Solution: The output y is given by the function:

Given some non-linear function g, calculate $\nabla_w y$. Don't forget to use δ 's.

 $y = g(s_u) = g(w_{hu}h + w_{xy}x) = g(w_{hy}g(s_h) + w_{xy}x) = g(w_{hy}g(w_{xh}x) + w_{xy}x)$ To calculate ∇y we need all the partial derivatives $\frac{\partial y}{\partial w_h}$, $\frac{\partial y}{\partial w_{hn}}$, $\frac{\partial y}{\partial w_{rn}}$. We'll start

To calculate
$$\nabla y$$
 we need all the partial derivatives $\frac{\partial y}{\partial w_h}$, $\frac{\partial y}{\partial w_{hy}}$, $\frac{\partial y}{\partial w_{xy}}$. We'll start with the ones closest to the output.

 $\frac{\partial y}{\partial y} = \frac{\partial y}{\partial y} = \frac{\partial y}{\partial x_h}$

$$\frac{\partial y}{\partial w_{hy}} = \frac{\partial y}{\partial s_y} \cdot \frac{\partial s_y}{\partial w_{hy}} = g'(s_y)h = \delta_y h$$

$$egin{align} rac{\partial y}{\partial w_{hy}} &= rac{\partial y}{\partial s_y} \cdot rac{\partial s_y}{\partial w_{hy}} = g'(s_y)h = \delta_y h \ & rac{\partial y}{\partial w_{hy}} &= rac{\partial y}{\partial s_y} \cdot rac{\partial s_y}{\partial w_{hy}} = g'(s_y)x = \delta_y x
onumber \end{align}$$

$$\frac{\partial y}{\partial w_{xy}} = \frac{\partial y}{\partial s_y} \cdot \frac{\partial s_y}{\partial w_{xy}} = g'(s_y)x = \delta_y x$$

$$\frac{\partial y}{\partial w_{xh}} = \frac{\partial y}{\partial s_y} \cdot \frac{\partial s_y}{\partial w_{xh}} = g'(s_y) \frac{\partial}{\partial w_{xh}} (w_{hy}h + w_{xy}x)$$

$$\frac{\partial y}{\partial w_{xh}} = \frac{\partial y}{\partial s_y} \cdot \frac{\partial s_y}{\partial w_{xh}} = g'(s_y) \frac{\partial}{\partial w_{xh}} (w_{hy}h + w_{xy}x)$$

$$\frac{\partial w_{xh}}{\partial w_{xh}} = \frac{\partial}{\partial s_y} \cdot \frac{\partial}{\partial w_{xh}} = g(s_y) \frac{\partial}{\partial w_{xh}} (w_{hy}n + w_{xy}x)$$

$$= g'(s_y) (\frac{\partial}{\partial s_y} (w_{hy}g(s_h)) \frac{\partial s_h}{\partial w_{xh}} + \frac{\partial}{\partial w_{xh}} w_{xy}x)$$

$$= g'(s_y)(\frac{\partial}{\partial s_h}(w_{hy}g(s_h))\frac{\partial s_h}{\partial w_{xh}} + \frac{\partial}{\partial w_{xh}}w_{xy}x)$$

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$$= w_{hy}g'(s_h)g'(s_h)\frac{\partial s_h}{\partial w_{xh}}$$

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$$= w_{hy}g'(s_y)g'(s_h)\frac{\partial (w_{xh}x)}{\partial w_{xh}}$$

 $= w_{hu}q'(s_u)q'(s_h)x = w_{hu}\delta_uq'(s_h)x$