Decompose Restaurant in Detail

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0) Notations

Hierarchical Dirichlet Process Model with Dirichlet-Multinomial:
Hyper-parameter:
α, γ: HDP concentration parameter
λ: Prior for Dirichlet Distribution(W:number of different words,$\phi_1, ..., \phi_W = \phi$)
Hidden Variable:
(M-step)z: Discrete assignment(t_{ji}, k_{jt} correspond to customer,table assignment in Chinese Restaurant Franchise)
(E-step)θ:Multinomial parameter
Observation:
x:$\in$(1,...W)

1) Algorithm:Decompose Restaurant (DR)

GOAL: Maximize log Probability P=$log\ p(x, z|\lambda, \alpha, \gamma)$

(i) Make Restaurant j into one table t_0 where customers following uniform distribution:
(%Thus the Probability P($t_{ji} = t_0$)=$\frac{1}{W}$)

(ii) Possible Dish=$\{Nonempty\ dishes\}$

(iii) Iterate until no customers are left in this uniform table t_0:

(a) For each dish k$\in$Possible Dish, propose to form a new table t_k out of t_0 with dish k and calculate the change ΔP_k:
(%For each customer i in t_0, sample $t_{ji} \in \{t_0, t_k\} \sim \{\frac{1}{W}, \frac{n^w_{\cdot\cdot k}+\phi}{n_{\cdot\cdot k}+W\phi}\}$)
(%Propose to form table t_k with customers whose $t_{ji} = t_k$)

(b) Sample a proposal t_{k*} according to the weight and make the new table:
(%Sample a proposal $\{t_{k_1}, ..., t_{k_K}\} \sim e^{r_{proposal}\{\Delta P_{k_1}, ...\Delta P_{k_K}\}}$)
(%$r_{proposal} > 0$, the more decrease of ΔP_k, the less propable to form table t_k)

(c) Possible Dish=Possible Dish/k_*

(iv) TKM:Local search Table/Dish(allowing new dish)+Merge dish
(%Calculate the change of P between present config and config before DR move: ΔP)

(v) Decision:
(%Accept the new config with Probability min$\{e^{r_{accept}\Delta P}, 1\}$
(%$r_{accept} > 0$, if P increase,always accept; otherwise more decrease,more likely to reject)