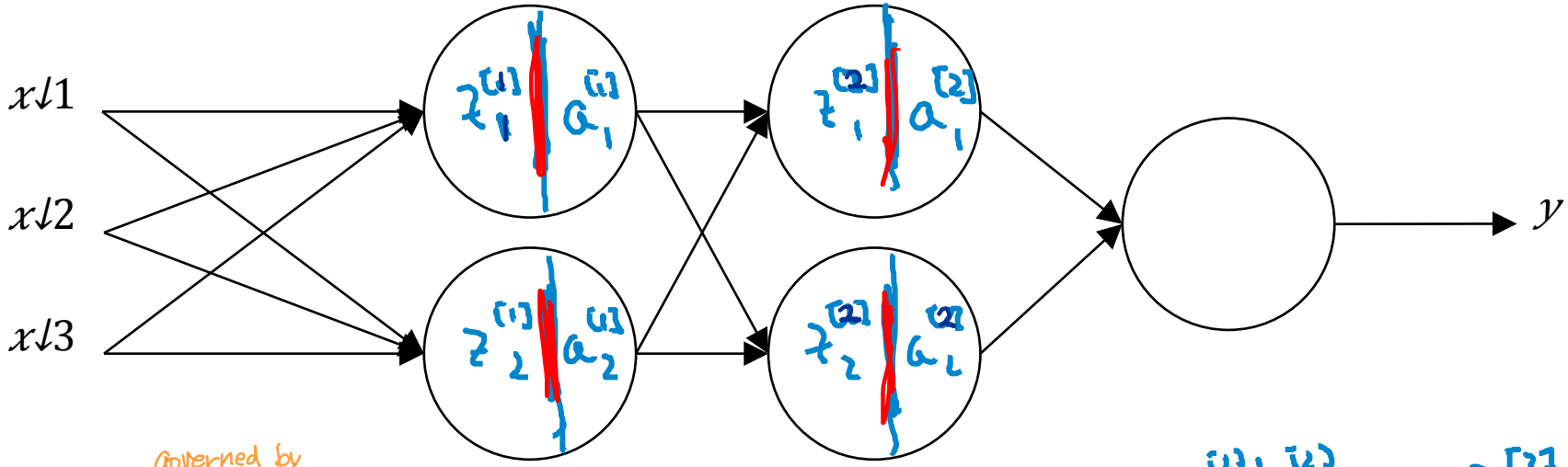
deeplearning.ai

Batch Normalization

Fitting Batch Norm into a neural network

Adding Batch Norm to a network



governed by

$X \rightarrow z^{[1]} \xrightarrow[\text{Batch Norm (BN)}]{\beta^{[1]}, \gamma^{[1]}} \tilde{z}^{[1]} \rightarrow a^{[1]} = g^{[1]}(\tilde{z}^{[1]}) \rightarrow z^{[2]} \xrightarrow[\text{BN}]{\beta^{[2]}, \gamma^{[2]}} \tilde{z}^{[2]} \rightarrow a^{[2]} \rightarrow \dots$

Parameters: $w^{[1]}, b^{[1]}, w^{[2]}, b^{[2]}, \dots, w^{[L]}, b^{[L]}, \beta^{[1]}, \gamma^{[1]}, \beta^{[2]}, \gamma^{[2]}, \dots, \beta^{[L]}, \gamma^{[L]}$

$\rightarrow \beta$

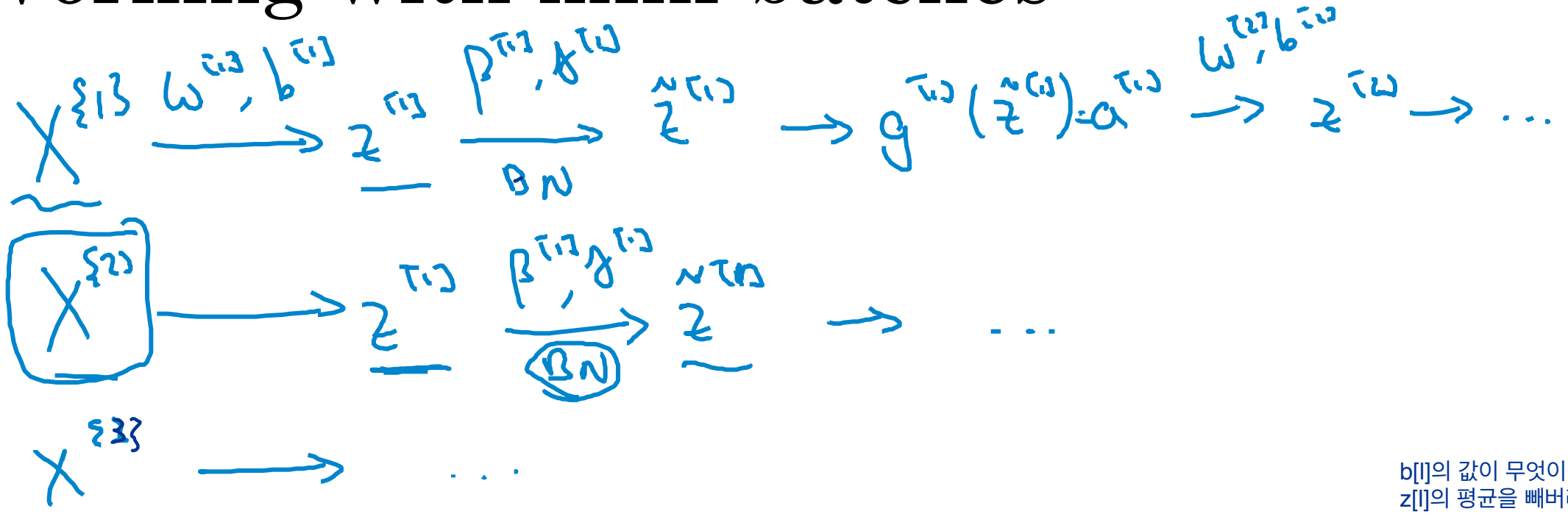
$d\beta^{[2]}$

$\beta^{[2]} = \beta^{[2]} - \alpha\, d\beta^{[2]}$

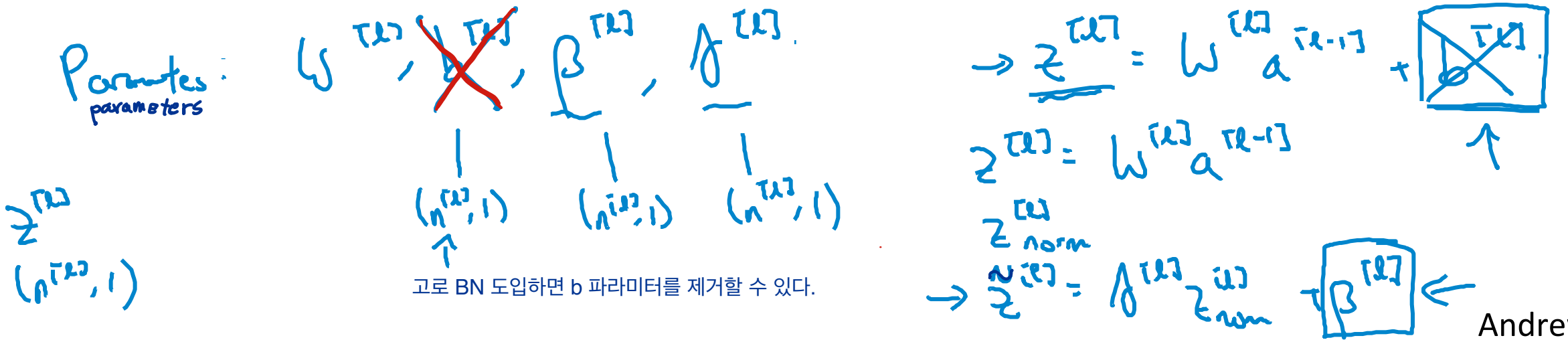
tf.nn.batch-normalization

Andrew Ng

Working with mini-batches



b[l]의 값이 무엇이건 간에 BN 과정에서 z[l]의 평균을 빼버리기 때문에 소용없는 값이 되어 버린다.



고로 BN 도입하면 b 파라미터를 제거할 수 있다.

Andrew Ng

Implementing gradient descent

for $t = 1 \ldots$ numMiniBatches

Compute forward prop (propagation) on $X^{\{t\}}$.

In each hidden layer, use BN to replace $z^{[l]}$ with $\tilde{z}^{[l]}$.

Use backprop to compute $dw^{[l]}$, ~~$db^{[l]}$~~, $d\beta^{[l]}$, $d\gamma^{[l]}$

Update parameters $w^{[l]} := w^{[l]} - \alpha\, dw^{[l]}$

$\beta^{[l]} := \beta^{[l]} - \alpha\, d\beta^{[l]}$

$\gamma^{[l]} := \ldots$ ←

Works w/ momentum, RMSprop, Adam.