$$=-u_0+\sum_t \hat{y}_t u_t$$

$$= - Uy + U\hat{y} = U(\hat{y} - y)$$

$$\frac{\omega = 0}{\delta \left( -u \nabla v_c + \log \sum_{i=1}^{\infty} e^{u \nabla v_i} \right)}$$

$$=-v_c+\hat{y}_ov_c$$

$$\frac{\partial \left(-u_{0}^{T}v_{c}+\frac{\log \sum e^{u_{0}^{T}v_{c}}}{2}\right)}{\partial u_{0}}$$

$$= \omega + \frac{e^{u_{0}^{T}v_{c}}}{\sum_{e}e^{u_{0}^{T}v_{c}}}$$

$$=\hat{J}_{\omega}$$

$$U: [D \times |W|]$$

$$V'_{c} = V_{c} [0 \circ 0 \circ 0] [1 \times |W|]$$

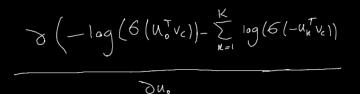
$$\frac{\partial J}{\partial U} = V_{c} + V_{c} \int_{[D \times |W|]}^{A} [1 \times |W|]$$

$$\frac{(e^{\alpha})' = e^{\alpha} (e^{\alpha} + 1) - (e^{\alpha}) (e^{\alpha})}{(e^{\alpha} + 1)^{2}} = \frac{e^{\alpha} (e^{\alpha} + 1 - e^{\alpha})}{(e^{\alpha} + 1) (e^{\alpha} + 1)}$$

$$=\frac{e^{n}}{e^{n}+1}\times\frac{1}{e^{n}+1}=6(n)(1-6(n))$$

$$= \frac{-6(u_0^T v_c)(1-6(u_0^T v_c))u_0}{6(u_0^T v_c)(1-6(u_0^T v_c))(-u_0)} - \frac{\kappa}{6(-u_0^T v_c)(1-6(u_0^T v_c))(-u_0)}$$

$$=-(1-6(u_0^Tv_c))u_0+\sum_{n=1}^{K}(1-6(u_n^Tv_c))u_n$$



$$= \frac{-6(u \cdot \nabla c)(1 - 6(u \cdot \nabla c)) \vee e}{6(u \cdot \nabla c)} - 0$$

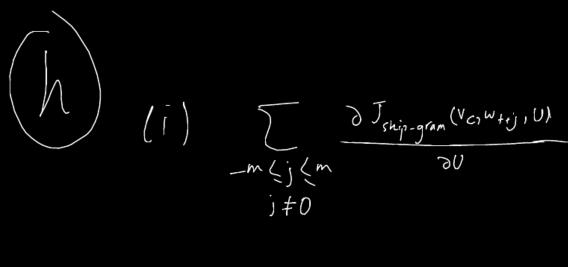
$$= -(1 - 6(u \cdot \nabla c)) \vee c$$

$$= 0 - \frac{6(-u_{\kappa}^{T}v_{c})(1-6(-u_{\kappa}^{T}v_{c}))(-v_{c})}{6(-u_{\kappa}^{T}v_{c})}$$

more efficient because this approach computes over u samples (O(U)) but in naive robtness computing the denominator costs O(IVI) and we know that KK(IVI

$$= 0 - (5) \left( \frac{6(-u_{N}^{T}v_{L})(1-6(-u_{N}^{T}v_{c}))(-v_{c})}{6(-u_{N}^{T}v_{L})} + 0 \right)$$

$$= 5(1-6(-u_k^T v_c)) v_c$$



Thip-gram (Vc, W+i), U)

-m (j (m)

j +0

(111)

One thing that can easily be seen is analogy of king: male:: queen: female. Also proximity of similar words such as "female" and "woman" is visible.

