The 11th Conference of the IASC-ARS
The Asian Regional Section
of the International Association for Statistical Computing

Book of Abstracts

Imadegawa Campus
Doshisha University, Kyoto, JAPAN

21-24 Feb 2022

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https://iasc-ars2022.org/

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Data Science Everywhere:

Innovations in Statistical Computing

Preface

It is a great pleasure and honor to welcome you to the 11th regular conference of the Asian Regional Section (ARS) of the International Association for Statistical Computing (IASC).

The IASC-ARS has been established in 1993 to promote regional co-operation in pursuing the aims of the IASC. In particular, the IASC-ARS aims, in the Asia-Pacific context, to further the progress of the theory, methods, and practice of statistical computing and data science, and to foster interest and knowledge in effective and efficient statistical computing and data science.

The first regular conference of the IASC-ARS was held in Beijing in 1993, and since then, a total of 10 regular conferences have been held: Seoul (1995), Manila (1998), Busan (2002), Hong Kong (2005), Yokohama (2008), Taipei (2011), Seoul (2013), Singapore (2015) and Auckland (2017). And now, the 11th regular conference (IASC-ARS 2022) is held here in Kyoto with hybrid format. This IASC-ARS2022 was originally planned as the 12th conference, but because the 11th conference was cancelled twice due to severe local circumstances, this Kyoto conference was decided to be held as the 11th conference.

IASC-ARS2022 consists of Keynote Lecture, Invited Talk Session, Contributed Talk Session, and e-Poster Session. The theme is “Data Science Everywhere - Innovation in Statistical Computing", which is designed to discuss advanced statistical computing/computational statistics in a context where data science is becoming an essential part of any discipline. Presentations in the conference are thus cover a variety of topics in several areas and could be discussed with a very wide range of scientific audiences. To promote young statisticians, “Young Researcher/Student Award" will be given to some outstanding presentations from contributed talks and e-posters presented by young researchers/students.

IASC-ARS2022 is supported by the IASC, the Japanese Federation of Statistical Science Association and its six member societies, and the Institute of Statistical Mathematics (ISM). IASC-ARS2022 is also financially supported by the ISI Tokyo Congress Memorial Fund from the Japan Statistical Society, the grant from the ISM, Doshisha University, Kyoto city, NTT DATA Mathematical Systems Inc, and SAS Institute. We would express our gratitude to all persons and institutions who make IASC-ARS2022 possible: the colleagues from the Scientific Program Committee, the keynote and invited speakers, the

organizers of invited talk sessions and their speakers, the sponsors, Doshisha University, all staff of the conference, and all the people who contribute to the scientific program.

We believe that our IASC-ARS regular conference is a place not only for exchanging academic knowledges but also for deepening friendships with old and new friends. We would therefore hope you enjoy IASC-ARS2022 and look forward to an exciting conference.

Kyoto, February 2022

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Tempered expectation-maximization algorithm for discrete latent variable models

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The Latent Class (LC) model is one of the most well-known latent variable models; it is very popular for the analysis of categorical response variables, and it is typically used to cluster subjects, by assuming the existence of individual-specific latent variables having a discrete distribution. A Hidden (or Latent) Markov (HM) model represents a generalization of the LC model to the case of longitudinal data. It assumes the existence of a discrete latent process generally following a first-order Markov chain, corresponding to subpopulations, usually referred to as latent states. As typically happens for discrete latent variable models, despite maximum likelihood estimation of both LC and HM model parameters can be rather simply performed using the Expectation-Maximization (EM) algorithm, a well-known drawback of this estimation method is related to the multimodality of the log-likelihood function. The consequence is that the estimation algorithm could converge to one of the local maxima, not corresponding to the global

optimum.
In order to face the multimodality problem described above, we propose a Tempered EM (T-EM) algorithm, which is able to explore the parameter space adequately. It consists in rescaling the objective function depending on a parameter known as the temperature, which controls global and local maxima prominence. High temperatures allow us to explore wide regions of the parameter space, avoiding the maximization algorithm being trapped in non-global maxima; low temperatures, instead, guarantee a sharp optimization in a local region of the parameter space.
By properly tuning the sequence of temperature values, the target function is gradually attracted towards the global maximum, escaping local sub-optimal solutions.
We rely on an accurate Monte Carlo simulation study to compare the proposal with the standard EM algorithm, evaluating both the ability to hit the global maximum and the computational time of the proposed algorithm. We also show the results for both LC and HM models, using the proposal on discrete and continuous cross-sectional and longitudinal data in connection with some applications of interest. We conclude that the proposal outperforms the standard EM algorithm, significantly improving the chance to reach the global maximum in the overwhelming majority of considered cases. The advantage is relevant even considering the overall computing time.