

## Batch Normalization

## Batch Norm at test time

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$$\mu = \frac{1}{m} \sum_{i} z^{(i)}$$

$$\sigma^{2} = \frac{1}{m} \sum_{i} (z^{(i)} - \mu)^{2}$$

$$Z_{\text{norm}}^{(i)} = \frac{z^{(i)} - \mu}{\sqrt{\sigma^{2} + \varepsilon}}$$

$$\tilde{z}^{(i)} = \gamma z_{\text{norm}}^{(i)} + \beta$$

$$M, \in^{2}$$
: estimate way exponetially weighted average (across unini-hartely).  $X^{S13}, X^{S13}, X^{S13}, X^{S13}, \dots$ 
 $M^{S13}, X^{S13}, X^{S13}, \dots$ 
 $M^{S13}[I]$ 
 $M^{S2}[I]$ 
 $M^{S2}$