Mat Factorization

- Weight regularization $J = \cancel{y_b} - t \log a_3^{(2)} - (1-t)\log(1-a^{(2)}) + \lambda \|W\|^2$ $\cancel{\|W\|}$

$$\frac{\partial}{\partial w_{ij}^{(2)}} \lambda \|w\|^2 = \lambda {w_{ij}^{(2)}}^2 = 2\lambda w_{ij}^{(2)}$$

$f(w) = w^2$ $\quad w_0 = (-2)$

$f'(w) = w$ $\quad w_1 = -2 - (0.1 \cdot (-2))$

$w = w - \lambda w$ $\quad = -2 - (-0.2) = -1.8$

$w_2 = -1.8 - (0.1 \cdot (-1.8))$

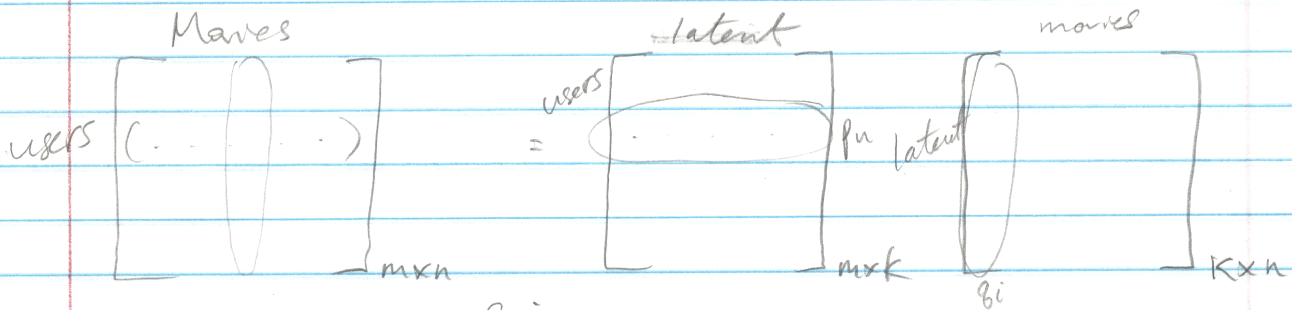
$= -1.8 - (\overset{-0.18}{\cancel{0.1 \cdot 0}})$

$= -1.62$

$w_0 = 2$

$w_1 = 2 - 0.1 \cdot 2$

$= 1.8$



$$J = \min_{p,q,b} \sum_{(u,i)\in K} (\overbrace{r_{ui} - \cancel{\mu} - b_u - b_i - p_u^T q_i}^{e_{ui}})^2 + \lambda\left(\|p_u\|^2 + \|q_i\|^2 + b_u^2 + b_i^2\right)$$

$$\frac{\partial J}{\partial b_u} = 2(r_{ui} - b_u - b_i - p_u^T q_i)(-1) + 2\lambda b_u$$ ← sum over all i

$$\frac{\partial J}{\partial b_i} = 2(\underbrace{r_{ui} - b_u - b_i - p_u^T q_i}_{e_{ui}})(-1) + 2\lambda b_i$$ ← sum over all u

$$\frac{\partial J}{\partial p_u} = 2(e_{ui})\, q_i\, (-1) + 2\lambda p_u$$

* needs to be a multiplication

$$\frac{\partial J}{\partial q_i} = 2(e_{ui})\, p_u\, (-1) + 2\lambda q_i$$

$$\frac{\partial J}{\partial p_u} = 2\sum_{i=0}^{n\_movies}(e_{ui} q_i) = \text{movies\_mat} \overset{x}{(\cancel{\text{dot}})} \text{Err\_fix}^T + \lambda(\text{users\_mat}) \cancel{\lambda}$$

$$\frac{\partial J}{\partial q_i} = \text{users\_mat}^T \overset{\text{dot}}{x} \text{Err\_fix} + \lambda(\text{movies\_mat})$$