Final report 4TU workshop Combinatorics in Digital Communication

Eindhoven University of Technology (TU/e), The Netherlands

April 19 - April 21, 2023

`https://sites.google.com/view/workshop4tu/home`

Introduction

The goal of this 3-day international workshop was to bring together researchers working on the interplay between digital communication and discrete mathematics, most notably combinatorics. The workshop featured both invited speakers on key topics and multiple contributed talks. The format of the event facilitated research interactions and networking.

Scientific committee and organizers

Aida Abiad (Eindhoven University of Technology, Ghent University, Vrije Universiteit Brussel)
Anurag Bishnoi (Delft University of Technology)
Anina Gruica (Eindhoven University of Technology)
Relinde Jurrius (Netherlands Defence Academy)
Alberto Ravagnani (Eindhoven University of Technology)
Jos Weber (Delft University of Technology)

Support

The event was funded (15k euro) by the Netherlands Institute for Research on ICT.

Scientific motivation, goals, and outcomes

This 3-day international workshop was meant to showcase the most recent advances in the applications of combinatorics to digital communication. The event provided a forum for combinatorialists and coding theorists (two communities that often are not interacting) to share recent progress and thus build and strengthen connections.

The workshop was very successful, with 75 several participants and 9 invited speakers from 8 different countries, of remarkable scientific standing.

The budget was used to (partially) cover the expenses of the invited speakers and award small travel grants to a set of PhD students, who were selected based on CV and proposed abstract. We also covered coffee breaks and an informal reception in the Atlas building. TU/e, thanks to the generous support of 4TU, successfully hosted the event.

In recent years (especially during the pandemic period), Dutch universities hired various researchers in combinatorics, coding theory and related areas. This conference became the ideal venue to connect the existing community with the new researchers. As a long-term goal, this conference also aimed at increasing the visibility of combinatorics in the coding theory research landscape, and vice versa. The workshop also aimed at reaffirming the Netherlands as a leading place for the applications of combinatorics in digital communication. We were very pleased that the workshop was also attended by industry representatives.

The conference focused on different aspects of combinatorics in digital communication including algebraic and quantum approaches, as well as geometric and probabilistic aspects. The workshop led to exchanges of ideas and new collaborations.

Information about the workshop was made accessible via the workshop website:
`https://sites.google.com/view/workshop4tu/home`.

Participation and outcomes

Figure 1: Participants of the workshop.

This workshop was open to all participants and was widely and internationally advertised via the "dmanet" network, national mailing lists (like DCN or DIAMANT), and via the networks of the organizers. Almost 100 people registered for the event, and a total of 75 people participated in person. Given that no registration fee was charged, we consider this a success.

The nine invited speakers were selected with the goal of creating a coherent, diverse, and accessible program.

The conference was very well received. Several participants commented that they enjoyed it, and particularly noted its timeliness (because of the exciting recent developments in the field, with few chances to share them because of Covid). There was a good balance of talks by senior and junior researchers, taking the opportunity to disseminate their work. The quality of the talks and of the research presented was high, with strong participation from the audience. A detailed programme can be found below.

Wednesday, April 19

08:30-09:00	Registration		

		Speaker	**Title**
09:00-10:00	Invited talk I	Emina Soljanin	Service Rate Regions of MDS Codes & Fractional Matchings in Quasi-uniform Hypergraphs
10:00-10:30	*Coffee break*		
10:30-10:50		Felicitas Hörmann	Error-Erasure Decoding of Interleaved Linearized Reed–Solomon Codes
10:50-11:10		Ago-Erik Riet	Simplex Code - is it a Functional Batch Code?
11:10-11:30		Robert F. Bailey	Decoding twisted permutation codes
11:30-12:30	Invited talk II	John Bamberg	Caps of finite projective spaces having two intersection numbers with hyperplanes, and the linear codes arising from them.
12:30-14:00	*Lunch*		

14:00-14:20		Sam Adriaensen	Projective geometric codes
14:20-14:40		Jozefien D'haeseleer	On the sunflower bound for k-spaces pairwise intersecting in a point
14:40-15:40	Invited talk III	Eitan Yaakobi	Cover Your Bases: How to Minimize the Sequencing Coverage in DNA Storage Systems
15:40-16:10	*Coffee break & photo session*		
16:10-16:30		Junming Ke	The update problem in the distributed storage systems and codes from projective planes
16:30-16:50		Theresa Körner	Partial results on the possible effective lengths of divisible codes
16:50-17:10		Ferdinand Ihringer	Affine vector space partitions
17:10-17:30		Jessica Bariffi	The Geometry and Error Probability of the Lee Channel
17:30-19:00	*Reception*		

Thursday, April 20

		Speaker	Title
09:00-10:00	Invited talk IV	Barbara Terhal	Quantum Error Correction
10:00-10:30	*Coffee break*		
10:30-10:50		Robin Simoens	Classifying weighted graphs up to Clifford group equivalence
10:50-11:10		Thomas Karam	Lower-order ranks of polynomials and the structure of the ranges of boolean polynomials on finite fields.
11:10-11:30		Jonathan Mannaert	On a non-existence of boolean degree d functions with $d \leq 2$
11:30-12:30	Invited talk V	David Conlon	Ramsey numbers and error-correcting codes
12:30-14:00	*Lunch*		
14:00-14:20		Carla Groenland	Skipless chains in the Boolean lattice
14:20-14:40		Richard Lang	Tiling Combinatorial Structure
14:40-15:40	Invited talk VI	Frank Vallentin	Generalizations and Applications of the Lovász theta number
15:40-16:10	*Coffee break*		
16:10-16:30		Willem de Muinck Keizer	The Lasserre hierarchy for equiangular lines with a fixed angle
16:30-16:50		Sven Polak	Semidefinite programming and uniqueness of codes
16:50-17:10		Vladislav Taranchuk	On the girth of the graphs $D(n, q)$
17:10-17:30		Simone Costa	Variations on the Erdös distinct-sums problem

Friday, April 21

		Speaker	Title
09:00-10:00	Invited talk VII	Andrea Švob	LCD subspace codes
10:00-10:30	*Coffee break*		
10:30-10:50		Tin Zrinski	Application of genetic algorithms in constructions of block designs and strongly regular graphs from orbit matrices
10:50-11:10		Jesús Ceresuela	Ranking measures for mixed radial Moore graphs
11:10-11:30		Yanni Dong	On the main distance-based entropies: the eccentricity- and Wiener-entropy
11:30-12:30	Invited talk VIII	Ragnar Freij-Hollanti	Private information retrieval: algebraic construction and combinatorial capacity bounds
12:30-14:00	*Lunch*		
14:00-14:20		Seyma Bodur	Single Server Private Information Retrieval Schemes over Rings
14:20-14:40		Haider Al Kim	Coding for Partially Stuck Cells with Errors
14:40-15:40	Invited talk IX	Zsuzsa Weiner	Algebraic methods of Galois geometries yielding results in coding theory
15:40-16:10	*Coffee break*		
16:10-16:30		Stefano Della Fiore	New upper bounds on (b, k)-hash codes
16:30-16:50		Tovohery Randrianarisoa	Shellability of chain complexes from q-complexes
16:50-17:10		Nadja Willenborg	Asymptotic Density and Counting Results for Lee Metric Codes
17:10-17:30		Flavio Salizzoni	Results on the MacWilliams' Extension Theorem for rank-metric codes