CSE 250A. Assignment 8 Solutions

Out: *Tue Nov 16*
Due: *Tue Nov 23*

8.1 EM algorithm for binary matrix completion

(a) **Sanity check**

You may paste screenshot of output to cover these tables (instead of filling them).

Rec (%)	Title

Rec (%)	Title

Rec (%)	Title

(b) **Likelihood**

$$P\left(\left\{R_j = r_j^{(t)}\right\}_{j \in \Omega_t}\right) \quad =$$

(c) **E-step**

$$P\left(Z = i \,\middle|\, \left\{R_j = r_j^{(t)}\right\}_{j \in \Omega_t}\right) \quad =$$

(d) **M-step**

(e) **Implementation**

iteration	log-likelihood $\mathcal{L}$
0	-27.0358
1	-17.5604
2	
4	
8	
16	-14.2638
32	
64	
128	
256	

(f) **Personal movie recommendations**

(g) **Source code**

8.2 Mixture model decision boundary

(a) **Posterior probability**

$$P(y = 1|\vec{x}) \quad =$$

(b) **Decision boundary**

(c) **Shifting hyperplane**

8.3 Gradient ascent versus EM

(a) **Log likelihood**

(b) **Gradient**

(c) **Noisy-OR**

(d) **Chain rule**

(e) **Gradient ascent versus EM**

8.4 Similarity learning with logistic regression

(a) **Inference for similar examples**

(b) **Inference for dissimilar examples**

(c) **E-Step**

( ) $P(y = 1|\vec{x}, \vec{x}', s=1) =$

( ) $P(y' = 1|\vec{x}, \vec{x}', s=1) =$

( ) $P(y = 1|\vec{x}, \vec{x}', s=0) =$

( ) $P(y' = 1|\vec{x}, \vec{x}', s=0) =$

(d) **Log-likelihood**

(e) **M-step**

8.5 Logistic regression across time

(a) **Likelihood**

$$\alpha_{j,t+1} \quad =$$

(b) **Most likely hidden states**

$$\ell^*_{j,t+1} \quad =$$

(c) **Prediction**

for $t = 1$ to $T-1$

  for $j = 0$ to 1

    $\Phi_{t+1}(j) \;=\; \text{argmax}_{i \in \{0,1\}} \Big[\qquad \Big]$

for $t = T-1$ to 1

  $y^*_t \;=\; \Big[\qquad \Big]$