DATE TA TAFOROMO
TRAP 最大な多数では Z= aug max P(Z X) ~ aug max P(X,Z)
MAP最大百彩杯原 Z= aug max P(Z X) ~ aug max P(X,Z)
(+ + range) 液晶:出路 Variable Tlingingtin (VI)
(精确推断) 变量消除 Variable Timination (VE) 2种VE思想
Dellet Indpagation DI TAKA 起
e.g. Sum-Product Algorithm BP在国结构的拓展
13/377 Junction Tree Algorithm
[Loop Belief Propagation (处理环结构) =
近似推断 \ Monte Carlo Inference \ Importance sampling
LMMC: 和仍不胜新行洛
variational inference 委许能断
Variable Elimination
$\bigcirc \rightarrow \bigcirc \rightarrow$
= S P(a) P(bla) P(clb) P(dlc) (3斤海)
1般设a,b,c,d均是离散的一值 a,b,c
Bpa.b.c,d∈ {0,1}.
P(d)= P(a=0) P(b=0 a=0) P(c=0 b=0) F(d) (c=0) + 111111 +
P(a=1) (b=1 a=1) P(c=1 b=1) P(d a c=1)
= ₩ 8· 因3·顶
FORT P(d)= \(\times \times \times \) P(c1b) P(d1c) \(\times \) P(a) P(b1a)
abic bic
= \(\(P(c b) \\ \(P(c b) \\ \(P(c b) \)
c 5 (C10) 7alo/
= \$c(d) \$\frac{1}{9b(c)}\$
利用乘法对加法的分理行
VERED computation order NP-Hard
②更复计算 11/2 11/2 11/2 11/2 11/2 11/2 11/2 11/



DATE
一. Belief Propagation (凡适用于积结构)(Sum-Product)
VE Ba. Q XD
$P(e) = \sum_{n=1}^{\infty} P(a,b,c,d,e)$
= \(P(eld) \(\superpresection P(dlc) \(\superpresection P(clb) \(\superpresection P(bla) \) \(\frac{1}{a} \)
$= \sum_{\mathbf{d}} P(\mathbf{e} \mathbf{d}) \sum_{\mathbf{c}} P(\mathbf{d} \mathbf{c}) \sum_{\mathbf{c}} P(\mathbf{c} \mathbf{b}) \cdot \mathbf{m} \frac{\mathbf{d} \cdot \mathbf{b}}{\mathbf{d} \cdot \mathbf{b}} \frac{\mathbf{d} \cdot \mathbf{b}}{\mathbf{d} \cdot \mathbf{c}} $ $= \sum_{\mathbf{d}} \times \sum_{\mathbf{c}} \times \times \cdot \mathbf{m}_{\mathbf{b} \rightarrow \mathbf{c}} (\mathbf{c}) \frac{\mathbf{d} \cdot \mathbf{c}}{\mathbf{d} \cdot \mathbf{c}} \frac{\mathbf{d} \cdot \mathbf{c}}{\mathbf{c}} \frac{\mathbf{d} \cdot \mathbf{c}}{\mathbf{c}} \frac{\mathbf{d} \cdot \mathbf{c}}{\mathbf{d}} $
BATTER MONTH IN THE REST OF TH
$P(c) = \sum_{a,b,d,e} P(a,b,c,d,e)$
= (SPE16) SPUID PLA) (SP(dIC) SP(eld))
mboc (c) 前回 md→c (o) 反句
这是VE的 drawback:里庭计算
(a) AP(a,b,c,d) = \frac{1}{2} \langle (a) \cdot \gamma (b) \cdot \gamma (c) \cdot \gamma (d) \cdot \gamma (a,b) \cdot \gamma \gamma (b,c) \cdot \gamma (b,c) \gamma (b,c) \cdot \gamma (b,c) \gamma (b,c) \gamma (b,c) \gamma
P(a)= > P(a,b,c,d) Y作品分類
$P(b) = \sum_{a,c,d} P(a,b,c,d)$
$\begin{cases} P(a) = \psi_a M_{b \to a}(X_a) \end{cases}$
Mba(Xa)= 5 46 taib Mc b(Xb) Md b(Xb)
= \(\frac{1}{\sqrt{1}} \Partial \text{TT } \mathbb{M}_{\kappa \rightarrow \beta}(\text{Xb}) \\ \$\times N(b) - \alpha \text{\$\exititt{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$\
线站的舒展

DATE		S M T	T W T F
如何计算边缘概率?	(AMas	ria on	Morning.
$P(Xi) = Y_i T m_{k \to i} (Xi)$ $k \in NB(i), NB is ne$	ighbor"	77.10	
and the second s			. 360
$m_{j \to i}(x_i) = \sum_{x_j} \frac{y_{ij}}{y_j} \frac{y_j}{y_j} \prod_{k \in NB}$	(0) 1	1846 = 6	(AV A
边的帮能函数 点的	势能函数	100 -7	,
弘避免VE中的"重复计算"问题,	只需要抵所有的 M	知即可计算	算所有的边缘
而对于BP算法:BP=VE+Caching=1	nii导从边缘概率=	=图的遍历	717777
			/Azan Kir
$m_{b \to a} = \sum Y_{ab}$ belief (b), the state of (b):从6出发一支有多	少信息量	14V	
Mb+a:从b到q的路行	山影送给《网信息	量	
		Telus:	- carl Date
BP (Sequential Implementation)		15° 70	역 전
对一棵和树	get root (Phiko	是根结点	
, ,	. collect msg	(逆归)	遊线
	distribute msq	(通2)	4230
Collect Msg:/* 递归收集消息*/	A . AZ		<u> </u>
for Xi in NB(root)	OTHER LAND	Alban APA	`Q
collect Msg (Xi)	Mill warn	MM	
BP (Parallel Implementation)	Of H Wall t	Man shall	
Q	FINT Y WW		
ndam) Strack St	该结点的消息		
0 0 0 把目前保存的	催息分发给舒结点 .	1 1887	Noti
这个并行的算法	会使整个系统收敛		(1 p. s.
			V
Little / Ex	22-1-0101	in the last	

A. I-Charles have

DATE 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	4 500 200
= . Max-Product Algorithm	8 3 30 3 1 CM
Graph = [X E]	6,111
(1) 地路相談 E={e,,ex} P(E) likelihood	(1/2) 名元随机变量
(II) 新作格字 P(X E) posterior	X=(Y,Z) 多元随机变量
(M) MAP $\hat{\chi} = \operatorname{argmax} P(X E)$	P(Y/E)=ZP(X/E)
Ŷ= argmax P(Y/E) ←	At Burner
$= \operatorname{avgmax} \sum P(X E)$	yes yt yes
The state of the s	\(\frac{1}{2}\)\(\frac{1}{2}\)\(\frac{1}{2}\)\(\frac{1}{2}\)
>>> >>> >>> >>> >>> >>> >>> >>> >>> >>	
Viterbi 1	*** **** ***
与对於积 为	Xt1 Xt Xt11
而对3 Max-Roduct:	
0是即的改进	X rai seral Tupla &
②是 Viterbi 的 沒化	MIGHT XX -E
mbon (XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
Mbg: AEIL P(Xb, Xc, Xd E) E: evi	dence
达到 max 的值	(a) y ProgNan
mal: 结过c结点的证 P(XclE)达到x	Nax的值
mini = max Yi Yii ∏ Mk→1	
	Mill St. Comments
Note: $\overrightarrow{X} \xrightarrow{BP}$: $\overrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow{X} \xrightarrow$	max P(a,b,c,d)
e.g. max ya yba xj	= max 络· Mb→a 第30的函数
e.g. $mc \rightarrow b = mox \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	美和的函数
mboa = max 464ab mosb masb	
b的迅数	

精确推断总结	, ;
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	S	M	T	W	T	F	
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AND 12 0 12 0 12 0 12 0 12 10 1	S •	M 0	T W		0
1、Max-Product是一种动态机划,要求每一个分词是看	附近到相	6率	人	 	
2. Snm-Product 与 Max-Product 附区刻:					
都是图的精确推断					
max-product 就是sum-product 把粉布符	号换成 max				
为由绿椒泽					
$\rho(X_i) = \psi_i \prod m_{j \to i}(X_i)$					
$P(X_{i}) = Y_{i} \prod_{\substack{i \in NB(i) \\ k \in NB(i)}} M_{j \to i}(X_{i})$ $M_{j \to i}(X_{i}) = \sum_{\substack{i \in NB(i) \\ X_{j} \notin K \in NB(i) = j}} M_{k \to j}(X_{j})$					
				*	
	,			-	