

# Pseudo-code for Split and Merge

Donglai Wei

2010.4.21

## Goal

find higher log-probability  $P = \log(p(x|\lambda, \bar{z}))$

## Code

While no more changes of table assignment and dish assignment can increase P:

(I)

$$a = \text{rand}([0, 1]) \Rightarrow \begin{cases} \text{Go to Step II : Split tables} & a \in [0, \frac{1}{4}] \\ \text{Go to Step III : Merge tables} & a \in [\frac{1}{4}, \frac{2}{4}] \\ \text{Go to Step IV : Split dishes} & a \in [\frac{2}{4}, \frac{3}{4}] \\ \text{Go to Step V : Merge dishes} & a \in [\frac{3}{4}, 1] \end{cases}$$

(II) Split tables:

- (1) Randomly pick a Restaurant R, which has m tables.
- (2) Randomly pick a table t in R, which has n customers.
- (3) if(n≠1) Do 2-means++ (current: K dishes, table assignment:  $z_{t0}$ , dish assignment:  $z_{k0}$ )
  - (a) Initialization:

Randomly pick a customer C1 in from table t to form a new table (m+1) with a new dish(K+1)  
 $\Rightarrow (z_{t1}, z_{k1})$

For  $ww = \text{randperm}(\text{customers from table t except C1})$   
 $z'_{t1}$ : change  $z_{t1}$  by assigning customer ww to the new table (m+1)  
 $\text{weight}(ww) = \max\{\log(p(x|\lambda, z_{t1})) - \log(p(x|\lambda, z'_{t1})), 0\}$  (more decrease, more weight)  
End

Randomly sample another customer C2 from table t according to weight, form a new table (m+2) with a new dish(K+2)  $\Rightarrow (z_{t2}, z_{k2})$

For  $ww = \text{randperm}(\text{customers from table t except C1, C2})$   
 $z'_{t2}$ : change  $z_{t2}$  by assigning customer ww to the table (m+1), which increase the P by tmp1  
 $z''_{t2}$ : change  $z_{t2}$  by assigning customer ww to the table (m+2), which increase the P by tmp2

assign customer ww to table (m+argmax{tmp1,tmp2})  
End

(b) Iteration(2-means):

While no more changes of table assignment and dish assignment can increase P:  
b=rand([0,1])  
Switch (ceil(b\*4)):  
case 1: Randomly pick a customer from table (m+1), assign it to table (m+2) if the change increase P  
case 2: Randomly pick a customer from table (m+2), assign it to table (m+1) if the change increase P  
case 3: pick table (m+1), assign it the dish which increase P mostly  
case 4: pick table (m+2), assign it the dish which increase P mostly  
End

(4) Go back to Step I)

(III) Merge table:

(1) Randomly pick a Restaurant R, which has m tables.  
(2) While no more changes of table assignment and dish assignment can increase P:  
b=rand([0,1])  
Switch (ceil(b\*2)):  
case 1: Randomly pick a table in R, merge it to the table in R which increase P mostly  
case 2: Randomly pick a table in R, assign it the dish which increase P mostly  
End

(3) Go back to Step I)

(IV) Split dishes:

(1) Randomly pick a Restaurant dish k, which has m tables.  
(2) if(m≠1) Do 2-means++ (current: K dishes,dish assignment: $z_{k0}$ )  
(a) Initialization:

Randomly pick a table t1 in from dish k to form a new dish (K+1) $\Rightarrow z_{k1}$

For ww=randperm(tables from dish k except t1)  
 $z'_{k1}$ : change  $z_{k1}$  by assigning table ww to the new dish (K+1)  
weight(ww)=max{ $\log(p(x|\lambda, z_{k1})) - \log(p(x|\lambda, z'_{k1}))$ , 0} (more decrease,more weight)  
End

Randomly sample another table t2 from dish k according to weight,form a new dish (K+2): $z_{k2}$

For ww=randperm(tables from dish k except t1,t2)  
 $z'_{k2}$ : change  $z_{k2}$  by assigning table ww to dish (K+1), which increase the P by tmp1

$z''_{k2}$ : change  $z_{k2}$  by assigning table  $ww$  to dish  $(K+2)$ , which increase the  $P$  by  $tmp2$   
assign table  $ww$  to dish  $(K+\text{argmax}\{tmp1,tmp2\})$   
End

(b) Iteration(2-means):

While no more changes of dish assignment can increase  $P$ :  
b=rand([0,1])  
Switch (ceil(b\*2)):  
case 1: Randomly pick a table from dish  $(K+1)$ , assign it to dish  $(K+2)$  if the change increase  $P$   
case 2: Randomly pick a table from dish  $(K+2)$ , assign it to dish  $(K+1)$  if the change increase  $P$   
End

(3) Go back to Step I)

(V) Merge dishes:

(1) if( $K \neq 1$ ) Do:

While no more changes of dish assignment can increase  $P$ :  
Randomly pick a dish, merge it to the dish which increase  $P$  mostly  
End

(2) Go back to Step I)

END