CArd Glahn

Started w/ all weights at .5

Hmwk #3

input = [1, .58, .61, .47, .13, .5, 0, .48, .22]

forward propogation

$\text{sigm}(x) \to \left(\frac{1}{1+e^{-x}}\right)$

$a_1^{(2)} = \text{sig}(1(.5) + (.58)(.5) + (.61)(.5) + (.47)(.5) + (.13)(.5) + .25 + 0 + (.5)(.48) + (.5)(.22))$

$= \text{sig}(1.995)$

$= .8803$

$a_2^{(2)} = \text{sig}(1.995)$

$= .8803$

$a_3^{(2)} = \text{sig}(1.995)$

$= .8803$

$a_1^{(3)} = \text{sigm}(1(.5) + (.8803)(.5) + (.8803)(.5) + (.8803)(.5))$

$= \text{sigm}(1.82045)$

$= .8606$

same weights

$a_2^{(3)} = .8606$ $a_6^{(3)} = .8606$ $a_{10}^{(3)} = .8606$

$a_3^{(3)} = .8606$ $a_7^{(3)} = .8606$

$a_4^{(3)} = .8606$ $a_8^{(3)} = .8606$

$a_5^{(3)} = .8606$ $a_9^{(3)} = .8606$

output = [0 0 1 0 0 0 0 0 0 0]

error $= \delta^{(3)} = a^{(3)} - y$ [.8606, .8606, -.1394, .8606 . . . . . . .8606]

$\delta^{(2)}$ This is $\delta^{(3)}$ a a little unconventional but its the way I think of doing this

$d(3) = \frac{dE_{total}}{dout_{01}} \cdot \frac{\partial out_{01}}{\partial net_{01}}$

$= \delta^{(3)} \cdot (a^{(3)})(1 - a^{(3)})$

$= [.8606 ((.8606)(1 - .8606))$, " " $-.1394(.8606 \cdot (1 - .8606))$,

$.8606((.8606)(1 - .8606))$, " " . . . . .]

$= [.1032, .1036, -.0167, .1036, .1036, .1036, .1036$

$.1032, .1036, .1036]$

$\frac{\partial out_{o1}}{\partial w} = w_{11}^{(2)} a_1^{(3)}$ + in a a layer

$\delta_2^{(2)} = (w_{11}^{(2)} \delta_1^{(3)} + w_{21} \delta_2^{(3)} + w_{31} \delta_3^{(3)} \ldots w_{10,1} \delta^{(3)}) a_1^{(2)} (1 - a_1^{(2)})$

$= (.5(.8606) + .5(.8606) + .5(-.1394) + .5(.8606) \ldots)(.8803)(.1197)$

$= .4561$

$\delta_3^{(2)}$ = same weights, same error $= .4561$

$\delta_4^{(3)} = .4561$

$w_{10}^{(2)} = w_{10}^{(2)} - \alpha(d(3)_1 \, a_0^{(2)})$

$= .5 - .05(.1032 \cdot 1)$

$\boxed{= .4948}$

$w_{20}^{(2)} = .5 - .05(.1032 \cdot 1)$

$\boxed{= .4948}$

$w_{30}^{(2)} = .5 - .05(-.0167 \cdot 1)$

$\boxed{= .5008}$

$w_{40}^{(2)} \longrightarrow w_{10,0}^{(2)} = w_{10}^{(2)} = \boxed{.4948}$

↳ all modified the same

$w_{11}^{(2)} = w_{21}^{(2)} = w_{41}^{(2)} \ldots w_{10,1}^{(2)} = w_{11}^{(2)} - \alpha(d(3)_1 \cdot a_1^{(2)})$

$= .5 - .05(.1032 \cdot .8803)$

$\boxed{= .4955}$

$w_{31}^{(2)} = w_{31}^{(2)} - \alpha(d(3)_3 \cdot a_1^{(2)})$

$= .5 - .05(.1032 \cdot .8803) \boxed{= .5007}$

$$w_{12}^{(2)} = w_{22}^{(2)} = w_{42}^{(2)} \cdots w_{10,2}^{(2)} = w_{12}^{(2)} - \alpha(d(3) \cdot a_1^{(2)})$$
$$= .5 - .05(.1032 \cdot .8803)$$
$$\boxed{= .4959}$$

$$w_{32}^{(2)} = .5 - .05(-.0167 \cdot .8803) \boxed{= .5007}$$

$$w_{13}^{(2)} = w_{23}^{(2)} = w_{43}^{(2)} \cdots w_{10,3}^{(2)} = .5 - .05(.1032 \cdot .8803) \boxed{= .4959}$$

$$w_{33}^{(2)} = .5 - .05(-.0167 \cdot .8803) \boxed{= .5007}$$

$$w_{14}^{(2)} = w_{24}^{(2)} = w_{44}^{(2)} \cdots w_{10,4}^{(2)} = .5 - .05(.1032 \cdot .8803) = \boxed{.4959}$$

$$w_{44}^{(2)} = .5 - .05(-.0167 \cdot .8803) \boxed{= .5007}$$

$$d(2) = \delta^{(2)} (a^{(2)})(1 - a^{(2)})$$
$$= [.4156(1)(1-1), .4156(.8803)(1-.8803), \text{''}, \text{''}]$$
$$= [.0481, .0481, .0481, .0481]$$

truncate $\Rightarrow [.0481, .0481, .0481]$ ← derivative of 1 is 0

$$w_{10}^{(1)} = w_{10}^{(1)} - \alpha(d(2) \cdot a_0^{(1)})$$
$$= .5 - .05(.0481 \cdot 1)$$
$$\boxed{= .4976}$$

$$w_{20}^{(1)} = w_{10}^{(1)} = w_{30}^{(1)} = .5 - .05(.0481) = \boxed{.4976}$$

use same #'s

$$w_{11}^{(1)} = w_{21}^{(1)} = w_{31}^{(1)} = w_{11}^{(1)} - \alpha(d(2) \cdot a_1^{(1)})$$
$$= .5 - .05(.0481 \cdot .8803)$$
$$= .4986$$

$$w_{12}^{(1)} = w_{22}^{(1)} = w_{(3)(2)}^{(1)} = w_{12}^{(1)} - \alpha(d(2) \cdot a_2^{(1)})$$
$$= .5 - .05(.0481 \cdot .61)$$
$$= .4985$$

$$w_{1,3}^{(1)} = w_{2,3}^{(1)} = w_{3,3}^{(1)} = w_{1,3}^{(1)} - \alpha(\delta(2)_1 \cdot a_3^{(1)})$$
$$= .5 - .05(.0481 \cdot .47)$$
$$= .4989$$

$$w_{1,4}^{(1)} = w_{2,4}^{(1)} = w_{3,4}^{(1)} = .5 - .05(.0481 \cdot .1300) = .4991$$

$$w_{1,5}^{(1)} = w_{2,5}^{(1)} = w_{3,5}^{(1)} = .5 - .05(.0481 \cdot .57) = .4988$$

$$w_{1,6}^{(1)} = w_{2,6}^{(1)} = w_{3,6}^{(1)} = .5 - .05(.0481 \cdot 0) = .5$$

$$w_{1,7}^{(1)} = w_{2,7}^{(1)} = w_{3,7}^{(1)} = .5 - .05(.0481 \cdot .48) = .4988$$

$$w_{1,8}^{(1)} = w_{2,8}^{(1)} = w_{3,8}^{(1)} = .5 - .05(.0481 \cdot .22) = .4995$$