KONINKLIJKE
HOLLANDSCHE MAATSCHAPPIJ
DER WETENSCHAPPEN

Juryrapport
KHMW Jong Talent Afstudeerprijzen voor Informatica en Informatiekunde 2025

Gedeelde 2e prijs Valentijn Hol MSc, Universiteit Twente
Explorations in Quasi-Polynomial Algorithms for Parity Games

The thesis by Valentijn Hol, *Explorations in Quasi-polynomial Algorithms for Parity Games*, is concerned with fundamental questions in theoretical computer science that have applications in the real world.

When building complex or mission-critical systems, designers want to answer questions related to the safety and long-term operation of their systems. One of the main techniques for getting a grip on such questions is model checking: The designer formalizes the system, makes a model of it, and then checks whether the model has the desired properties. Such desired essential properties are usually formulated in an appropriate logic, such as linear temporal logic or the modal mu-calculus. Theoretical computer scientists have found a way to answer the difficult question whether a model of a system satisfies the specified properties by translating the question into a question about a certain type of games, called parity games. In his thesis, Valentijn Hol introduces and validates algorithms to solve such games.

Interestingly, although many computer scientists believe that parity games are solvable efficiently, in polynomial time, nobody has yet shown an actual polynomial time algorithm. Valentijn Hol comes pretty close. He introduces several algorithms that solve the problem and proves them to be correct. He then investigates their performance in terms of resources. The thesis is rich in original results, some of which are related to the famous open “P=NP” problem in complexity theory: Can all problems that are solvable in non-deterministic polynomial time (in NP) in fact be solved in deterministic polynomial time (in P)? This mixture of applicability and theoretical relevance make the excellent thesis of Valentijn Hol a fascinating read. Therefore, the jury decided to award a second prize to his master’s thesis.

Gedeelde 2e prijs Remco Leijenaar MSc, Rijksuniversiteit Groningen
Self-Supervised 3D Representation Learning with Asymmetric Dual Self-Distillation for Point Clouds

De masterscriptie van Remco Leijenaar heeft als onderwerp automatische objectherkenning uit 3D-camera’s, zoals LIDAR, een techniek die een laser gebruikt om 3D-beeld (“point cloud”) van objecten te maken.

Voor 2D-afbeeldingen (foto’s) van objecten zijn omvangrijke gelabelde databestanden beschikbaar, bestaande uit bijvoorbeeld een 2D-afbeelding van een hond met het bijbehorende label “hond”. Gelabelde databestanden bieden de mogelijkheid om met moderne deep-learning algoritmen automatische objectherkenning te realiseren. Echter, voor de omvangrijke LIDAR-databestanden ontbreken de labels, hetgeen een obstakel is voor het ontwikkelen van automatische objectherkenning.

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In zijn masterthesis getiteld *Self-Supervised 3D Representation learning* ontwikkelde Remco Leijenaar een baanbrekende methode genaamd AsymDSD om dit obstakel te omzeilen. Zijn methode is gebaseerd op “self-supervised learning”. Dit is een automatische leermethode die geen labels nodig heeft. In plaats daarvan wordt het algoritme getraind om een ontbrekend deel van de point cloud te voorspellen.

Daarnaast combineerde Remco deze aanpak met “invariance learning” waarbij verschillende aanzichten van door point clouds gerepresenteerde objecten worden gecombineerd. Hierdoor werd het getrainde algoritme in staat gesteld om objecten te herkennen uit point clouds, ongeacht het aanzicht van het object.

Uit evaluaties van de AsymDSD methode bleek de superioriteit ten opzichte van bestaande methoden. De uitzonderlijke kwaliteit van de helder geschreven thesis alsmede de overtuigende evaluaties en resultaten hebben de jury doen besluiten de scriptie de tweede prijs toe te kennen.

1e prijs Aleksander Buszydlik MSc, Technische Universiteit Delft
Endogenous Macrodynamics in Algorithmic Recourse

Automated decision systems are increasingly being applied to requests by individuals for institutional resources. These systems range from simple if-then-else expert systems to AI-based decision systems. They enable faster processing, shorter turnaround times, and efficient handling of high request loads. However, these systems are usually black boxes — it is often impossible to understand how they reach their decisions without additional tools. As a simple example, if your application for a loan is denied, it would be very helpful to know what could be improved for a follow-up request.

The research area of Aleksander Buszydlik, Algorithmic Recourse, aims to improve this situation by helping individuals who face adverse outcomes to understand how the decision was made and how they might obtain a more favorable result in the future. Existing research in this area has largely focused on static settings, i.e., satisfying the needs of individual applicants. However, most real-world applications involve large groups of individuals competing for scarce resources. The choices made by one applicant are likely to affect the broader collective in a macroeconomic sense. Moreover, some application areas are highly sensitive to the treatment of collectives of individuals. A clear example is social welfare, where fairness, equal treatment of groups, and cost considerations are extremely important.

Aleksander’s thesis addresses these situations. He developed an experimental framework to study the macro-dynamics of Algorithmic Recourse through simulations. Using this framework, he conducted an in-depth analysis of the endogenous recourse dynamics induced by various popular counterfactual generators described in the literature. Based on his results, he proposes and assesses several mitigation strategies.

His MSc thesis is characterized by both technical depth and breadth. In the case study on fraud detection in Rotterdam, Aleksander examined Dutch legislation and conducted in-depth

interviews with civil servants from the City of Rotterdam to gain a deep understanding of the possibilities and pitfalls of applying Algorithmic Recourse techniques.
For his thesis, Aleksander Buszydlik received the highest grade and has already co-authored a conference paper, with more to come. His research brings together computer science, information science, law, and social science. The jury was highly impressed by his work and awarded him the first prize

Prof. dr. E.O. (Erik) Postma, hoogleraar kunstmatige intelligentie Tilburg University
Prof. dr. ir. H.J. (Henk) Sips, hoogleraar programmatuuraspecten van parallelle en gedistribueerde systemen Technische Universiteit Delft
Prof. dr. L.C. (Rineke) Verbrugge, hoogleraar logica en cognitie Rijksuniversiteit Groningen

De jury vergaderde op 21 oktober 2025 via Zoom onder leiding van KHMW-maatschappelijk lid J.A. (Jeroen) Brouwers MSc. Tevens was ter vergadering aanwezig prof. dr. A.P. (Ad) IJzerman, bestuurslid en secretaris natuur- en medische wetenschappen KHMW.