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**Algorithm 1**UMIETM batch learning algorithm

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1: initiate the topic label and the statistics
2: for  $i = 1 : I_1$  do
3:   for  $u$  in user set  $\mathcal{U}$  do
4:     for  $n = 1 : P_u$  do
5:       sample profile's hidden topic  $s_{un}$  by
        (1)
6:       update  $s_{un}, c_{u,k}^{(p)}$  and  $c_{k,v}^{(p)}$ 
7:   for iteration  $i = 1 : I_2$  do
8:     for  $t = 1 : T$  do
9:       for  $u$  in user set  $U_t$  do
10:        for  $d = 1 : D_u$  do
11:          sample  $y_{ud}$  and  $z_{ud}$  by (2), (3)
12:          if  $y_{ud} = 0$  then
13:            update  $z_{ud}, y_{ud}, c_u^{(0)}, c_{u,k}^{(0)}, c_{k,v}^{(0)}$ 
14:          else
15:            update  $z_{ud}, y_{ud}, c_u^{(1)}, c_{t,k}^{(1)}, c_{t,k,v}^{(1)}$ 
16:          for  $n$  in  $1, \dots, N_{ud}$  do
17:            sample  $x_{udn}$  by (4), (5)
18:            if  $x_{udn} = 0$  then
19:              update  $x_{udn}, M_0^\rho, c_v^{(B)}$ 
20:            else
21:              update  $x_{udn}, M_1^\rho, c_{k,v}^{(0)}, c_{t,k,v}^{(1)}$ 
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**Algorithm 2**UMIETM online learning algorithm

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1: for all  $u \in \mathcal{U}$ , load  $\mathbf{p}_u$  and  $\mathbf{w}_u$ 
2: for all  $u \in \mathcal{U}, k, v$ , load  $M_0^\rho, M_1^\rho, c_{u,k}^{(p)}, c_{k,v}^{(p)},$ 
    $c_u^{(0)}, c_u^{(1)}, c_{u,k}^{(0)}, c_{k,v}^{(0)}, c_v^{(B)}$  from trained Model
    $\mathcal{M}$ .
3: for  $t = 1 : T$  do
4:   update the vocabulary for profile and tweet
5:   for iteration  $i = 1 : I_1$  do
6:     for  $u$  in user set  $\mathcal{U} \cup U_t$  do
7:       do operation as line 4 to line 5 in Al-
        gorithm 1
8:    $\mathcal{U} = \mathcal{U} \cup U_t$ 
9:   for iteration  $i = 1 : I_2$  do
10:    for  $u$  in user set  $U_t$  do
11:      do operation as line 9 to line 20 in Al-
        gorithm 1
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