Re: Progress

Fu Amos <fs1984@msn.com>

Mon 2017-01-30 2:23 PM

To: Nizar Bouguila <nizar.bouguila@concordia.ca>;

Dear Doctor,

Recently I read the papers you sent to me with priority and I got some thought and questions and want to confirm with you.

From the paper **<Practical Bayesian estimation of a finite beta mixture through gibbs sampling and its applications>,** you explained a method to estimate parameters of Beta distribution using **Gibbs sampling**. From the best of my understanding, in the traditional **EM steps**, we are using **log-likelihood** to maximize parameters of the target distribution (here is Beta distribution). But actually log-likelihood is not a Bayesian method and also has some numerical problems so the **Gibbs sampling** could be a better solution because it can sampling **prior P and parameters ξ** directly and avoid numerical problems. To understand how **Gibbs sampling** works, I mentioned the following facts:

- The distribution of parameters $|\Theta$ can be derived from

$$\pi(\Theta|\mathcal{X},\mathcal{Z}) = \frac{p(\mathcal{X},\mathcal{Z}|\Theta)\pi(\Theta)}{\int p(\mathcal{X},\mathcal{Z}|\Theta)\pi(\Theta)} \propto p(\mathcal{X},\mathcal{Z}|\Theta)\pi(\Theta) \tag{10}$$

- Using Gibbs sampler, we need to find **two distributions** in order to generate new **prior P** and **new parameters ξ.**

(a) Generate $Z_i^{(t)} \sim \mathcal{M}(1; \hat{Z}_{i1}^{(t-1)}, \ldots, \hat{Z}_{iM}^{(t-1)})$
(b) Generate P from $\pi(P|\mathcal{Z}^{(t)})$
(c) Generate ξ from $\pi(\xi|\mathcal{Z}^{(t)}, \mathcal{X})$

- For calculating **π(P|Z),** we need to calculate **π(Z|P)** first since **π(P|Z) ∝ π(P)π(Z|P) (Eq. 11).** Then we got **π(P |Z) ∝ D(η1 + n1, . . . , ηM + nM) (Eq. 14)**
- For calculating **ξ,** we chose a prior which was proposed by Robert and Rousseau(2002) then we have Eq 19 & 20 ready for sampling.
- During Gibbs sampling step,you were using M-H algorithm and chose a **log-normal distribution as proposal distribution**. Then sampling from the proposal distribution and calculate the **acceptance value** based on both **target distribution** and proposal distribution.

Questions:

- In this equation, does Nj indicates the amount of observations belong to component j? In practice, can we generate Nj by simply associate one observation to the component with the highest probability?

$$\pi(\mathcal{Z}|P) = \prod_{i=1}^{N} \pi(Z_i|P) = \prod_{i=1}^{N} P_1^{Z_{i1}} \dots P_M^{Z_{iM}}$$

$$= \prod_{i=1}^{N}\prod_{j=1}^{M} P_j^{Z_{ij}} = \prod_{j=1}^{M} P_j^{n_j} \qquad (13)$$

where $n_j = \sum_{i=1}^{N} \mathbb{I}_{Z_{ij}=j}$. Then

So I realized for my topic which is asymmetric mixture model, I need to use the same idea(MC method) to replace EM to estimate unknown parameters because full Bayesian solutions estimate parameters in a way more directly based on Bayes rules. I'm not sure if my thoughts are correct, please correct me if I made any mistake. Thank you for your help!

Best regards,
Shuai

From: Fu Amos <fs1984@msn.com>
Sent: January 17, 2017 6:07 PM
To: Nizar Bouguila
Subject: Re: Progress

Thank you very much Doctor!

Best regards,
Shuai

From: Nizar Bouguila <nizar.bouguila@concordia.ca>
Sent: January 17, 2017 4:31 PM
To: Fu Amos
Subject: Re: Progress

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From: Fu Amos <fs1984@msn.com>
Sent: January 17, 2017 3:52 PM
To: Nizar Bouguila
Subject: Re: Progress

Dear Doctor,
Thank you for your time and giving me your papers about Bayesian methods, I will work on MCMC approach for asymmetric mixture model from now on. If you have time , I hope we could have a meeting every week in order to keep myself in schedule. Thank you very much!

BTW: may I have your IM account? (skype, wechat or whatsapp)

Thank you!
Shuai

From: Nizar Bouguila <nizar.bouguila@concordia.ca>
Sent: January 17, 2017 3:09 PM
To: Fu Amos
Subject: Re: Progress

Nizar Bouguila, Djemel Ziou, Ernest Monga: Practical Bayesian estimation of a finite beta mixture through gibbs sampling and its applications. Statistics and Computing 16(2): 215-225 (2006)

Nizar Bouguila, Djemel Ziou, Riad I. Hammoud: On Bayesian analysis of a finite generalized Dirichlet mixture via a Metropolis-within-Gibbs sampling. Pattern Anal. Appl. 12(2): 151-166 (2009)

Tarek Elguebaly, Nizar Bouguila: Bayesian learning of finite generalized Gaussian mixture models on images. Signal Processing 91(4): 801-820 (2011)

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From: Fu Amos <fs1984@msn.com>
Sent: January 16, 2017 5:51 PM
To: Nizar Bouguila
Subject: Re: Progress
When: January 17, 2017 3:00 PM-3:30 PM.
Where: