The Research Group
Artificial Intelligence
has the honor to invite you to the public defense of the PhD thesis of

Edna Milgo

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:
Comparison of MCMC Adaptation Schemes

Promotors:
Prof. dr. Ann Nowé (VUB)
Prof. dr. Bernard Manderick (VUB)
Prof. dr. Peter Waiganjo Wagacha (University of Nairobi)

The defense will take place on
Tuesday, January 16, 2024 at 13h (CET)
and can be followed through a live stream:
https://youtube.com/live/FkAjf-anHH4

Members of the jury

Prof. dr. Viviane Jonckers (VUB, chair)
Prof. dr. Beat Signer (VUB, secretary)
Prof. dr. Jan Lemeire (VUB)
Prof. dr. Dirk Thierens (Utrecht University)
Prof. dr. Yvan Saeys (University of Ghent)
Prof. dr. Isel Grau Garcia (Technical University Eindhoven)

Curriculum vitae

Edna Milgo received her B.Sc. and M.Sc. in Computer Science from Kenyatta University-Kenya (2007) and Columbus State University-USA (2009) respectively. She is a lecturer of Computer Science at the Mathematics and Computing Department, Moi University since 2010. Edna was awarded a sandwich PhD scholarship in the VLIR-IUC program with Moi University, Kenya, to do a PhD in the AI Lab of Vrije Universiteit Brussel in the area of Bayesian Machine Learning. She previously worked at KCB bank, Tenwek Hospital and Columbus State University in ICT related roles.

Abstract of the PhD research

Markov chain Monte Carlo (MCMC) methods are used to generate samples from complex probability distributions using a proposal distribution assumed to be Gaussian in our research. Adaptive MCMC learns the covariance of the proposal during sampling.

We expound on three different principles of adaptation that can be used to improve the efficiency of MCMC samplers. The first principle is used in Adaptive Metropolis (AM), which is the benchmark adaptive MCMC. It estimates the covariance of the proposal using past samples of the chain. The second is the maximum entropy principle that adapts the covariance such that the entropy of the proposal is maximized given some constraints depending on whether the proposed sample was rejected or accepted. Third is the principle that adapts the proposal distribution such that the likelihood of generating better search points is increased. It uses a predefined target acceptance rate. The last two principles are respectively used in Gaussian Adaptation (GaA) and Covariance Matrix Adaptation Evolution Strategy (CMAES), both of which are stochastic optimization algorithms. GaA and the (1+1)-variant of CMAES are hill climbers that can be transformed in a straightforward way into MCMC samplers herein referred to as M-GaA and M-CMA respectively.

Adapting the proposal using past samples annuls the Markov property of the chain and the guarantee that the chain converges to the target. Therefore, we further sought to find the impact of diminishing adaptation in the effectiveness of the samplers. AM by design has diminishing adaption, while M-GaA and M-CMA do not. We experiment with adaptation stopped halfway and varying rates of diminishing adaptation to find the best variant. Using five performance measure, we compare AM and the best variants of M- GaA and M-CMA on a test suite of seven target distributions with dimensions ranging from 2 to 50.