



Perspectives on Probabilistic **Graphical** Models

DONG LIU

Doctoral Thesis in Electrical Engineering
Stockholm, Sweden 2020

Devision of Information Science and Engineering
TRITA-EE XXXX KTH, School of Electrical Engineering and and Computer Science
ISSN SE-100 44 Stockholm
ISBN SWEDEN

Akademisk avhandling som med tillstånd av Kungl Tekniska högskolan framlägges
till offentlig granskning för avläggande av teknologie doktorsexamen i Elektroteknik
onsdag den 13 september 2017 klockan 13.15 i F3, Lindstedtsvägen 26, Stockholm.

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Tryck: Universitetsservice US AB

To my beloved

Abstract

Sammanfattning

Acknowledgements

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Acronyms and Notations

Notations

X	random variable
x	realization of the random variable X
\mathcal{X}	alphabet of the random variable X
X_i^k	random sequence (X_i, \dots, X_k)
x_i^k	realization of the random sequence X_i^k
\mathcal{X}_i^k	alphabet of the random sequence X_i^k
X^k	random sequence (X_1, \dots, X_k)
x^k	realization of the random sequence X^k
\mathcal{X}^k	alphabet of the random sequence X^k
$X_i^{k \setminus n}$	random sequence $(X_i, \dots, X_{n-1}, X_{n+1}, \dots, X_k)$
$x_i^{k \setminus n}$	realization of the random sequence $X_i^{k \setminus n}$
$\mathcal{X}_i^{k \setminus n}$	alphabet of the random sequence $X_i^{k \setminus n}$
$X^{k \setminus n}$	random sequence $(X_1, \dots, X_{n-1}, X_{n+1}, \dots, X_k)$
$x^{k \setminus n}$	realization of the random sequence $X^{k \setminus n}$
$\mathcal{X}^{k \setminus n}$	alphabet of the random sequence $X^{k \setminus n}$
$ \cdot $	set cardinality
f_X	p.d.f. of the continuous random variable X
p_X	p.m.f. of the discrete random variable X
$\mathcal{N}(\mu, \sigma^2)$	normal distribution with mean μ and variance σ^2

$D(\cdot \cdot)$	Kullback-Leibler divergence
$D_\tau(\cdot \cdot)$	τ -th order Rényi divergence
$C(\cdot, \cdot)$	Chernoff information
$E[\cdot]$	expectation
$\partial\cdot$	boundary of a closed set
$\hat{\partial}\cdot$	upper boundary of a two-dimensional closed set
$\check{\partial}\cdot$	lower boundary of a two-dimensional closed set
$\log(\cdot)$	natural logarithm

Chapter 1

Introduction

Motivate the research in probabilistic models.

1.1 Motivations

1.2 Thesis Outline

[1]

Chapter 2

Background

Background on probabilistic graphical models

2.1 Directed and Undirected graphs

.

2.2 Dealing with latent variables

Chapter 3

An alternative view of belief propagation

Content:

1. α Belief Propagation as Fully Factorized Approximation, GlobalSIP 2019.
2. α Belief Propagation for Approximate Bayesian Inference, under review.

3.1 α belief propagation

3.2 Convergence study

3.3 Experimental results

Chapter 4

Region-based Energy Neural Network Model

work in Region-based Energy Neural Network for Approximate Inference, under, review

4.1 Region-based graph and energy

4.2 RENN model for Approximate Inference

4.3 RENN model for markov random field training

4.4 Experimental results

Chapter 5

Powering the expectation maximization method by neural networks

content: Neural Network based Explicit Mixture Models and Expectation-maximization based Learning, under review

- 5.1 Normalizing flow
- 5.2 expectation maximization of neural network based mixture models
- 5.3 An alternative construction method
- 5.4 Experiments

Chapter 6

Powering Hidden Markov Model by Neural Network based Generative Models

content:

1. Powering Hidden Markov Model by Neural Network based Generative Models, ECAI 2020
2. Antoine Honore, Dong Liu, Hidden Markov Models for sepsis detection in preterm infants, ICASSP, 2020

6.1 Hidden Markov Model

6.2 GenHMM

6.3 Application to phone recognition

6.4 Application to sepsis detection in preterm infants

Chapter 7

An implicit probabilistic generative model

content: Entropy-regularized Optimal Transport Generative Models, ICASSP 2019

- 7.1 Modeling data without explicit probabilistic distribution**
- 7.2 Employing EOT for modeling**
- 7.3 Experimental results**

Chapter 8

Conclusion and Discussions

Bibliography

- [1] Dong Liu, Baptiste Cavarec, Lars K Rasmussen, and Jing Yue. On dominant interference in random networks and communication reliability. In *ICC 2019-2019 IEEE International Conference on Communications (ICC)*, pages 1–7. IEEE, 2019.