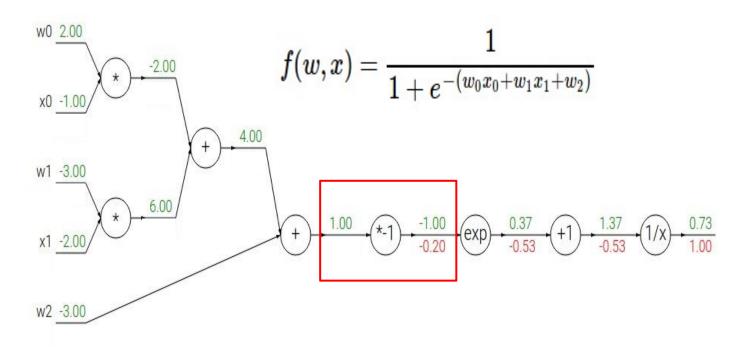
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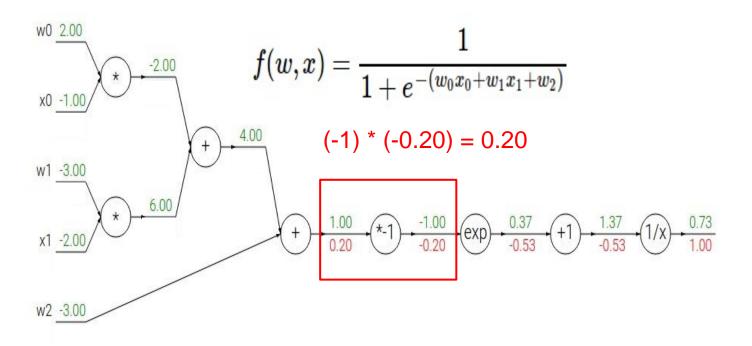


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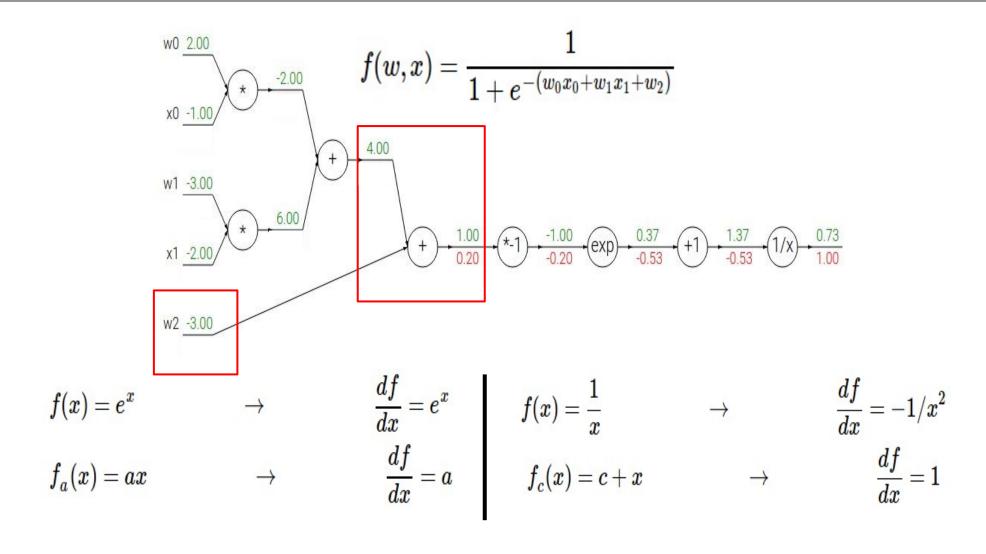
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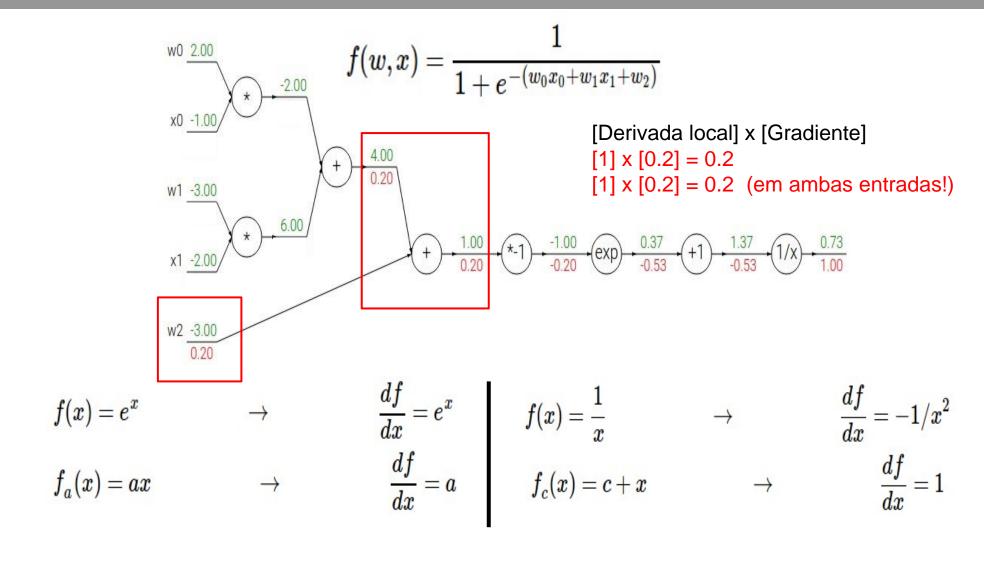
$$egin{aligned} rac{df}{dx} = e^x \ rac{df}{dx} = a \end{aligned} \hspace{1cm} f(x) = rac{1}{x} \qquad 
ightarrow \qquad rac{df}{dx} = -1/x^2 \ f_c(x) = c + x \qquad 
ightarrow \qquad rac{df}{dx} = 1 \end{aligned}$$

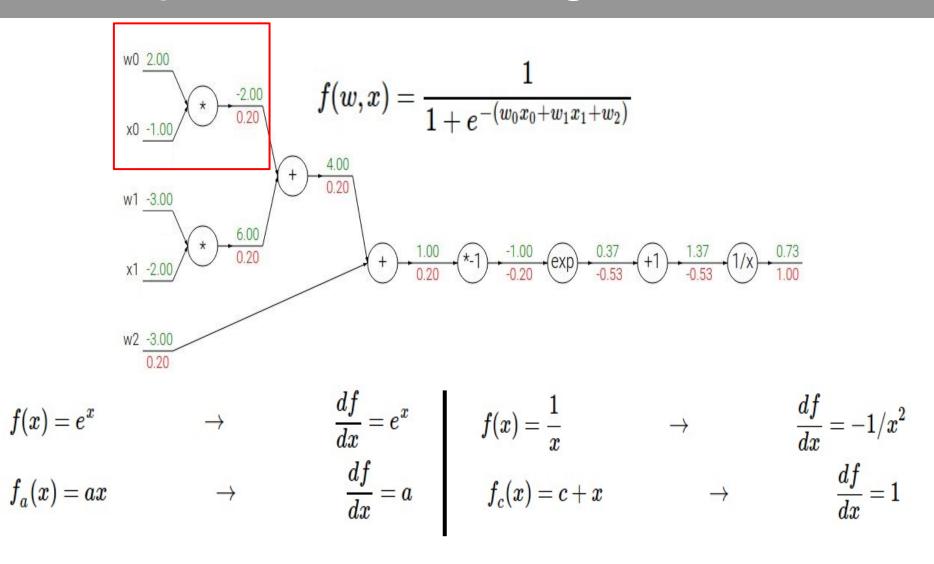


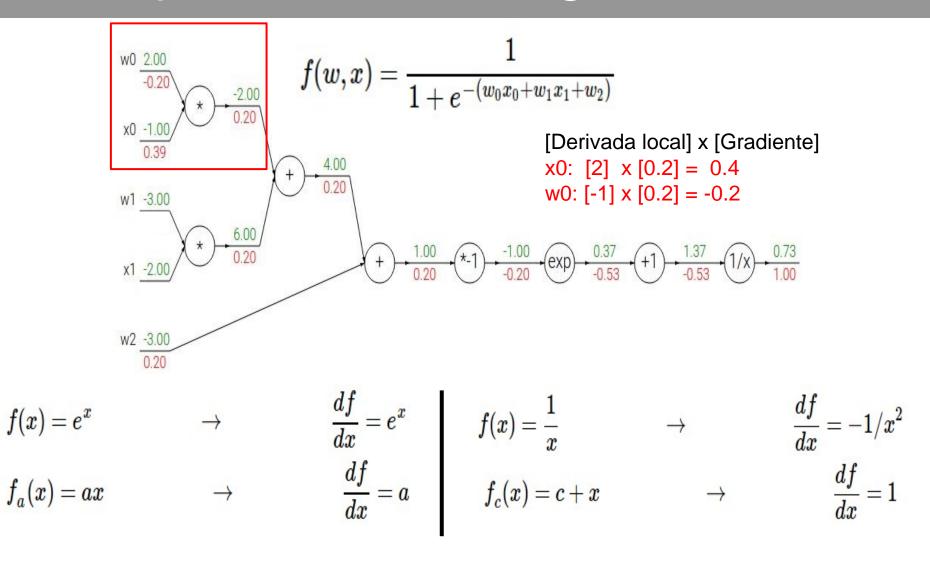
$$f(x) = e^x \qquad o \qquad rac{df}{dx} = e^x \ f_a(x) = ax \qquad o \qquad rac{df}{dx} = a$$

$$egin{aligned} rac{df}{dx} = e^x \ rac{df}{dx} = a \end{aligned} \hspace{1cm} f(x) = rac{1}{x} \qquad 
ightarrow \qquad rac{df}{dx} = -1/x^2 \ f_c(x) = c + x \qquad 
ightarrow \qquad rac{df}{dx} = 1 \end{aligned}$$









$$f(w,x)=rac{1}{1+e^{-(w_0x_0+w_1x_1+w_2)}}$$
  $\sigma(x)=rac{1}{1+e^{-x}}$  Função sigmoide

$$\sigma(x) = rac{1}{1+e^{-x}}$$

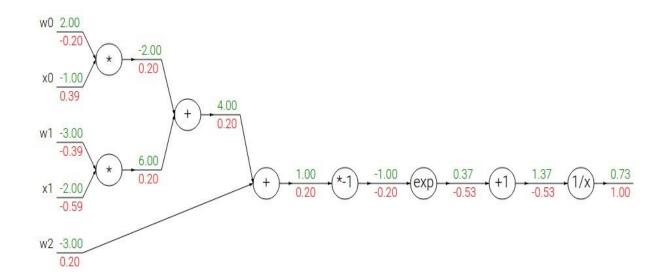
$$\frac{d\sigma(x)}{dx} = \frac{e^{-x}}{(1+e^{-x})^2} = \left(\frac{1+e^{-x}-1}{1+e^{-x}}\right) \left(\frac{1}{1+e^{-x}}\right) = (1-\sigma(x))\sigma(x)$$

$$f(w,x) = rac{1}{1 + e^{-(w_0 x_0 + w_1 x_1 + w_2)}} \qquad \qquad \sigma(x) = rac{1}{1 + e^{-x}}$$

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

Função sigmoide

$$\frac{d\sigma(x)}{dx} = \frac{e^{-x}}{(1+e^{-x})^2} = \left(\frac{1+e^{-x}-1}{1+e^{-x}}\right) \left(\frac{1}{1+e^{-x}}\right) = (1-\sigma(x))\sigma(x)$$

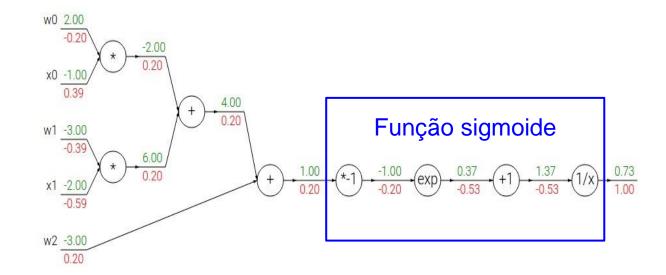


$$f(w,x) = rac{1}{1 + e^{-(w_0 x_0 + w_1 x_1 + w_2)}} \qquad \qquad \sigma(x) = rac{1}{1 + e^{-x}}$$

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Função sigmoide

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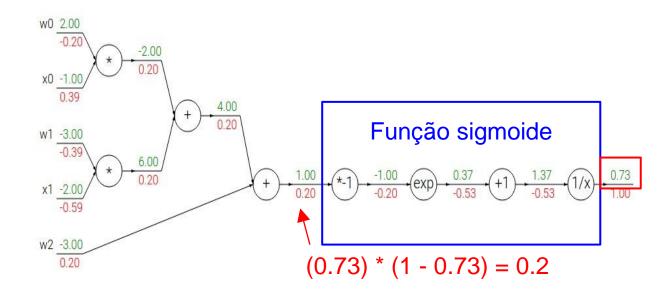


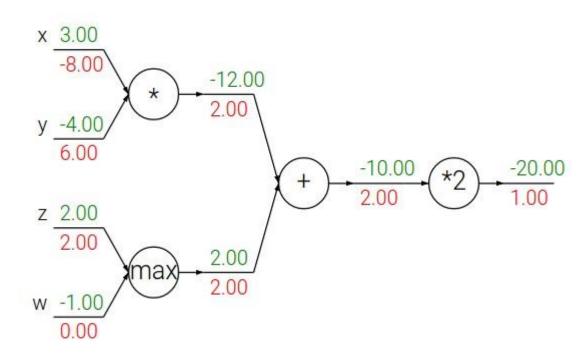
$$f(w,x) = rac{1}{1 + e^{-(w_0 x_0 + w_1 x_1 + w_2)}} \hspace{1cm} \sigma(x) = rac{1}{1 + e^{-x}}$$

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

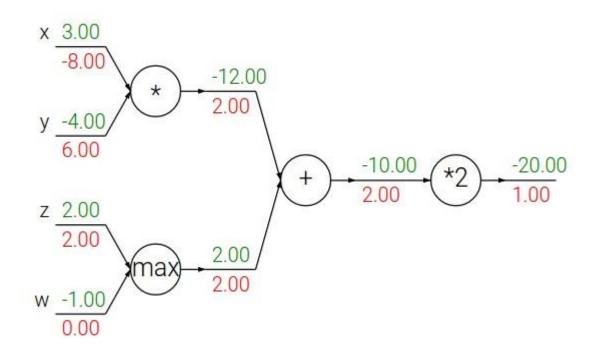
Função sigmoide

$$\frac{d\sigma(x)}{dx} = \frac{e^{-x}}{(1+e^{-x})^2} = \left(\frac{1+e^{-x}-1}{1+e^{-x}}\right) \left(\frac{1}{1+e^{-x}}\right) = (1-\sigma(x))\sigma(x)$$

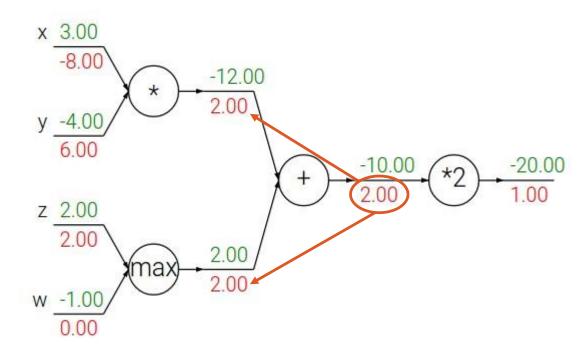




Adição: distribuidor de gradiente

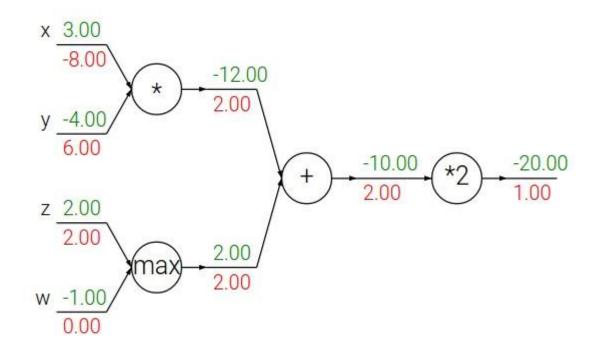


Adição: distribuidor de gradiente



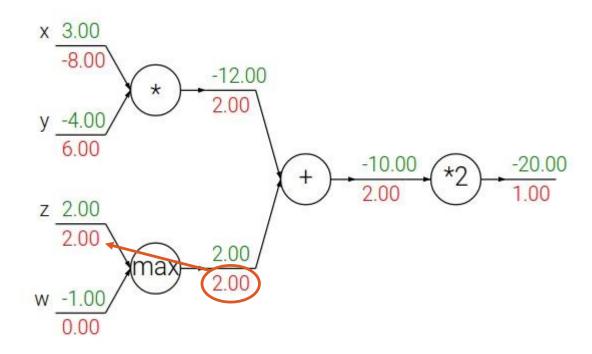
Adição: distribuidor de gradiente

**Max** : direcionador de gradiente



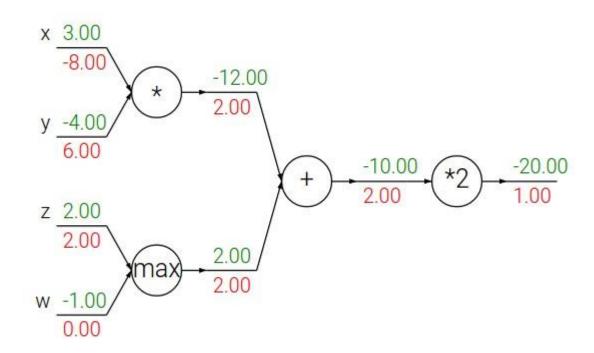
Adição: distribuidor de gradiente

**Max** : direcionador de gradiente



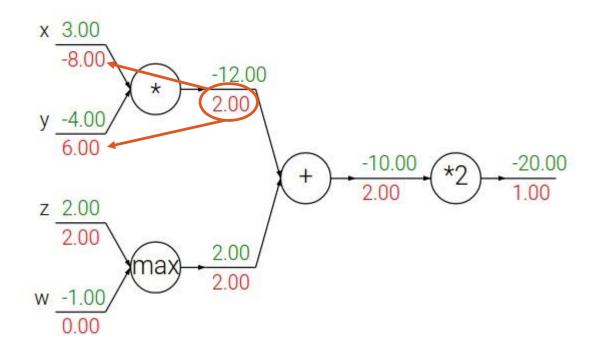
Adição: distribuidor de gradiente

**Max** : direcionador de gradiente



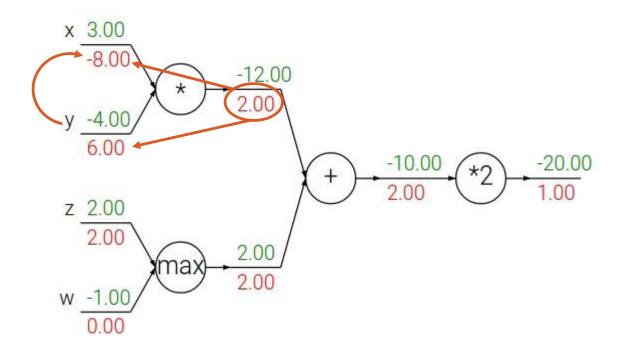
Adição: distribuidor de gradiente

Max : direcionador de gradiente



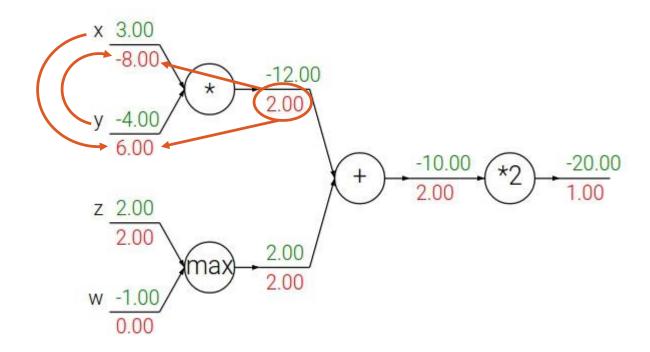
Adição: distribuidor de gradiente

Max : direcionador de gradiente

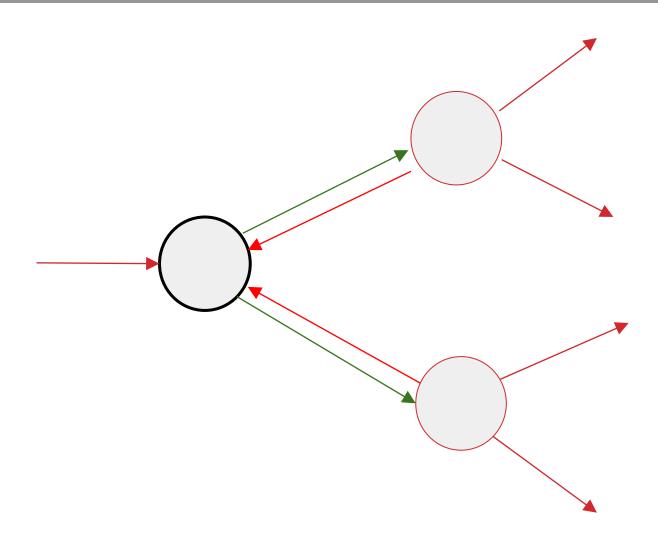


Adição: distribuidor de gradiente

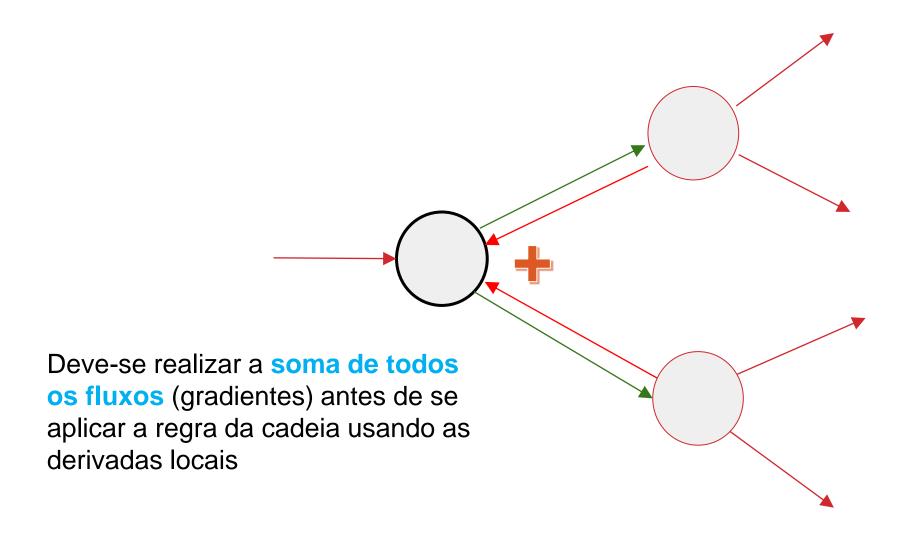
Max : direcionador de gradiente



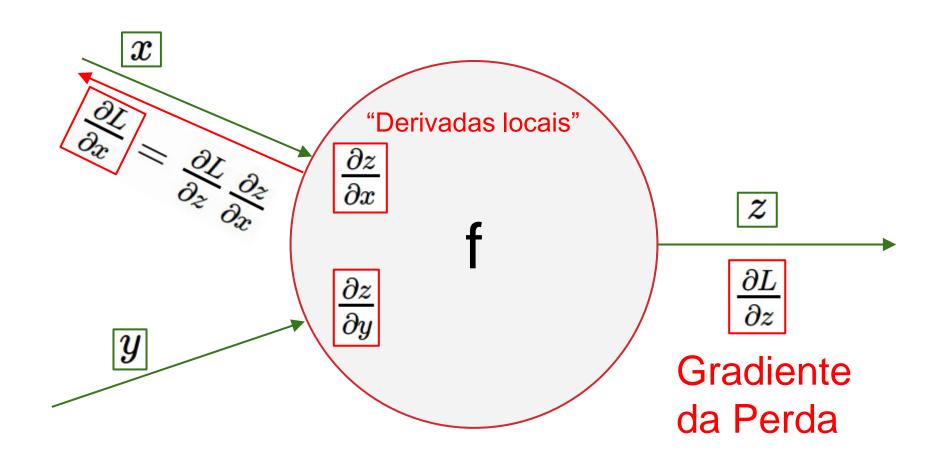
# Gradientes nas Ramificações



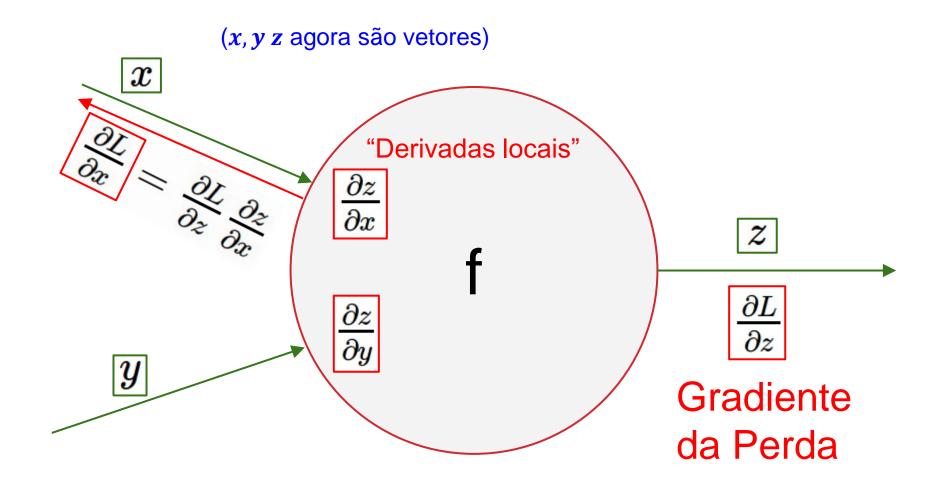
#### Gradientes nas Ramificações



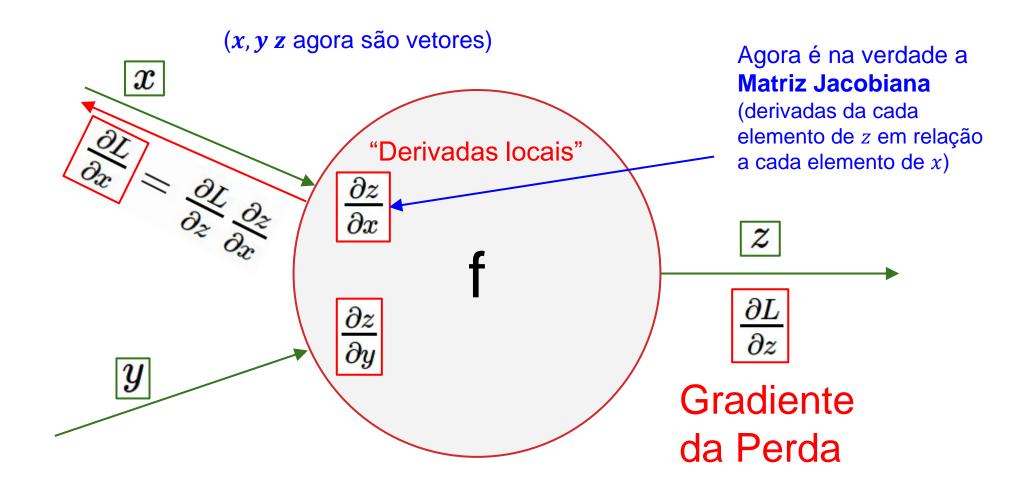
#### Gradientes para Dados Multidimensionais

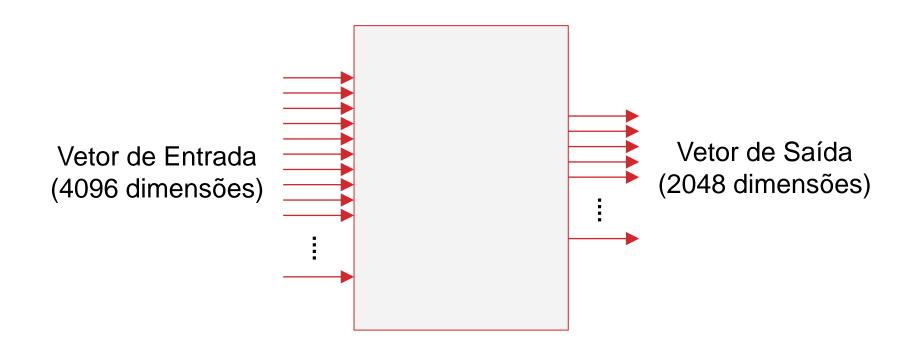


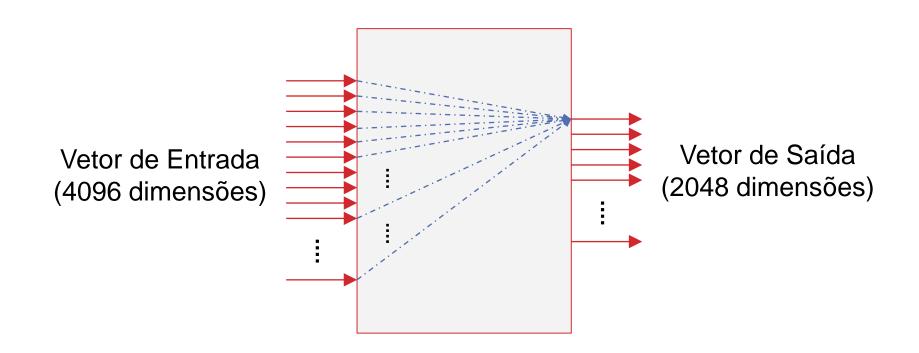
#### Gradientes para Dados Multidimensionais

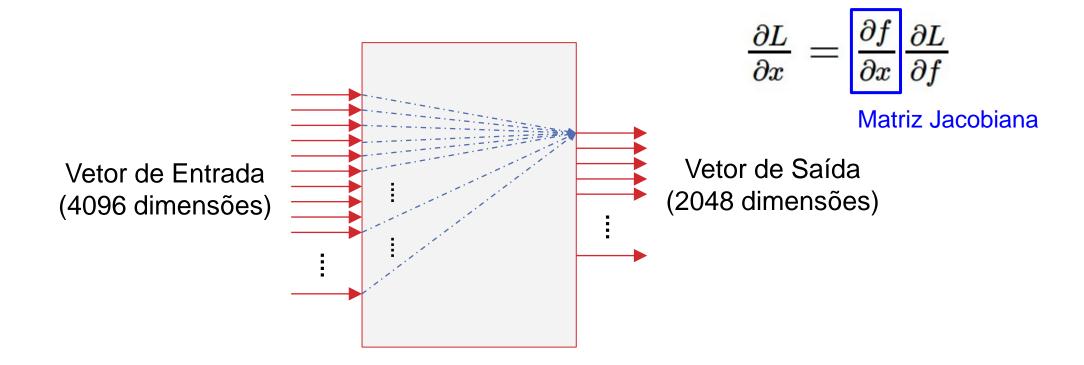


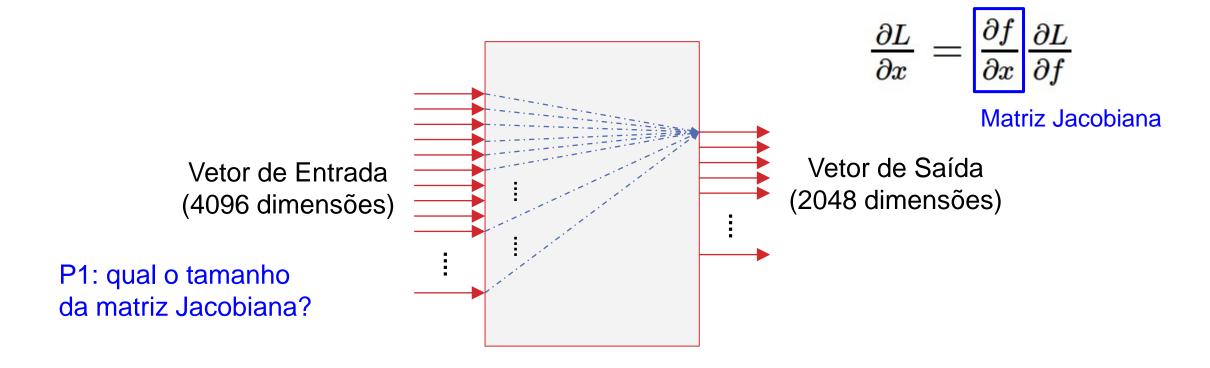
#### Gradientes para Dados Multidimensionais

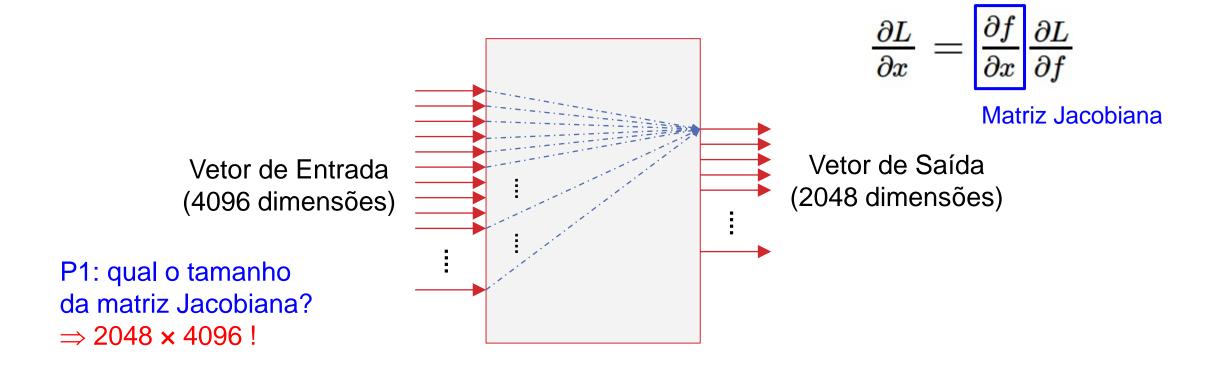


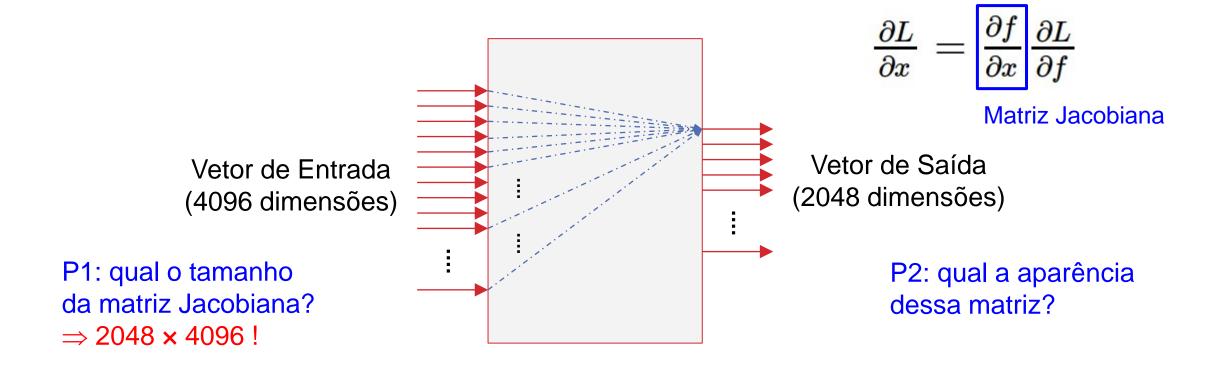


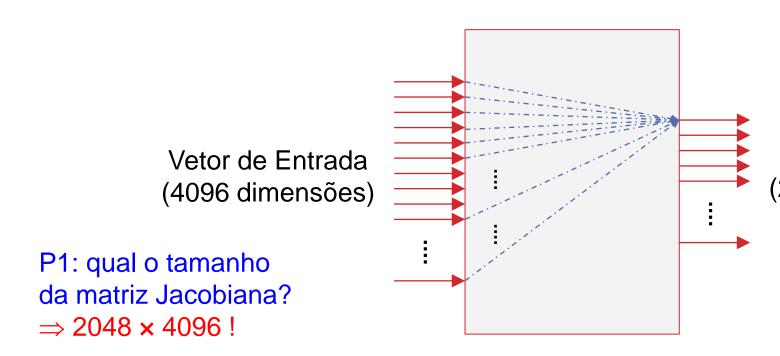












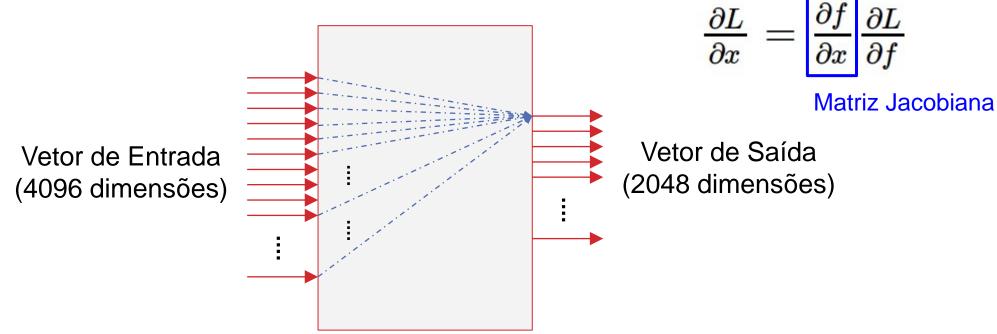
$$\frac{\partial L}{\partial x} = \frac{\partial f}{\partial x} \frac{\partial L}{\partial f}$$

Matriz Jacobiana

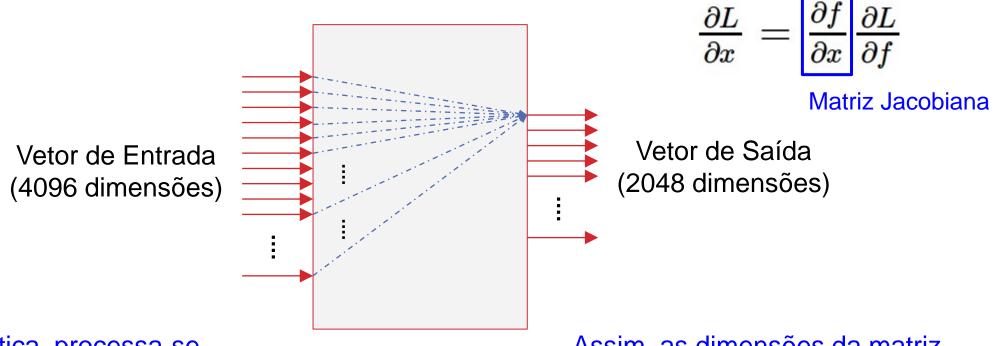
Vetor de Saída (2048 dimensões)

P2: qual a aparência dessa matriz?

$$\begin{bmatrix}
\frac{\partial f_1}{\partial x_1} & \frac{\partial f_1}{\partial x_2} & \cdots & \frac{\partial f_1}{\partial x_m} \\
\frac{\partial f_2}{\partial x_1} & \frac{\partial f_2}{\partial x_2} & \cdots & \frac{\partial f_2}{\partial x_m} \\
\vdots & \vdots & \ddots & \vdots \\
\frac{\partial f_k}{\partial x_1} & \frac{\partial f_k}{\partial x_2} & \cdots & \frac{\partial f_k}{\partial x_m}
\end{bmatrix}$$



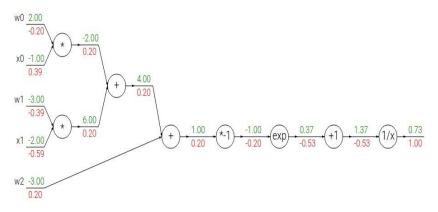
Na prática, processa-se todo um lote ou "*minibatch*" (p.ex. 100 amostras) de uma só vez



Na prática, processa-se todo um lote ou "*minibatch*" (p.ex. 100 amostras) de uma só vez Assim, as dimensões da matriz Jacobiana desse exemplo seriam

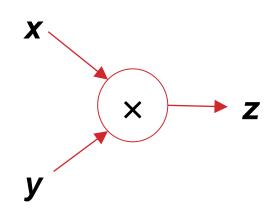
 $2.048 \times 4.096 \times 100$ 

≈ 839 milhões de pesos :(

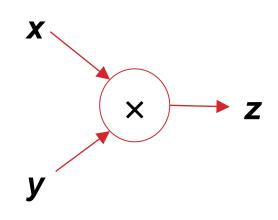


#### Para um grafo ou rede (pseudocódigo)

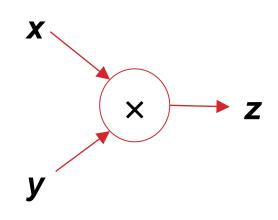
```
class ComputationalGraph(object):
    def forward(inputs):
       # 1. [pass inputs to input gates...]
       # 2. forward the computational graph:
        for gate in self.graph.nodes topologically sorted():
           gate.forward()
        return loss # the final gate in the graph outputs the loss
    def backward():
        for gate in reversed(self.graph.nodes_topologically_sorted()):
           gate.backward() # little piece of backprop (chain rule applied)
        return inputs gradients
```

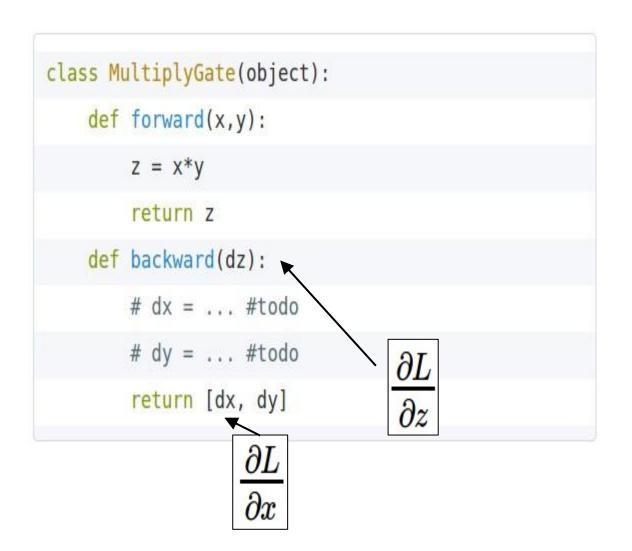


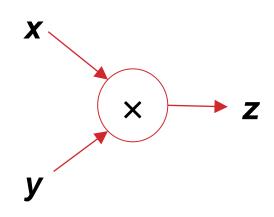
```
class MultiplyGate(object):
    def forward(x,y):
        z = x*y
        return z
    def backward(dz):
        \# dx = \dots \#todo
        # dy = ... #todo
        return [dx, dy]
```



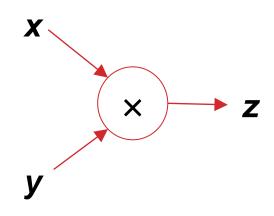
```
class MultiplyGate(object):
    def forward(x,y):
        z = x*y
        return z
    def backward(dz):
        \# dx = \dots \#todo
        \# dy = \dots \#todo
        return [dx, dy]
```







```
class MultiplyGate(object):
    def forward(x,y):
       z = x*y
       self.x = x # must keep these around!
       self.y = y
       return z
    def backward(dz):
       dx = self.y * dz # [dz/dx * dL/dz]
       dy = self.x * dz # [dz/dy * dL/dz]
       return [dx, dy]
```



```
class MultiplyGate(object):
    def forward(x,y):
       z = x*y
       self.x = x # must keep these around!
       self.y = y
       return z
    def backward(dz):
       dx = self.y * dz # [dz/dx * dL/dz]
       dy = self.x * dz # [dz/dy * dL/dz]
       return [dx, dy]
```

# Biblioteca de Componentes / Camadas

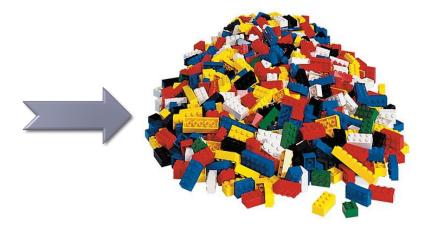
	∏ Pull requests tis ⊞ Wiki + Pulse	in Graphs		
io description or website provided.				
@ 1,039 commits	₽7 branches	○ © releases	∯ 86 contributors	
Franch master - New pull	Now tie   F	ind file HTTPS - https://githu	sb.com/torch 😩 Download	
soumith Marga pull request t	565 from turch/reverl-563-master 📨		Latest commit 23dd17d 15 hours	
E doc	Fix batch mode in MarginRankingCriterion		4 days :	
generic	Improve error message in Spatial Convolution MM		a day i	
810	THNN: add missing OpenMP include		2 days	
E rocks	Add fusffi dependency		14 days i	
gitgrare	tell git to ignore build output		4 months :	
hachedirc	[Torch] Move test (us to the top level		a year	
travis ymi	small fixes for test path		2 months i	
Abs.lua	Add THNN conversion of (ELU, LeakyReLU, Log	Sigmoid, LogSofMax, Looks	7 days i	
AbsCriterion.lus	Add THNN conversion of (ELU, LeskyReLU, Logi	Sigmoid, LogSofMax, Looku	7 days i	
Additus	fix Add with multi-dim bias		10 months :	
AddConstant.lus	Adding in-place AddConstant and WulConstant		9 months i	
BCECriterion lus	Remove unnecessary mallocs from BCEOriterion		3 months	
BalchNormalization lua	fix batchnorm reset		3 months i	
CAddTable lua	fixing table modules to return correct number of g	radirputs	6 months	
CDvTable lux	fising table modules to return correct number of g	radirputs	6 months i	
CMakeLists.trt	Add C implementation of SpatialBalchNormalizati	on	7 days :	
CMUlus	m. Module preserve type sharing semantics (#16)	T); add m Module apply	4 months i	
CWulTable lus	fixing table modules to return correct number of g		6 months	
CONTRIBUTING	added developing figs		3 months i	
COPYRIGHT M	add copyright file		2 years 1	
CSubTable lus	fixing lable modules to return correct number of g	ndrous	6 months :	
Clarolia	Use custom range in HardTanh and mask it as CI		3 months	
ClassINII Coleron lus	Add functional conversion of ClassINLLCriterion		13 days )	
Concettus	fix a bug in conditional expression		a month i	
Coveffable kie	fising bug in ConcalTable variable length		4 months	
Container lux	Adding applyToModules() to ran Container, which	is the world but	3 months	
Copy kas	rn Module preserve type sharing semantics (#16		4 norths	
Cosine ha	Fix type() in Cosine	), and in accountability	a nonth i	
CosineTistance Isa	Do not change state variables in CosineDistance	Contraction Chairm	2 months	
CosineEmbeddingCriterion (	Do not change state variables in CosineDistance		2 months	
Oterios las				
Criterion Table Isa	nn Module preserve type sharing semantics (#16 Rename unpack to table unpack for Lus 5.2	), ass m.woose.appy	4 months i 8 months i	
CrossEntropyCriterion kas	Check for "m.Module" and "m.Criterion" in recurs		8 months i	
	adding direct (beckward to Concat, DepthConcat,		9 months	
DistKLDisCriterion.lus	Use tensor for THNN functions even for single ele	ment outputs	10 days :	
DorProduct/lua	Add batch mode in DoProduct + unit test		2 months	
Dropout lus	in-place dropout		4 months i	
ELU ka	Add THNN conversion of (ELU, LeakyReLU, Logi		7 days i	
ErrorMessages.lus	Give better error messages when trying to use the		a year i	
Euolidean.lus	m Module presence type sharing semantics (#16)	7); add m Module apply	4 months :	
Exp.lus	Exp made lus only		9 months :	
PlatterTable lue	m Module preserve type sharing semantics (#16	7); add m Module apply	4 months :	
GradientReversal lus	Add Gradien/Reversal layer		4 months i	
HardShrink Jua	Add functional conversion of HardShrink		10 days :	
HardTenh.lua	Add functional conversion of HardTanh		10 days )	
HingeEmbeddingCriterion lus	rewrote HingsEmbeddingCriterion to support batc	h mode	6 months i	
Identity lua	Revert to previous identity lue implementation		2 months i	
Index.lue	Simplifying and more efficient multides		2 months	
Jacobian Isa	Add unit tests for hessian lus, fix bugs detected b	y the tests.	6 months :	
JoinTable lua	m Module preserve type sharing semantics (#16	T): add m Module apply	4 months	
L1Costius	Use tensor for THNN functions even for single ele	ment outputs	10 days :	
L1HingsEmbeddingCriteria	Make type() truly recursive.		9 months :	
LiPenaltylus	fixed L1Penalty constructor arguments		ayear	
LeakyReLUJus	Add THINN conversion of (ELU, LeskyReLU, Logi	Sigmoid, LogSofMax, Looku	7 days i	
Linearlus	Remove spurious mallocs from nn.Linear		4 months :	

E LogSigmoid las	Add THNN convenion of (ELU, LeskyReLU, LogSigmoid, LogSofMax, Looku	7 days ag
El LogSofMaxiua	Add THNN conversion of [ELU, Lesin, ReLU, LogSigmoid, LogSoftMax, Looku	7 days ag
LookupTable.lus	Harmonize LookupTable signature with ours impl	5 days ag
€ MM.lua	Rename urpack to table urpack for Lus 5.2	8 months ag
MSECritarion.lua	Add SizeAverage to criterions in the constructor	2 months sig
MarginCriterion Jua	modernized MarginCriterion	a year ag
MarginRankingCriterion.lus	Fix batch mode in MarginRankingOriterion	4 days sig
E Marka	Merge pull request #464 from viginal haster	2 months ag
⊇ Mean.lua	Add support for negative dimension and both batch and non-batch input.	2 months sig
R Minha	Merge pull request #464 from vigre master	2 months ag
NictizeTable ka	cancel unused variable and useless expression	29 days ag
P Module kar	Revert "Don't re-Eathen parameters if they are already flattened"	15 hours ag
P Mulha	emoving the requirement for providing size in res Mul.	5 year ag
E MuConstantiva	Ignore updateGradinput if self-gradinput is nil	3 months ag
E Multicherry ha	ignore uposecrator put in set greatings in in assects in Multi-Oderion and Parallel Oferion add	
		2 months ag
MutiLabelMarginCriterion lus	initial reyamp of torch? tree	4 years ag
El MutMarginCriterion lus	multimargin supports p=2	11 months ag
Rerow/ue	typeAs in Narrow not done in place.	6 months ag
NanowTable.lus	NarowTable :	6 months ag
El Normalze lus	Ramoye brinn and beddfrom from Normalize, because they allocate memory,	20 days ag
PReLUite	Buffers for PReLU cuda implementation:	8 months ag
Padding lus	fixed broken im Padding input was returned in backprop	5 months ag
PairwiseDistance.lus	Merge pull request #532 from xwgenglinaster	29 days ag
E Paralellus	fix a bug in conditional expression	a month ag
El Parallel Criterion lus	asserts in MultiCriterion and ParallelCriterion add	2 months ag
R Parate/Table lue	Parallel colinication: Parallel able inherts Container unit tests	8168130
Powerlus	Use UNIX line endings	7 months ag
R READNE md	do: readhedos	5 months as
E RReLUbs	Add randomized leaky redified linear unit (RReLU)	3 months ag
ReLUxe	adds in-place ReCU and fixes a potential divide-by-zero in nn Signt	9 months ag
Replicate lus	Replicate batchlifode	8 months ag
Restape lus	Added more informative pretty printing.	a year ag
E Select lus	Initial revemp of torch? tree	4 years ag
SelectTable.lua	m Module preserve type sharing semantics (#167); add m Module apply	4 months ag
Sequertial lua	Tising Sequential remove corner case	6 months ag
⊇ Sigmoid ka	initial revening of torch? time	4 years ag
Smooth_1Orberion.lue	Add SpeAverage to criterions in the constructor	2 months ag
R Soffdex lus	Fix various unused variables in m	a year ag
Sottlinius	Fix various unused variables in no	8 V08 80
F) SotPlusius	fixed a numerical issue in the SofPlus module (it breeks for input g	2 years ag
El SatShrink ba	initial reventy of torch? tree	4 years ag
Ri SofSignitus	initial review of toroit? tree	
		4 years ag
Sperse lacobien lus	Fix various unused variables in m	a year ag
El SparseLinear.tua	Using sparse implementation of zeroGradParameters for SparseLinear	a north ag
Spatial Adaptive Max Pooling		a year ag
Spatial Average Pooling. lua	Spatial-Average-Pooling supports padding, cell mode and exclude_pad div	29 days ag
Spatia/BatchNormalization.lua	Add C implementation of SpatialBatchNormalization	7 days ag
SpatialContrastiveNormalz	Make type() stuly recursive.	9 months ag
SpatialConvolution/ua	Fix type() in SpatialConsolution	3 months sig
SpatialConvolutionMM lua	Fix type() in SpelialConsolution	3 months ag
SpatialConvolutionMapilus	Remove unused and expensive initialization logic from nn.SpatialConvo	8 months ag
Spatial CrossMapi, RN Isa	cude consistency	18 days ag
El Spata DivisiveNormalizatio	SpallefConstrastive.Divisive.Subtractive/Normalization work with bat	8 months ag
R) Spetia Dropout (up	small for on error measure	6 months ag
El Spatia Fractional Mas Poolin	Adding Fractional Max Pooling	3 months ag
Spatia/FullConvolution.lus	Add adjustment farm to Spatia Full Convolution to control the size of	5 days ag
Speta FullConvolutionMep.lue		3 years ag
Spetial LPPooling lue	Spatial-Average-Pooling divides by kIRTAH	10 months ag
Spatia Max Pooling Jua	SpatialMarPooling supports padding and cell mode	6 months ag
Spatia ManUnpooling lua	Add SpatialMayUnpooling	26 days ag
Spata/SofMax/ua	Update SoftMax to work in spatial mode	4 months sig
	Merge branch 'nn fast resel'	3 years ag
SpetialSubSampling.lua	MENGE DIRECT THE LAST CENTER.	
	Spatia(Constructive, Divisive, Subtractive)Normalization work with bat	
Spatial Subtractive Normaliz	Spatia@Constructive.Divisive.Subtractive@Normalization work with bat.	8 months ag
SpetalSubSampling.lus     SpetalSubtractiveNormaliz     SpetalUpSamplingNeureal     SpetalUpSamplingNeureal     SpetalUpSamplingNeureal	Spatia@Constructive.Divisive.Subtractive@Normalization work with bat.	8 months ag 7 months ag a year ag

# Biblioteca de Componentes / Camadas

O Code ⊕ Issues 27	∏ Pull requests to ⊞ Wiki + Pulse ja Graphs			
in description or website provided.				
⊕ 1,039 commits	₽7 branches ○ € releases	(f) 86 contributions		
Branch master - New pull	New file Find file HTTPS - https://gst	hub.com/torch 😩 Download ZF		
soumith Marge pull request	#565 from turch reven-563-master :—	Latest commit 23dd17d 15 hours ag		
ill doc	Fix batch mode in Margin Ranking Criterion	4 days ag		
m generic	Improve error message in SpatialConvolutionMM	a day ag		
m 10	THNN: add missing OpenMP include	2 days ag		
■ rocks	Add Nasti decendency	14 days ag		
P store	tell of to ignore build output	4 months as		
E luachediro	Forch! Move test has to the too level	a year ag		
P. tovis imi	small fixes for test path	2 months as		
P Abs.las	Add THRW convenien of (ELU, LeakyReLU, LogSigmoid, LogSofMax, Looks	7 days ag		
■ AbsCriterion.lus	Add THWI convenion of (ELU LeskyReLU LogSigmoid, LogSidMiox, Looku	7 days ag		
P Add to	for Add with multi-dim has	10 months as		
E AddConstant.lus	Adding in-place AddConstant and MulConstant	9 months ag		
El ROFORIeron La	Remove unnecessary malfocs from BOED/tenton	3 months ag		
E Ratri Normalinalina Ina	The batchroom reset	3 months ag		
E CAddTable lua	to cazznom reser  fising table modules to return correct number of gradinguits	6 months ag		
E CASTADANA R COnTabana	tang sale mobules to return correct number of gracinguis.  Fairs table mobules to return correct number of practinguis.	6 months ag 6 months ag		
E China inchr	Add C inclementation of Scala/BatchNormalization			
		7 days ag		
E CM/Intelia	m Module preserve type sharing semantics (#167), add m Module apply	4 months ag		
E CONTRICTING and	fixing table modules to return correct number of gradinguts	6 months ag		
	added developing tips	3 months ag		
COPYRIGHT.bt	add copylight file	2 years ag		
CSubTable lus	fieing table modules to return correct number of gradinguis	6 months ag		
E Campius	Use custom range in HardTanh and mask it as Clamp	3 months ag		
ClassNLL Orienton lus	Add functional convenion of ClassINLLCriterion	13 days ag		
Concetius	fix a bug in conditional expression	a north ag		
Conceffable kus	fising bug in ConcelTable variable length	4 months ag		
Container lus	Adding applyToModules[] to m.Container, which is like apply() but	3 months ag		
E Copy km	m Module preserve type sharing semantics (#167); add m Module apply	4 months ag		
☐ Cosine.lua	Fix type() is Cosine	a nooth ag		
CosineDistance lus	Do not change state variables in CosineDistance/CosineEmbeddingOrderion	2 months ag		
CosineEmbeddingCriterion.L.	Do not change state variables in CosineDistance/CosineEntheddingCriterion	2 months ag		
Criterion.lua	nn Module preserve type sharing semantics (#167); add m Module apply	4 months ag		
Criterian Table Jus	Rename unpack to table unpack for Lua 5.2	8 months ag		
CrossEntropyCriterion.lux	Check for 'm: Module' and 'm: Critarion' in recursive Type.	8 months ag		
■ DepthConcatios	adding direct :backward to Concat, DepthConcat, Sequential	9 months ag		
DistKLDisCriterion.lus	Use tensor for THNN functions even for single element outputs	10 days ag		
■ DorProduct/lua	Add batch mode in DolPhoduct + unit test	2 months ag		
■ Dropout lus	in-place dropout	4 months ag		
El El Uka	Add THNN conversion of (ELU, LeakyRaLU, LogSigmoid, LogSoffMax, Looku	7 days ag		
ErrorMessages.lux	Give better error messages when trying to use the wrong kind of Tensor.	a year ag		
Euclidean.lus	m Module preserve type sharing semantics (#187); add m Module apply	4 months ag		
El Explus	Esp made lus only	9 months ag		
☐ FlattenTable.lue	m Module preserve type sharing semantics (#167); add m Module apply	4 months ag		
Gradien Pleversal lua	Add Gradien/Reversal layer	4 months ag		
☐ HardShrink Jua	Add functional convenion of HardShrink	10 days ag		
■ HardTarthJus	Add functional convenion of HardTanh	10 days ag		
HingeEmbeddingCriterion lus	rewrote HingeEmbeddingCriterion to support batch mode	6 months ag		
B Identify las	Revert to previous identity Liu implementation	2 months ag		
R Index lua	Simplifying and more efficient multides	2 months ag		
P Jacobian har	Add unit tests for hessian lus, fix buce detected by the tests.	6 norths ap		
E John Table las	m Module preserve type sharing semantics (#187); add m Module apply	4 months ag		
El LiCostius	Use tensor for THIN functions even for single element outputs	10 days ag		
E L'HingsEmbeddingCriterio	Make type) truly recursive.	9 months ag		
E Litergianosongumens	Make oper, truy recursive.  Seed I. Flenally constructor arounsets	a neurao		
El LookyReLUtus	taed Litrerally constructor arguments  Add THINN convenion of (ELU, LeakyReLU, LogSigmoid, LogSidMax, Looku			
E LeavyMeLUJus	was inner conversion of (ELU, LeakyHeLU, LogSigmod, LogSirfMax, Looku	7 days ag		

E LogSigmoid las	Add THNN conversion of (ELU, LeskyReLU, LogSigmoid, LogSofMax, Looku	7 days ag
El LogSofMaxiua	Add THNN conversion of [ELU, Lesin, ReLU, LogSigmoid, LogSoftMax, Looku	7 days ag
LookupTable.lus	Harmonize Lookup Table signature with ours impl	5 days ag
€ MM.lua	Rename urpack to table urpack for Lus 5.2	8 months ag
MSECritarion.lua	Add SizeAverage to criterions in the constructor	2 months sig
MarginCriterion Jua	modernized MarginCriterion	a year ag
MarginRankingCriterion.lus	Fix batch mode in MarginRankingOriterion	4 days sig
E Marka	Merge pull request #464 from viginal haster	2 months ag
⊇ Mean.lua	Add support for negative dimension and both batch and non-batch input.	2 months sig
R Minha	Merge pull request #464 from vigre master	2 months ag
NistreTable ka	cancel unused variable and useless expression	29 days ag
P Module kar	Revert "Don't re-Eathen parameters if they are already flattened"	15 hours ag
P Mulha	emoving the requirement for providing size in res Mul.	5 year ag
E MuConstantiva	Ignore updateGradinput if self-gradinput is nil	3 months ag
E Multicherry ha	ignore uposecrator put in set greatings in in assects in Multi-Oderion and Parallel Oferion add	
		2 months ag
MutiLabelMarginCriterion lus	initial reyamp of torch? tree	4 years ag
El MutMarginCriterion lus	multimargin supports p=2	11 months ag
Rerow/ue	typeAs in Narrow not done in place.	6 months ag
NanowTable.lus	NarowTable :	6 months ag
El Normalze lus	Ramoye brinn and beddfrom from Normalize, because they allocate memory,	20 days ag
PReLUite	Buffers for PReLU cuda implementation:	8 months ag
Padding lus	fixed broken im Padding input was returned in backprop	5 months ag
PairwiseDistance.lus	Merge pull request #532 from xwgenglinaster	29 days ag
E Paralellus	fix a bug in conditional expression	a month ag
El Parallel Criterion lus	asserts in MultiCriterion and ParallelCriterion add	2 months ag
R Parate/Table lue	Parallel colinication: Parallel able inherts Container unit tests	8168130
Powerlus	Use UNIX line endings	7 months ag
R READNE md	do: readhedos	5 months as
E RReLUbs	Add randomized leaky redified linear unit (RReLU)	3 months ag
ReLUxe	adds in-place ReCU and fixes a potential divide-by-zero in nn Signt	9 months ag
Replicate lus	Replicate batchlifode	8 months ag
Restape lus	Added more informative pretty printing.	a year ag
E Select lus	Initial revemp of torch? tree	4 years ag
SelectTable.lua	m.Module preserve type sharing semantics (#167); add m.Module.apply	4 months ag
Sequertial lua	Tiving Sequential remove corner case	6 months ag
⊇ Sigmoid ka	initial revenup of torch? tree	4 years ag
Smooth_1Orberion.lue	Add SpeAverage to criterions in the constructor	2 months ag
R Soffdex lus	Fix various unused variables in m	a year ag
Sottlinius	Fix various unused variables in no	8 V08 80
F) SotPlus lug	fixed a numerical issue in the SofPlus module (it breeks for input g	2 years ag
El SatShrink ba	initial reventy of torch? tree	4 years ag
Ri SofSignitus	initial review of toroit? tree	
		4 years ag
Sperse lacobien lus	Fix various unused variables in m	a year ag
El SparseLinear.tua	Using sparse implementation of zeroGradParameters for SparseLinear	a north ag
Spatial Adaptive Max Pooling		a year ag
Spatial Average Pooling. lua	Spatial-Average-Pooling supports padding, cell mode and exclude_pad div	29 days ag
Spatia/BatchNormalization.lua	Add C implementation of SpatialBatchNormalization	7 days ag
SpatialContrastiveNormalz	Make type() stuly recursive.	9 months ag
SpatialConvolution (ua	Fix type() in SpatialConsolution	3 months sig
SpatialConvolutionMM lua	Fix type() in SpelialConsolution	3 months ag
SpatialConvolutionMapilus	Remove unused and expensive initialization logic from nn.SpatialConvo	8 months ag
Spatial CrossMapi, RN Isa	cude consistency	18 days ag
El Spata DivisiveNormalizatio	SpallefConstrastive.Divisive.Subtractive/Normalization work with bat	8 months ag
R) Spetia Dropout (up	small for on error measure	6 months ag
El Spatia Fractional Mas Poolin	Adding Fractional Max Pooling	3 months ag
Spatia/FullConvolution.lus	Add adjustment farm to Spatia Full Convolution to control the size of	5 days ag
Speta FullConvolutionMep.lue		3 years ag
Spetial LPPooling lue	Spatial-Average-Pooling divides by kIRTAH	10 months ag
Spatia Max Pooling Jua	SpatialMarPooling supports padding and cell mode	6 months ag
Spatia ManUnpooling lua	Add SpatialMayUnpooling	26 days ag
Spata/SofMax/ua	Update SoftMax to work in spatial mode	4 months sig
	Merge branch 'nn fast resel'	3 years ag
SpetialSubSampling.lua	MENGE DIRECT THE LAST CENTER.	
	Spatia(Constructive, Divisive, Subtractive)Normalization work with bat	
Spatial Subtractive Normaliz	Spatia@Constructive.Divisive.Subtractive@Normalization work with bat.	8 months ag
SpetalSubSampling.lus     SpetalSubtractiveNormaliz     SpetalUpSamplingNeureal     SpetalUpSamplingNeureal     SpetalUpSamplingNeureal	Spatia@Constructive.Divisive.Subtractive@Normalization work with bat.	8 months ag 7 months ag a year ag



### Biblioteca de Componentes / Camadas



El LogSigmoid lua	Add THMN conversion of (ELU, LesinyReLU, LogSigmoid, LogSofMax, Looku	7 days
E LogSofMaxius	Add THNN conversion of (ELU, LeakyReLU, LogSigmoid, LogSofMax, Looku	7 days
RI Lookup Table kus	Hamonize Lookus Table signature with gurn impl	5 days
P MM.ka	Rename unpack to table unpack for Lus 5.2	8 months
R MSECritarion lua	Add SizeAverage to criterions in the constructor	2 months
El Margin Criterion Iua	modernized MarginCriterion	ayear
Margin Ranking Criterion Aus	Fix batch mode in MarginRankingCriterion	4 days
P Marcha	Merge pull request #464 from vojne/master	2 months
P. Mean lus	Add support for negative dimension and both batch and non-batch input.	2 months
P Maha	Merge pull request #464 from vignelmaster	2 months
ej MintreTable.lus		
	cancel unused variable and useless expression	29 days
El Module kar	Revert "Don't re-Batten parameters if they are already flattened"	15 hours
E Multue	removing the requirement for providing size in nn.Mul.	ayea
El MuConstantiva	Ignore updateGradit put if self gradit put is nil	3 norths
MultiCriterion.lus	asserts in Multi-Orderion and Parallel Orderion add	2 months
MutiLabelMarginCrisrion.lus	initial revamp of toron? tree	4 years
E MutMarginCriterion lus	multimargin supports p=2	11 months
Rerow/ue	typeAs in Narrow not done in place.	6 months
NarrowTable.lus	NarowTable :	6 months
⊇ Nomalze lus	Ramove brain and beddown from Normalize, because they allocate memory,	20 days
El PReLUite	Buffers for PReLU cude implementation.	8 months
R Padding lus	fixed broken im Padding: input was returned in backgrop	5 months
PainwiseCintence lus	Merge pull request #532 from xegergimenter	29 days
El Paralelius	fix a bug in conditional expression	a north
R ParallelCriterion lus	asserts in MultiCriterion and ParallelOtterion add	2 months
E ParaleTable lus	Parallel optimization. Parallel able inherts Container, unit tests	
		8 ) 98
Power.lua	Use UNIX line endings	7 months
E READVE md	doc readfledocs	5 months
E RReLUbs	Add randomized leaky racified linear unit (RRsLU)	3 months
ReLU lue	adds in-place ReCU and fixes a potential divide-by-zero in m. Signt	9 months
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E Select lus	initial revemp of torch? tree	4 years
SelectTable lua	m Module preserve type sharing semantics (#167); add m Module apply	4 months
Sequential lua	Teing Sequential remove corner case	6 months
Sigmoid lua	initial reverse of tords? tree	4 years
El SmoothL1Criterion.lue	Add SzeAverage to criterions in the constructor	2 months
SoffMax lus	Fix various unused variables in m	a yea
Sottlinius	Fix various unused variables in nn	a year
⊇ SotPlusius	fixed a numerical issue in the SoftPlus module (it breaks for input g	2 years
R SofShrink lug	initial eyemp of torch? tree	4 years
R) SoftSign.tue	initial revamp of torch? tree	4 years
Pi Sparse Jacobian kus	For various unused variables in no	1 100
El SparseLinear.tua	Using sparse implementation of zero-Grad-Parameters for SparseLinear	a north
SpatialAdaptiveWaxPooling		ayea
R) Spatial Average Proling. lux	Spala/Average/Pooling supports padding, cell mode and exclude _pad div	29 days
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SpatialConvolutionMM lua	Fix type() in SpatialConsolution	3 months
Spatial Consolution Mapilia	Remove unused and expensive initialization logic from nn Spatial Convo	8 months
El SpatialCrossMapLRN ka	cuda consistency	18 days
Spata DivisiveNormalizatio	Spatiaf Constrastive Divisive Subtractive/Normalization work with bat	8 months
Spatia Dropoutius	small fix on error rossage	6 months
R Sosta/FractionalMas/Poolin	Adding Fractional Max Pooling	3 months
R Soata Full Convolution lua	Add adjustment term to Spatia Full Convolution to control the size of	Sdays
El Spatia Full Convolution Map lus		3 years
ej spetarultonvolutraseptus Ri SpetalLPPosinolus	Spatia/Average/Pooling divides by MITNH	10 month
SpatialMasPooling lua	SpatialMarPooling supports pedding and cell mode	6 months
	Add SpatiaMarUnpooling	26 days
E Spatia ManUnpooling lua		4 months
E Spata/SofMax/ua	Update SoffMax to work in spatial mode	
	Merge branch in fast reset	3 years
E Spata/SofMax/ua		3 years
B Speta/SoffMax.lua B Speta/SubSampling.lua	Merge branch'nn, fast, resel'  Spetial Constructive, Divisive, Subtractive/Normalization work with bat	3 yests 8 months 7 months
El Spatia SoftMax Jua El Spatia SubSampling Jua El Spatia Subtractive Normaliz	Merge branch'nn, fast, resel'  Spetial Constructive, Divisive, Subtractive/Normalization work with bat	3 years 8 months

