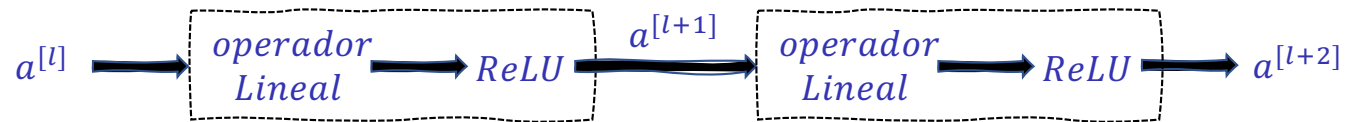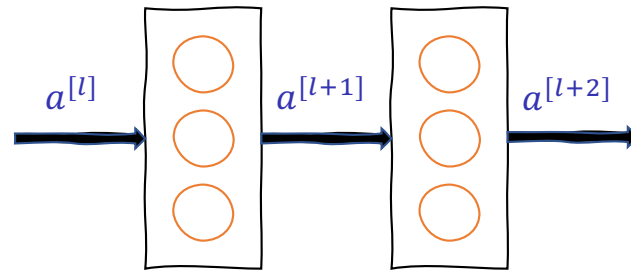# Redes Neuronales Convolucionales

Residual Networks

Francisco Cervantes
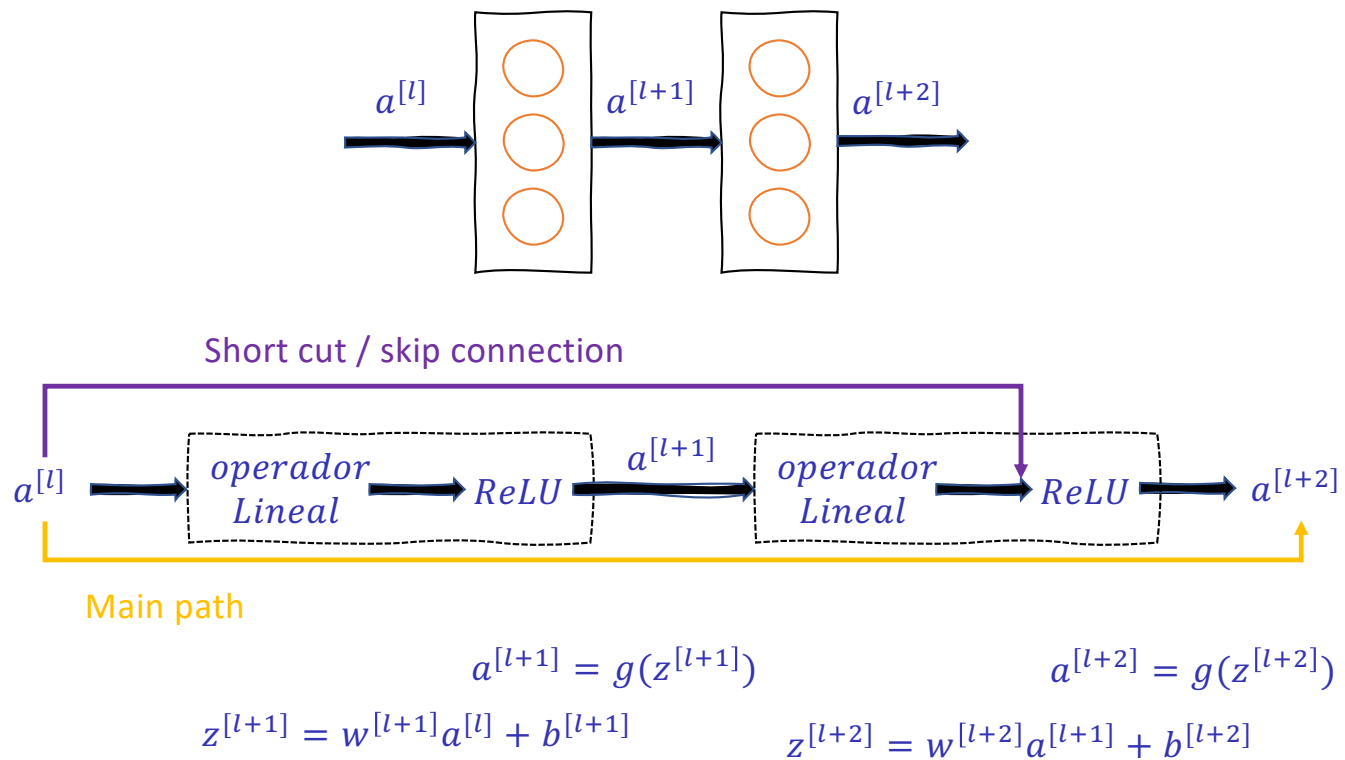
Octubre, 2019

ResNet (He et al., 2015)

$$a^{[l+1]} = g(z^{[l+1]}) \qquad\qquad a^{[l+2]} = g(z^{[l+2]})$$

$$z^{[l+1]} = w^{[l+1]}a^{[l]} + b^{[l+1]} \qquad\qquad z^{[l+2]} = w^{[l+2]}a^{[l+1]} + b^{[l+2]}$$

ResNet (He et al., 2015)

Short cut / skip connection

$a^{[l]}$ → operador Lineal → ReLU → $a^{[l+1]}$ → operador Lineal → ReLU → $a^{[l+2]}$

Main path

$$a^{[l+1]} = g(z^{[l+1]}) \qquad\qquad a^{[l+2]} = g(z^{[l+2]})$$

$$z^{[l+1]} = w^{[l+1]}a^{[l]} + b^{[l+1]} \qquad z^{[l+2]} = w^{[l+2]}a^{[l+1]} + b^{[l+2]}$$

ResNet (He et al., 2015)

Short cut / skip connection

$$a^{[l]} \rightarrow \boxed{\substack{operador \\ Lineal}} \rightarrow ReLU \rightarrow a^{[l+1]} \rightarrow \boxed{\substack{operador \\ Lineal}} \rightarrow ReLU \rightarrow a^{[l+2]}$$

Main path

$$a^{[l+2]} = g(z^{[l+2]} + a^{[l]})$$

$$a^{[l+1]} = g(z^{[l+1]})$$

$$\overline{a^{[l+2]} = g(z^{[l+2]})}$$

$$z^{[l+1]} = w^{[l+1]}a^{[l]} + b^{[l+1]}$$

$$z^{[l+2]} = w^{[l+2]}a^{[l+1]} + b^{[l+2]}$$

Residual Network

Red simple

x $a^{[l]}$

Red residual

x $a^{[l]}$
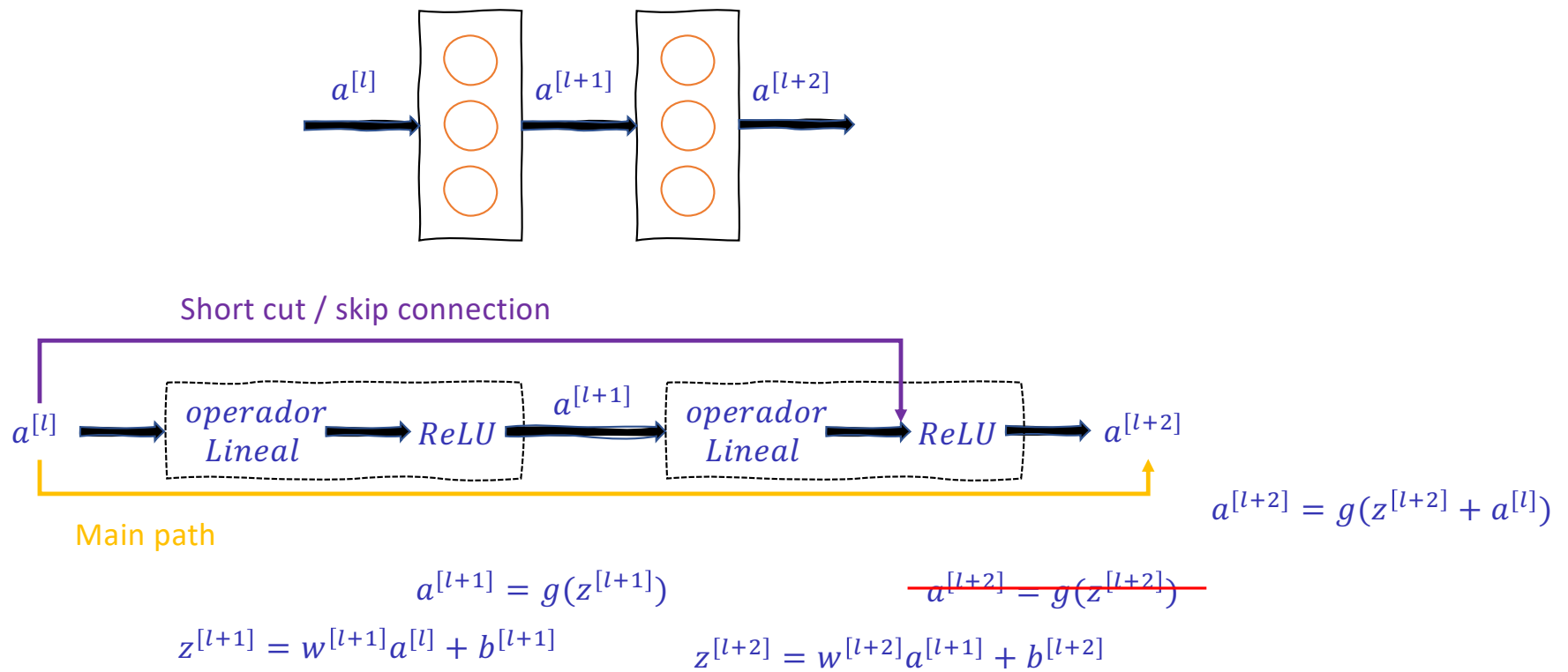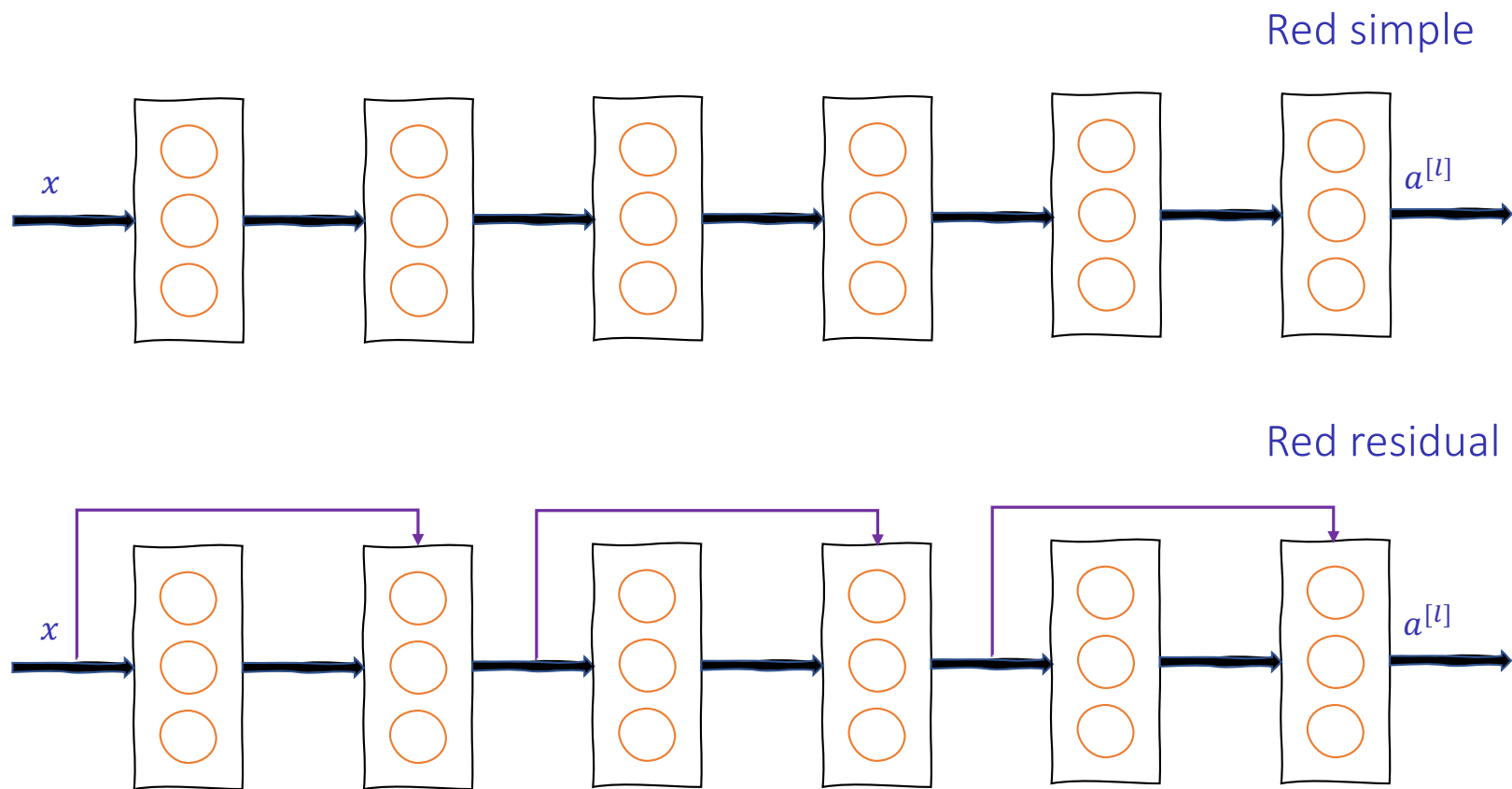
Residual Network

Red simple

Red residual