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NITheCS MINI-SCHOOL:

Phylogenetic Inference and Machine Learning

Prof Martin Bucher (French National Centre for Scientific Research, France)
and Dr Japie Greeff (North-West University)

Wednesday 2, 9, 16 & 23 November 2022 | 14h00 – 15h00 SAST

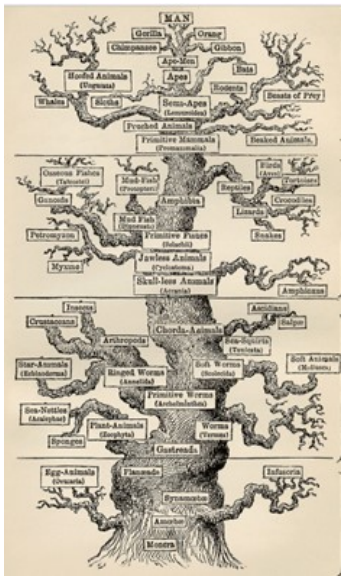
ABSTRACT

This Mini-School is linked to the NITheCS research programme '*Genomics, Bioinformatics, and Advanced Medicine*'. The theme of the first two lectures, given by Prof Martin Bucher, is the algorithmics of genomic inference. With modern genome sequencing, massive datasets have become available. How to fully exploit them remains an active area of research. The final two lectures by Dr Japie Greeff deal with applications of Artificial Intelligence and Machine Learning to problems in medicine.

LECTURE 1

Reconstructing Family Trees from Genomic Data: Basic Methods

The fundamentals of phylogenetic reconstruction are reviewed, including distance methods, parsimony, maximum likelihood, and Bayesian inference. For small datasets, these methods can be applied to all possible trees and the best solution, or most probable solutions, is found.



LECTURE 2

Reconstructing Family Trees from Genomic Data: Methods for Big Data

The methods of the last lecture are feasible for small datasets and always find the appropriately defined 'best' solution. These methods however are too slow for the large datasets now available. We discuss "heuristic" methods, which, while not guaranteed always to return the best solution, often return the best solution or a good approximation thereof. We discuss applications and future prospects.

LECTURE 3

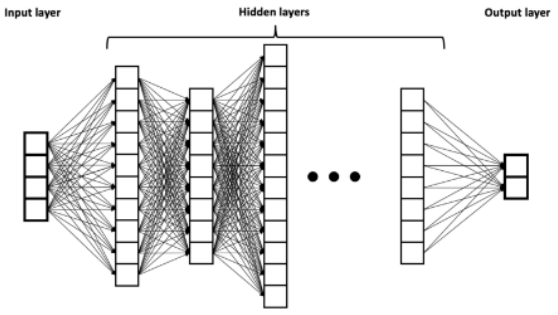
Applied Artificial Intelligence: Using AI for a Systematic Literature Review

The applications of AI are rapidly expanding. Systematic literature reviews play a major role in the medical sciences and are extremely labour intensive. We show how AI can simplify this task using semi-supervised learning. A very small amount of Python knowledge is helpful for the hands-on exercise.

LECTURE 4

Active Learning to Generate Models with Partially Labelled Data

We discuss a semi-supervised machine learning technique called Active Learning, where a fully labelled dataset is not needed to create a classification model. Instead, the act of labelling the data set will be used to train the model at the same time. A working knowledge of Python is assumed.



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BIOGRAPHIES

Prof Martin Bucher

Prof Martin Bucher is Director of Research at the French National Centre for Scientific Research (CNRS) in Paris, France, and is based at Paris Cité University. He has held various honorary and fractional professorships at the University of KwaZulu-Natal and the University of Stellenbosch.

Prof Bucher is a NITheCS Associate and an elected member of the Academy of Science of South Africa (ASSAf). He has made numerous contributions to theoretical particle physics and cosmology, and to observational cosmology. He shared the 2018 Gruber Prize in Cosmology as part of the Planck Team.

More recently, Prof Bucher co-edited with Professor Anwar Mall of the UCT Medical School a booklet on Covid-19 aimed at high school learners and teachers for ASSAf.

Dr Japie Greeff

Dr Japie Greeff is Deputy Director of the School of Computer Science and Information Systems at North-West University and Subprogram leader in Technology, Capability and Functioning at the Optentia Research Unit at North-West University. He is also a NITheCS Associate.

He holds a PhD in electronic engineering with a focus in engineering education.

His main areas of interest lie in artificial intelligence, serious game development, gamification, and the creation of technology artefacts that impact people on a human level.

MEET THE SPEAKERS AFTER THE EVENT

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