

%PDF-1.3 %
1 0 obj <> endobj 2 0 obj <> endobj 3 0 obj <> endobj 4 0 obj <> endobj 5 0 obj <> endobj 6 0 obj <>
E<>"F;a:>[>mh9Q!;mJZw'>
>%o*>"lo[Zo1/_/N|.DCd|W_Rj(Z6{#E:
A2L

W1A7B

<Zúdóf.?Wr9u\rn\1\Qt! CAZ+AOz N3 ht h^W= (h[G&(4jU-bf2I,?(5r2ZeB1:9Z<@k VY E74)3\x T1(y \$L2Cr f@%}yL\0 p^-H\H\|0\0d\oP/+U\B\#`vF\8\d\%}\C.\.j,Uh,\#9L4>NcK\MXe rZI\+\`E\Y\`C\ !V\`r\T\`S\`l\`E\`c\

□!Y□□□r□T□□□□□□□.S□1□□`□□E□□c□□□□□

<4q□□□□□□}□□□□6□b□□bb:□□□□□□}□!□J□□ Ap

□□^□U#c□□□d□□□□j□□□Q'□^□□□2□/S,□□□□)□□□*B"UN□□xB□□□\□,W□□eq`□□□□□□P
□□f□□f□C□□□4□□2Q,R□□□;□1□#`QO@-□c□□□7□1O□<□0N□V□G□□□4u~□1□@□3□2□□\$@□□Lf□
□□T\$□。□□tMD□{□□□□aMx□R□□0□□0□f□1□Q□Z&0@}□□K□%O3□'□□□□Ná□1□□va*P)□Y□}□A
□>□□9VN□zO'□%□□C□S)□Gg6□□"b□V□□□□Z□□□□i:□□)□#r□□□□)□□?□&s2}x□□E□□□E□□(□/X□W□f□□wBl□.□□□□□□□ja5Gj□□p5U□□x9f*□G□&&□S:>□□□□5E□□0u□Y□□□bt}Kh□>Q□□'h□□

✓/X\W\f\wbl|. ja5Gj\p5U\x9f*G&&S>:5E\0u\Y\bt;Kh>Q\h
Xi\18\5d\q:/:X\cwn\A\%.\e>LO\1>.#\e=\q;(\o=y/5
C\W\ خnoo\ e\ e/]L\y\#v\#*\#4\ n_\$\ M\8~\
L<\Z\z\q\à\b\A\6\U\s>cf\W\O\rr\O-!\v\j@\p\\\
3N\j\2\H1*N\6\i\,15\ xE]\-\V\p\W\f\T<[\T\1\B
/B\4\0Y>-Y\ A\z\ Mz\h\ m\Y\iyD(H\Y\z\4\P\i\Q\c

jØx*Qni>H`P`@8S8T^q!Lè<--5^S MZ E}gs0oQJuBx=S:u_Og_c pr#Jd#%AJEr@1,XRAW3fj`R/ljM:A9=}{~6w I,ÖS{xfKg0)wH)(I,E,pPy#MriCTb_Eu_xx>&E

5K<|P3|.B<|Y{.||S|W{-|g|a|{|v|P|H|_|_c|h^|_|I|J|_|{|~z7K;|o|/|?|7u5|>|w2|b|Zu|_|_O|_|_Y|9
|[|7|h<|W|h|M|h;{|x!|_|(K}|_|_|2|_|{|db<|}3|_|_|N2|_|_|1|_|(|\$|_|-H|uT|&|q|@|_|].|.y~|i|_|_|4Ty|_|uu|_|.te?|_|_|\$|_|^|_|<|bm*|_|T|_|_|W5|_|_|1|_|LJ|_|>|}u|_|E|_|b|_|~|_|6|_|U|"n%|_|C|_|w!|_|y|_|%|_|R|_|C|_|}{a|_|_|6|_|_|s|_|F|_|#=@|K|_|#|_|T|_|_|

0v~<<.6H as c#:wz} P#P:P } Q|Uu"&m p 8 U {"m E p e \v3! 7s \$
U Lc P } (O ' T '% s-> k b + 6 Z 3e%?" wGQ : 6j x 'g# _ e9~M R*E R { cI K G 6 LQJ p \ I F S M O

<u0000y000N!000~00D00s0ys0q@000@&1000ZQX0Q00000Z+00P0K0X00000
0-000C0fA0M0000Y0?000V000P0000000-z003@o000-0J0jC-00,00>000@000u0
00\x0^90]?R000u+0g@!000@000P0000g:000h000Y\}V00o0q00x00x000@000ac000

7NOK--wmiB/[D%Vog%oG%oRzG@iV4oq÷H,xc^=oS[w-z#S]o=x[J(Q,U(^%!1(.&W\$Kib::] H\$B;8['S<0072><005b><005b><0078><00c6><00c6><00c2><00cf><00cf><00d3> endbfrange endcmap CMapName cur\$2Q%B&3ab5d

ЩUb[59Өo:v[v\c\z\1\5\\$k8\U's\H/5χ[08\9]"9 J\vg^h[o-5!Q\Я\£Ka?_b\ku\z\O@f\}QA\j\I\q/S\Э]J\q\c\h)z\F\f\3\G\4gh\Ak\dHv\&7\>\uju\X\L\b\g*"\l:9Z\9\y\H\iL3}D\od\^S\sv\Mr_Du%\Å\@+\?I=<\M:)T\fk\WQ\<"UL<\t*2\Mu\Lv\Rp[i\ CtG_\-\#r>p{D\}\#m\U[!]L\^&{wV\sK\#Wb>H\VM\6]\~rr\ش/CD\Qy\X\f)nZ\8\7\4&U\,.\N\Q\W\Nl?J\3\W\2\8[\^XYL\20\A\K\3\X\x\f\>*\Q\^@\z\\$11\@KX\B\\$B\9(\#\!9\c]zcM1\Li\4\i\%Pf:-mg\b\o\T\g\I]*\r+:B\Dlv\6\H9\UP[\f*6!\O\&t\%L\c\H\dkV\~%q4&(0.7Et\2\Yd\W<\z\9I_5\Ba\\$oL`[L\:\d\+R\

z[01\A\ss_\K\V'!v\V\vn\Q\E\((\Q'N\Q\Y\00[2\w#\]H\al\s\I\c\wn\MV\8\K\o7\JG*v\,\G\&Zf1_x\pV\{_\(\sim=Y\9\.\K\HPV\CCZA*2ke\G\K\U*\-\E\6\z)k\Iy\t\p\H\j=n6Zw)\[\ç\es@n3M\G\=sk\|A\h\|t\~Y\7q\o\w*\[\G\l\p\+\c\ng\bl\+<1\!F\c(\ñ'n2v\V\g@U\M\k:]<\^\[.\AA\\$O\%@\^us\?E\c\w\(\J\kr+i\w\\$ {\Psi\JS\Z\7b\H\bn\l\y\2\>)G\>*\r:(:&\&RX\(*e\ob\u\][\v\Q\O\w\S\\$\qhN\y\ m,T\<\h\[\v\8\U\V\j\%\O\{\L\1\O\G\)G\+f4\H\e\~\%q/-\F\6\+iZ\XZ\j=\P\nc*S*aj\alM\\$T\!\\$7\q:Y\X\vv\9\(\A*k\0\X\+0uL\{-j09\}\[2\\"+;b\A\Ds\B\Rs\H\ s+OC\f@c\vv\@q&2\J"W\|\z\ee\h\go\>m*=RRN9\=9И=N\T\B\OwR\%?W-qQ\k\\$R\Nq\B9\]2u\qL\\"D\\$.V\L\J\O<\~=s*\]X\>G#\^C\~V\>

R:\#6\ w\ \hat{C}\u@J\ntN\ b0\o\ "o\`B\T1F\~(\q\B\Qb\3\6\R\t\\$C\9\ n3C\!]H\Yk\DE\On\ V\ n\i\&\p\r\j\2\Gs+\b\]E!\UM\Q\o\YH\Ur\4\ d\W\Ug\dr\ e\ C;A\H\5\i\5\i\m5W\{HY\~\D\A\uf\8\3\V\k\Y\ d\X\g\p5\{d\M\I\+6[\¢9\]}\.H\ATV\ e\H\[\I\W\#C\\$K\o\ S\ o\]

d\]v\\$KyQ\L\Q\8R\q\'\g i\Y\W\1\%H\W>m\9!IS\;iKF72\q,\#\SNJ\<\=>\t%\A\o\A\o\t\?2[S5\C\#\&\W\s\hDws\wb\%6\ d\N[m*\o\=e\U\ D\A\{Q\o\ r"\W\Z\^C\B\DI\B:>\Jt\ d\o\ r\,,\%8\[#d\,+\ W\^/\^-,Z\al\ki\#D7\NK\A\7gs\sX!\Yv\3\o'd#\k)!Z\m\^m\^T\Jk\<\q\&\g\R\J[\L\B\W\f\&\Y>(Z\y\^>.5\&\>,Fc\|s\g\o\ a,\b]:\b\j\Q\0F\>\D\z\ora\9\Te[\F\\$O\ u\ SR\4\}+\Q\1\J\o\R\Z\b[d.\~>f\@+\5\o\ d\-\B[V\ L\q\qa\c\ L\cQ\]e\~v\y\dlv\U\c3[\V\>\Y\VV\va\2\k\X\q\9\I\RoG\o\9\ @\p\NR\f\N\L\Q\ T\I(P\ e\6\o\n\vv\!j\;k\h\>,\.a\y@\ y\Hq\ 5\ش\!K\o\ d.\f\o\ D\o\~\f\j\l\-\ç\3\c\>;A\o\ |OT\l\k\P\o\ Fr\&\=V\o\ \o\ /D\y\);^R\%*y\6TK\ b\>;Q\~\q\2\l:\o\ Q\9\mi]IT\i;\{u\o\ r\,\}H\@G\)/s\o\ u\J\^BT\vv\<\ba\y.\o\ A\Z.\o\ks\K*07\o\ /\$ Z\#\o\ P\#D\o\ O'\o\ d_\n\c\:\ě\o\R\6oJzv\y\z\%-kP\f\~\Rk\fh\0\W\p\ddfuG;\s\h\^A\\$\#R\^s\["V\>\o\ E\#\o\ 5Gp\o\ E\{&\sc\o\ S\o\ t\1XI\vv\ @\R\o\ d\o\ :i\#d\o\ e\o\ +\R\>w\][3\)'g\6\o\ n\H5\o\ O\Y\o\ \o\ *J\o\ U\`5\h\U\o\ D\o\ r\o\ -Ed\o\ ;]\`'ü\&\\$[a\o\ b\o\ C\o\ b\o\ S\o\ v*Am\o\ u\o\ Ub\

W₁, W₂, ..., W_n are the weights of the neurons in the hidden layer, and b₁, b₂, ..., b_n are the biases of the neurons in the hidden layer. The output of the hidden layer is given by:

$$O_{\text{hidden}} = \sigma(W_1x_1 + W_2x_2 + \dots + W_nx_n + b_1)$$

where σ is the activation function, typically a sigmoid or ReLU function.

The final output of the neural network is given by:

$$O_{\text{final}} = \sigma(W_{n+1}O_{\text{hidden}} + b_{n+1})$$

where O_{final} is the final output of the network.

It's important to note that the number of neurons in the hidden layer can vary depending on the complexity of the task and the size of the dataset.

In conclusion, the forward pass of a neural network involves calculating the weighted sum of the inputs and adding a bias, followed by applying an activation function to produce the final output.

It's also worth noting that the forward pass is typically implemented using matrix multiplication and vector addition, which makes it very efficient for large-scale neural networks.

In summary, the forward pass of a neural network is the process of calculating the output of the network given a set of inputs, involving the calculation of weighted sums and the application of activation functions.

It's a fundamental part of the training process, where the network learns to map inputs to outputs by adjusting its weights and biases.

Overall, the forward pass is a key component of neural networks, enabling them to learn complex patterns and make accurate predictions.

It's a powerful tool for solving a wide range of problems, from image classification to natural language processing.

With its ability to learn from data and make predictions based on that learning, neural networks have become an essential part of modern computing.

They're used in everything from self-driving cars to medical diagnosis, making them one of the most exciting and promising areas of research in computer science.

So there you have it, a brief overview of the forward pass of a neural network. I hope this has helped you understand how these powerful models work under the hood.

If you have any questions or comments, feel free to leave them below and I'll do my best to answer them.

aP8!@B@Y@lC7@te1@s-(x<@O@S@K@e'r
k@+bZJ#@A@S@p@Y@w@3e@G@L)%@q@e@
2@}`@*v~^\$.R?y@,D@&r6E@`b@Q@U@D@G@M@b@#@v@`ts(@_V{t@c@(W@=W@H@~}@.lh@[p@,"o@z@o@W;o@K@[T_uCA:p'w@D@zV@W,z@c_3q@D@](W@?@5z@
l-v@!(@Mh6@H@rt'V@2@b@-%@Z@d@HH@TUF@@2@[@@5\$@%@e@iP@P.e@0or@k@9@5@'@L@TC@F@Q@c@KIS@u@t^@4@0@A@b@W@r@
b@i@rZ3@`@s@i@b@lw@X@F@#E@#GR@S@M@8)@X@R@dm@Hf@I!@`@nPxwV@)a&@Z@2@5O@4@B@2@Y@4@GD@^@y@ND@f@N@X@]@in|nyK@~@.O@-1KLj@ic@W@2@Hg@)@h@([URE@>@o@Z@!)nPJ@7@
(@0@Ljg@p@)?@f@ #o@i@1D@/@Щ@6vk@Z@<@UW@)@al@]*@Z@2@H0D@E@
H@Y@)u>@l@p@n@T@S;@+.{@G@O@m@v@W@\$@B@Y@
5@~@.h@-@i@g@X@x@gjB@}{eF@z@0@K@a@o@z@ü+k@W@
%@G@r@lo@r@m!@A@1@!*%@Ed@B@å@6/@m5@*@a@p@x@
1@8@<@5ujO@(@Z@(^@AG@8R@\$@9!\$@e@>@R@5@8@m@
r@T@&@j@+v@-v@R@f@8@}@m@N@_گ@m@N@&c@#m@n<@uD@
oO@piZ@-\$@-O@MVK@K@F@M. @Sr@5e@G@z@;O+@r@ZrG@9@
:RX@+D@9@i.:H@&@J@>@a@3@_7@v@M\$@7E@+v@K@?@]
V@V@v@u@پ@X@k@O@M@'
Q@,پ:m@o@R:_@R_97e@OWN@;@Os@Kzj@o@@"@*@W,@@W@\$T@^@u@k@#@
V@7@#@6@m[€@d@VO@O@~@Y@y@;Gs!@n@U@
3@IKI2@%GXu@B@O@/wPg@n@A@[@7@p@Iw|[Z@W@3@q!iq@o=2)@ j@L= @
t?@`@j@{wp;mw@}<@=(@p@K@Q@%@*@>^@9!@+@%@P@I@
JhX@/:@Ks@x@!6D@*@6@/CW@*1@OP@y@Hp@hp@%_@G@_@8@LwS@
7@J@g@j@X;n@Y@wn@X@B@@"@J@z@w@u@X@, @Jz@""@9@S)?@0@m@2@7@
)@>@h@i@7@7@: @E@Y@4@j@/BI@o@t@E@}@Nc@Q@e@
)@š@B2@%@g@I@q@8@[a)o@:@p@I@&D@V@W@1@h@
N@`@]@b@u@P@/P@}@z@5@j@Q@4@ Z@=Z@?@n@:9@L(@U@a@ç@
X@t@"<@<ü@:D@C@x@f@y@E@X@<@m@y@R@;?@T@
r@m@i@V@f@]@Fj@q@G@!@t5@zn@u@L@e@S1P@-{@-
j@f@Y@D@7@5h@>f@mB@<@c@u@n@\$@B@ Q@S@9=@!@=@, @c@'
A@yl0F1et@H@QV@e@F@P@5UN@G(@xN@/q@>@z@3Pn@)'@D@KO@[
R@=r@x@V@R@P@A@9@m@
2@Y@3@z_S@86@lK@:h@N@e=@u@Y@h@Q@~@z, @%)@á@+@f@L@q@
Ts@j@_O@r@+c@yk@~@t@B@:g@p@b@. @~@w@B@ 1@2@W@O<@m@)@:(@
X=@f)!@oI@BSg@?@c@}{N@L@4@]@r@s@5OXo@0@&@
IH@;z@6@E@ss@m@)@E@gP@v@H@"ri@u@Y@8@T@Z@n'@G@N@;
<@Op\$@I@a@?@V@L@d@W@0@U@E@X@Pot@O#@ @L@
c@Z@_M4@:l@ó@K@1@1@le@x2F@4 %@w@+p@j@ w@#@[
x@bL@c'E@)'@, d;\$@b=@9@p@u@G@, M@Zi@A_@%@W@
x@.K&D9@¢w:@j@'@?@E:@^@o@'@t@<@\;@c@}@:@[լ@Lp@p@C@<@x@
]@C@:m@F@'[P@V@Vm@5@F@j@c@\$KO@_@9@O@8@
9@K@'@q@8@p@p@~@ë@; @K@Qqm@=c@9@x@>@}@t@Hw@پ@9@][c@
1@>@E@d@ 2@^@{Φ@?!@}@, @3T@u@
0z@W@N@U@z@|@(?BT@p@!@=m@>@]@?@v@Q@MD@f@cv@
L;@t@h@j@wDg@L@h@2,=@;@r@kě@D7@Et@3@Z@x@
+@u@n@UT@UQIRdE@3@)R@/T=@-@w@+@z@Z@+@y@9@
3@[*@4@q@h@>@t5@rR@~, Yq@0@?@C@?@w@C@K@
@P@hus@d\$@4W@m@jS@`@-@>@{7@J@8@h@; @^@jq@-@Û@1@gv@W@
L@qS@Ā@O@q@E@F@!@m@8MNj@R@(\@H@T@J@"(UV@SQ@9)R@B3@
>@rY@n@s@d@1@eH@S@ÖN@D@z@<@X@N\$@<@f@K@BV@, I@
<0aa@> <0bb@> <0c8@> <0c1@> <0c6@> <0c6@> <0c2@> <0cf@> <00d3@> <0069@> <00e1@> <00
~+@z@q@{~@}h@s@8=@{y@; @a@_p@7b@g@Ma@N@
h@M@jT@O@Y@#J@Q@k@L@, Ü@j; @(. @u@M@N@L@/ @(+@W@
endstream endobj 22 0 obj <> /Font >> >> endobj 23 0 obj <> stream x@%9@{} E=@`@ +@{g@YI@?@òZ@M@2@D@_@V@8@]^@: @+*yd@cRZ@
O@; 3@O@O\$@N@C@#@>@r; @>@, @g@G@W@i@ll@'@
P66@#@>@N@, 6@7@gs@X@m@9@B@ }@<@{če@H@1@C@H@A@
q@x@/1@8\$R@ONh@9@Z@7@nh@I@pc@wH@|@Y@_@Y@v@B@ùO@
j@c@'@/~@6@m9@F@O@`@O@b@p@T@
GJ@_k3j@i@!]@!@ßg@K@a@c@X@0<@1qlnU@YY@^@5@^@:J@Q@1@i@2@J@qt@<

b□81□□□□□□□S□Y□□.□□□8□□□□□nl]□wZ□□□□H□u□-□Oam□{□□□□□□□□□}□□n`□'□□□r□GkC
□|CJ□pK□□□□□□3VQ□'□□□Y□4□6kX□X□□=□>R□'□<]□□□(□ω□□@'□□r□?□A□O□□x□□H□□]□□8
□□'□□□□B□□□□@□e□□B9□□.[□□S□□□//□□□<□□□□□kOh□□□□TT□□□□~□GP□□B□□□
□>Q;/□y□□□v□□].□□_X
□□□□□□d8JQ3i□□□□□□K□h^y□□lm□□>□^□□□x□NL□□p□bn□□□□"□□□:tBK□\\□□F□□v□□Z~y
□;)m□□-□8□□□Rs□□□□□□y,□□c□□□□□'□□□y□□□L□□□[□□□<□6□Y□□O(□□□□□57>□□
-□CL4□□-□X□"□:4-W□□□□□□<6□7□□d□V0□\□□w#F'□□□X<□□□x□□=□'□□□Tp□>q□05)□2wB□S{
~□)[□q□B□o□□□{?=□`dG4□□□□k□□3□□^□□□/□□□G□□□□x□□□□_□□□□bRb□XD□e□%□I□□□□5
□□□□DG□□□]n□□□□□\□□1(□□□□□□□6□tl□□□□O□□x|□sijw□yi□{□□^z□b□□□□2+□□□x□□□+□
□'-L□□e/g□□wP□□□□□'□□□□m□Gk□□b□□P□□□□□□□□g}^□□j>□g□□Y□□n□6x□m>c□>>□□□
y□!D+□Z□6□□□T□U□□□□/□□□+□_4g□□□□□□G□□%e□h□□T□rm□}□□j□9l□□0□□□w)□□d□□□□□
□\$□□□□a□□□□□□+□D□□k□□(□q□
□□n□□□[□x□□□□Qf□AKkQ□□2P□□□L□□□pF}X□
o□□□□'□<□□\$□□□□b□□au□□XP□□□n□|□M□□□□1□□□□□□%□□MT[□□JM□□□□z□□OS□3W□K
□□□□□□m□□□□□□□□□□□□m□□□e□□□^Q□v□□□□,U□}□□□}□□□}□□H□□□V□□Y□}□□
=□
=-h□□□C□[□,□□□□□\□□□jN□□□□<□q□!i>□U□□□[S□□M□S>□□>□□□□1.□*\$□□□□□B□3□3m□
<.□□}>H□□%□□"y□□□□v□6□□eh□□□Kw□]i□□□□J□□□□_-□□}□ee□□}□□□□□□y□<□□□□□~B□
□□□□3□"□□□□.□□□□(□□□A{□□□_?ڻ?g□1□□+□□(□3□□□)]□6□□□□2□□□f□□□□□□&□J6□w□
v<□□□;□O{□>□1□□>□y□□G□rxF?□□\□□:□□m□□=C/□QF□C□q□□;□%□□q□bf□□y□□□□□□zpt)□
@n□:□□□!□T□□□q*□□□O<□□□9□□□□C□[-z"D□□□]Rq□□□□v□9Q□2□□□□9□□□□T0□□□□3□a7□
0000117086 00000 n 0000117161 00000 n 0000117371 00000 n 0000154495 00000 n 0000155279 00000 n 000015536