Homework4

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1.

- y1=$(w_{11}x_{11} + ... + w_{14}x_{14}) + (w_{21}x_{21} + ... + w_{24}x_{24}) + (w_{31}x_{31} + ... + w_{34}x_{34}) + (w_{41}x_{41} + ... + w_{44}x_{44}) = 765$
- y2=$(w_{11}x_{12} + ... + w_{14}x_{15}) + (w_{21}x_{22} + ... + w_{24}x_{25}) + (w_{31}x_{32} + ... + w_{34}x_{35}) + (w_{41}x_{42} + ... + w_{44}x_{45}) = 1785$
- y3=$(w_{11}x_{21} + ... + w_{14}x_{24}) + (w_{21}x_{31} + ... + w_{24}x_{34}) + (w_{31}x_{41} + ... + w_{34}x_{44}) + (w_{41}x_{51} + ... + w_{44}x_{54}) = 510$
- y4=$(w_{11}x_{22} + ... + w_{14}x_{25}) + (w_{21}x_{32} + ... + w_{24}x_{35}) + (w_{31}x_{42} + ... + w_{34}x_{45}) + (w_{41}x_{52} + ... + w_{44}x_{55}) = 1020$

2.

- The first two options will not be affected since the first layer is fully connected. As all images changing in the same way, the $\sum x_i wi$ will not change so those two network will not be impacted.
- The last two options will be affected. Since the local connectivity is changed, the convolution neural network will not be able to identify changed images.

3.

- $\Delta\omega_i = -\epsilon \times \frac{dE}{d\omega_i} = -\epsilon \times \frac{dz}{d\omega_i} \times \frac{dE}{dz} = -\epsilon \times x_i \times \frac{dE}{dz} = -\epsilon \times x_i \times y \times (1-y) \times \frac{dE}{dz}$ $= -\epsilon \times x_i \times y \times (1-y) \times -(t-y) = -\epsilon y \times x_i \times (1-y) \times (y-t)$
- finally substitute y with $\frac{1}{1+e^{-\sum w_i x i}}$
- $\Delta\omega_i = -\epsilon \frac{1}{1+e^{-\sum w_i x i}} \times x_i \times (1 - \frac{1}{1+e^{-\sum w_i x i}}) \times (\frac{1}{1+e^{-\sum w_i x i}} - t)$

4.

- If we do this, then [2 1 0] can no longer encodes "aab" but also could be "aba" or "baa", so there is information loss; therefore the answer is "C".