University of Amsterdam
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Programme of the 14th NETWORKS Training Week

24 – 28 October 2022, Asperen

Monday, 24 October 2022

	Regular programme, room Leerdam
10:00-12:00	Meeting of the MT NETWORKS
12:00-13:30	Arrival and lunch
13:30-14:30	Minicourse Johannes 1
14:30-15.00	Break
15.00-16.15	Introtalks / research talks new members - Shreehari Bodas (UvA, PhD, intro 5-10 minutes) - Sten Wessel (TU/e, PhD, intro 5-10 minutes) - Benoit Corsini (TU/e, PD, research 30 minutes) - Alexander van Werde (TU/e, PhD, research 30 minutes)
16.15 – 16.45	Break
16.45 – 17.45	Research presentations - Rounak Ray (TU/e, PhD) - Manish Pandey (TU/e, PhD)
18.00	Dinner
19.30-20.30	Preparatory meeting COFUND midterm with COFUND PhD students.

Research presentations

Benoit: *Local weighted optimizations*

Alexander: *Clusters within Markov chains: detection, evaluation, and spectral fingerprints*

Rounak: *t.b.a.*

Manish: *t.b.a.*

Tuesday, 25 October 2022

	Regular programme, room Leerdam	**Parallel programme**
07:30-09:00	Breakfast	
09:00-10:00	Minicourse Johannes 2	
10:00-10:30	Break	
10:30-12:00	Research presentations - Francisco Escudero (CWI) - Roel Lambers (TU/e) - Gianluca Kosmella (TU/e)	

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12:00-13:30	Lunch	
13:30-14:30	Minicourse Johannes 3	Analytic Story telling group 1 **(start at 13.00!)** - Rounak Ray - Elene Anton - Haodong Zhu - Andres Lopez Martinez - Manish Pandey - Leonidas Theocharous
14:30-15:00	Break	
15:00-16:00	Research presentations - Martin Frohn (TU/e) - Wiktor Zuba (CWI)	
16:00-16:30	Break	
16:30-18:00	• Research session: work in small groups • Meeting of the workshop committee with postdocs and staff members	
18.30	Dinner	

Research presentations

Francisco: *Grothendieck inequalities characterize converses to the polynomial method*

Roel: *t.b.a.*

Gianluca: *Designing Noise-Resistant Optical Neural Networks*

Martin: *t.b.a.*

Wiktor: *Algorithms on strings and labelled graphs*

Wednesday, 26 October 2022

	Regular programme, room Leerdam
07:30-09:00	Breakfast
09:00-10:00	Minicourse Johannes 4
10:00-10:30	Break
10:30-12:00	Research presentations - Nandan Malhotra (UL) - Federico Capannoli (UL) - Frank den Hollander (UL)
12:00-13:30	Lunch
13:30-14:30	Minicourse Guus 1
14:30-15:00	Break
15:00-16:00	Research presentations - Nikki Levering (UvA) - Tom Pijnappel (TU/e)
16:00-18:00	Social event + dinner

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Research presentations

Nandan: *t.b.a.*

Federico: *t.b.a.*

Frank: *t.b.a.*

Nikki: *The externalities in an M/G/1 queue with LCFS-PR service discipline*

Tom: *Online Positioning of a Drone-Mounted Base Station in Emergency Scenarios.*

Thursday, 27 October 2022

NOTE: the midterm review of COFUND – PhD will take place!

	Regular programme, room Leerdam	**Parallel programme**
07:30-09:00	Breakfast	
09:00-10:00	Minicourse Guus 2	COFUND Management session: - Mark de Berg - Michel Mandjes - Marieke Kranenburg - Frits Spieksma
10:00-10:30	Break	
10:30-12:00	Research presentations - Davi Castro Silva (CWI) - Philip Verduyn Lunel (CWI) - Noela Müller (TU/e)	Cofund PhD students
12:00-13:00	Lunch	Lunch MT and EU project coordinator
13:00-14:00	Minicourse Guus 3	
14.00-14.30	Research presentation: - Roshan Mahes (UvA)	Analytic Story telling groep 2 - Wessel Blomerus - Francisco Escudero - Noela Muller - Marta Milewska - Rowel Gündlach - Martin Frohn
14.30-15.00	Break	
15:00-18:00	Research session: work in small groups	

Research presentations

Davi: *Noisy decoding by shallow circuits*

Philip: *Quantum entanglement, edge-transitive graphs and semidefinite optimization*

Noela: *t.b.a.*

Roshan: *Dynamic and Adaptive Appointment Scheduling*

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Friday, 28 October 2022

	Regular programme, room Leerdam
07:30-09:00	Breakfast
09:00-10:00	Minicourse Guus 4
10:00-10:30	Break
10:30-12:00	Research presentations - Michelle Sweering (CWI) - Purva Joshi (TU/e) - Frits Spieksma (TU/e)
12:00-13:30	Lunch

Research presentations

Michelle: *t.b.a.*
Purva: *t.b.a.*
Frits: *How to design a serial knockout competition*

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Minicourses

Johannes Schmidt-Hieber

Statistical theory for neural networks

Lecture 1) Survey on neural network structures and deep learning
There are many different types of neural networks that differ in complexity and the data types that can be processed. This lecture provides an overview and surveys the algorithms used to fit deep networks to data. We discuss different ideas that underly the existing approaches for a mathematical theory of deep networks. Special focus will be on initialisation of neural networks. To train a neural network a (random) starting point has to be chosen and the success of deep learning heavily depends on a proper initialisation scheme. Standard approaches initialise a network by drawing the parameters independently from a distribution. We discuss some known properties of such randomly initialised networks and describe the edge of chaos phenomenon.

Lecture 2) Theory for shallow networks
We start with the universal approximation theorem and discuss several proof strategies that provide some insights into functions that can be easily approximated by shallow networks. Based on this, a survey on approximation rates for shallow networks is given. It is shown how this leads to estimation rates. In the lecture, we also discuss methods that fit shallow networks to data.

Lecture 3) Statistical theory for deep networks
Why are deep networks better than shallow networks? We provide a survey of the existing ideas in the literature. In particular, we study localisation of deep networks and specific functions that can be easily approximated by deep networks. We outline the theory underlying the recent bounds on the estimation risk of deep ReLU networks. In the lecture, we discuss specific properties of the ReLU activation function. Based on this, we show how risk bounds can be obtained for sparsely connected ReLU networks. At the end, we describe important future steps needed for the future development of the mathematical theory of deep learning.

Lecture 4) Tutorial
The participants should try whether they can run the provided source code prior to the tutorial. We recommend to install Anaconda and use spyder. Additional packages have then to be installed via Anaconda. Most notably Keras/tensorflow does not work with all version of pythons and it can be a bit tricky to install it. During the tutorial, we will also ask the participants to work a bit on their own with this program along some questions that we prepare.

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Guus Regts

Partition functions: complex zeros and efficient algorithms

Partition functions originate in statistical physics, but also arise in several other areas. For example, the partition function of the hard core model is known as the independence polynomial in graph theory.

In this lecture series I will discuss how the absence/presence of complex zeros of partition functions is related to the computational complexity of approximately computing evaluations of these partition functions.

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