Show message in browser

STADIUS
Center for Dynamical Systems, Signal Processing and Data Analytics

STADIUS Newsletter

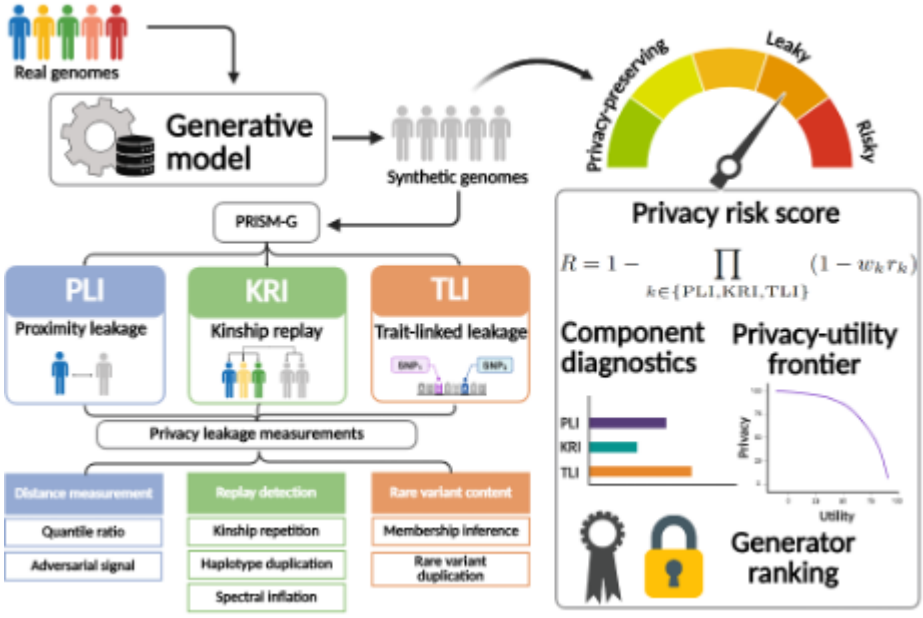
May2026

Research of the month by Alejandro Correa Rojo

"PRISM-G: an interpretable privacy scoring framework for assessing risk in synthetic human genome data"

Work under the supervision of Yves Moreau

Synthetic genomic data generated from generative models promises broader access to large-scale genetic data repositories, but unresolved privacy risks remain a major concern. Human genomes encode highly sensitive information and remain inherently identifiable even when explicit identifiers are removed, creating risks of re-identification or attribute disclosure. In this work, we introduce PRISM-G (Privacy Risk Integrated Score for Multi-representation Genomes), a framework for systematically assessing privacy exposure in synthetic genomes.

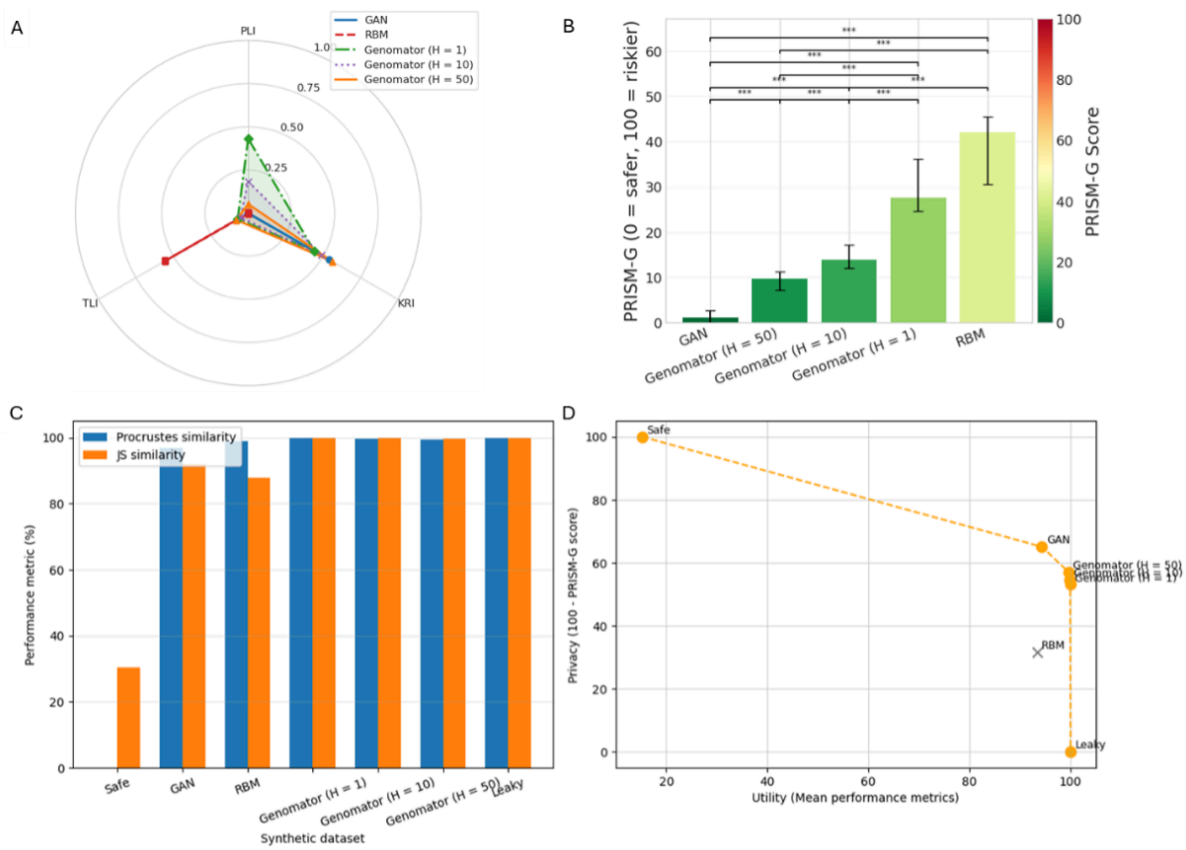


Overview of the PRISM-G framework for assessing privacy exposure in synthetic genomes.

PRISM-G evaluates privacy exposure by comparing real and synthetic genomes across three complementary components that describe genetic variation: the Proximity Leakage Index (PLI), which measures similarity between real and synthetic genomes; the Kinship Replay Index (KRI), which captures the replication of relatedness patterns such as kinship and haplotype sharing; and the Trait-Linked Leakage Index (TLI), which detects the preservation

of rare variants. These component metrics are then aggregated into a single score summarizing the overall privacy risk of a synthetic dataset. The score enables statistical comparison of datasets generated by different models and, when combined with downstream utility measurements, can be used to construct privacy–utility frontiers that characterize trade-offs between analytical utility and privacy risk.

We evaluated PRISM-G on synthetic genome cohorts derived from genetic marker subsets of the 1000 Genomes Project, generated using three model families: generative adversarial networks (GANs), restricted Boltzmann machines (RBMs), and a SAT-based solver generator (Genomator). Our results show that each generative model leaks genomic information through multiple mechanisms rather than through a single similarity signal, and that no single model is uniformly safest across contexts. By pairing the PRISM-G score with a performance metric using genetic ancestry prediction as the utility task, we show that generators with similar utility can differ markedly in privacy risk.



PRISM-G evaluation of synthetic genomic datasets (1000 Genomes Project, chromosome 1). Synthetic datasets generated using GANs, RBMs, and Genomator (Hamming distance tuning parameter) were evaluated with PRISM-G using genetic ancestry inference as a utility task. (a) Component level scores. (b) Generator ranking (c) Utility performance in population structure and ancestry inference. (d) Privacy–utility trade-off.

This work will be presented as a highlighted talk at the European Conference for Computational Biology (ECCB) in Geneva, Switzerland, and accepted as a proceedings paper in Oxford Bioinformatics:
"PRISM-G: an interpretable privacy scoring framework for assessing risk in synthetic human genome data" A. Correa Rojo, Y. Moreau, G. Ertaylan.

👉 A pre-print is available here: https://doi.org/10.1101/2025.10.17.682995

Projects Approved

FWO - Postdoctoral Fellowships announced

The FWO Fellowships were announced last week. Congratulations to **Simon Geinaert** on his successful proposal! The title of the research project (supervised by Alexander Bertrand and Tom Francart) is "Robust and Accurate EEG Signal Processing for Neural Attention Decoding to Speech and Music."

News



Prof. Bart De Moor - Plenary Speaker at the 21ste IFAC

Prof. Bart De Moor will be Plenary Speaker at the 21ste IFAC Symposium on System Identification in Lyon, France, July 2027
👉 see https://conferences.ifac-control.org/sysid2027/).
The (preliminary) title of his talk will be:
The role of numerical linear algebra in system identification.



Prof. Bart De Moor - member of the board of Vesalius Museum

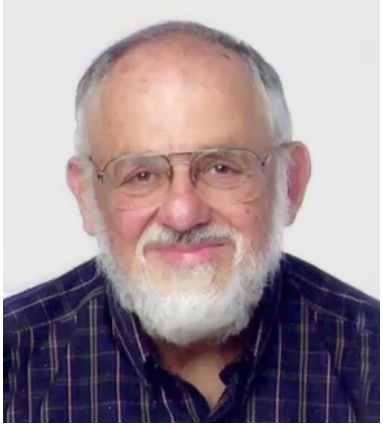
Prof. Bart De Moor, Chairman of **Health House**, which is currently being phased out, will become a member of the board of the newly established **Vesalius Museum**.
Health House is relocating to and merging with the new Vesalius Museum, whose official opening is planned for December 2026 as a concluding part of the 600-year celebrations of KU Leuven.
The historic section of the museum connects the present with the past, highlighting figures such as Andreas Vesalius, the renowned KU Leuven physician who later became the personal doctor of Emperor Philip II. The Health House section, in contrast, will focus on the future of healthcare and innovation through advanced immersive and interactive experiences.
Bart expressed that he is extremely proud of this integration into the Vesalius Museum. During its 10-year existence, Health House welcomed thousands of visitors, including renowned scientists, ministers, presidents, and even King Philippe of Belgium.

Prof. Bart De Moor - member of the international advisory board of DISC

Bart De Moor was appointed to the international advisory board of DISC, the National Graduate School for Systems and Control, in the Netherlands (https://disc.tudelft.nl/).

In Memoriam

Cleve Moler (1939–2026)



We are saddened to share the news that **Cleve Moler**, a pioneer of numerical linear algebra and a founding figure of modern scientific computing, has passed away.
Moler was one of the leading contributors to the *"golden age" of numerical linear algebra* in the second half of the 20th century. He is perhaps best known as the **co-founder of MathWorks** and the creator of **MATLAB**, a platform that has become indispensable across engineering, science, and academia.

Cleve Moler maintained strong ties with our community:
He was a **guest of STADIUS (SISTA)** at several workshops and conferences
He delivered a **talk at ESAT in 2008**
Many of us benefited directly or indirectly from his work and mentorship

Beyond MATLAB, Moler played a central role in shaping modern numerical computing practices. His work helped transform methods like the **Singular Value Decomposition (SVD)** from niche research topics into widely used tools.

Prof. Bart De Moor reflects:
"I have known Cleve very well since my postdoctoral years at Stanford with Gene Golub. Over the years, we stayed in close contact, and I always admired his vision and impact on the field."
He also recalls their last meeting a few years ago in Aachen, where Moler had invited him for dinner.

Recommended viewing & listening

Historical film: "1976 Matrix Singular Value Decomposition" (1976, Los Alamos National Laboratory)

Interview: Cleve Moler on the evolution of MATLAB (Computer History Museum)

Podcast: "In Control" featuring Cleve Moler (also featuring episodes with Rodolphe Sepulchre and Bart De Moor)



Events @ Stadius

State Elimination in Polynomial Dynamical Models: A Linear Algebraic Approach
When: 05 June, 11:00-12:00
Where: ESAT B91.200
Speaker: Sarthak De

Physical Models for Audio Signal Processing
When: 08 June, 11:00-12:00

For more information about STADIUS events please visit the STADIUS Event webpages.

Don't forget to check the website of VAIA for a wide choice of courses on (aspects of) AI: www.vaia.be

Where: B00.35, ESAT
Speaker: Alberto Bernardini

STADIUS Colloquium Series



Bayesian inference with physics-informed deep generative models: Applications to computational imaging
When: 17/06/2026; 15:00 - 16:00
Speaker: Marcelo Pereyra
Location: Aula C
Abstract: This talk introduces a novel mathematical and computational framework for constructing high-dimensional Bayesian inversion methods that leverage state-of-the-art generative denoising diffusion models as statistical priors.

A central innovation is the use of Langevin diffusion processes and Markov chain Monte Carlo sampling techniques to create stochastic neural network architectures that perform nearly-perfect sampling. The obtained networks are modular and composed of interpretable layers that are directly related to statistical priors and data likelihoods. The layers encoding the data likelihood function are designed for flexibility, enabling observation model parameters to be specified at inference time and seamlessly integrated with pre-trained foundational generative priors.

For more information go to STADIUS Colloquium Website

We wish the best of luck to the researchers who are leaving STADIUS

Best of luck!

- **Stefano Damiano**, a postdoctoral researcher from the group of Toon van Waterschoot is moving to industry. Next week, he starts his new position at Analog Devices in Leuven.

Good luck Stefano!

Visitors

Current and planned visitors

- **Andrea Costanzo** - in the group of Alexander Bertrand (since February)
- **Anna Fusari -** in the group of Toon van Waterschoot (since February)
- **Stefano Giacomelli** - in the group of Toon van Waterschoot (since March)
- **Francesco Cordiano** - in the group of Johan Suykens (since April)
- **Jiande Chen** - in the group of Maarten De Vos (since April)
- **Sunghyun Koo** - in the group of Rodolphe Sepulchre (since May)
- **Sofie Haesaert** - in the group of Panos Patrinos (since May)

- **Alberto Bernardini** - in the group of Rodolphe Sepulchre (arriving in June)

Enjoy your research visit at STADIUS !!!

New projects starting in May

MediSynth

📌 VLAIO Research Project
🎓 Maarten De Vos
🕒 Duration: 01/05/2026 -30/04/2029

Publications

Here's the monthly STADIUS Publications Digest, including new reports that have been added to the publications database. Please remember to have your own reports added in the publications database and make sure your entries are kept up to date (status submitted/accepted/published) at all times.

Contact Ida for new additions and updates; do not add/update database content yourself.

26-84
MacWilliam K., Dietzen T., van Waterschoot T., ``Room Geometry Inference from Room Impulse Responses via First-Order Image-Source Optimization'', Technical Report 26-84, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026.
26-85
Oikonomidis K., Laude E., Patrinos P., ``On the Regularity of Generalized Conjugate Functions'', Technical Report 26-85, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026.
26-86
Oikonomidis K., Quan J., Antonakopoulos K., Silveti-Falls A., Cevher V., Patrinos P., ``Constrained Stochastic Spectral Preconditioning Converges for Nonconvex Objectives'', Technical Report 26-86, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026.
26-89
Colette S., Francois J., De Moor B., van Noort V., ``OGTFinder : A curated growth temperature data set and its application to predict optimal growth temperatures of bacteria and archaea'', *Journal of Chemical Information and Modeling*, vol. 66, 2026, pp. 4903-4912.
Lirias number: 4413889.
26-90
Saad A., Dias S., Alhussein G., Lyreskog D., Gerasimou I., Alves B., De Vos M., Drivas I., Zaras J., Stergioulas A., Bensenousi I., Hadjileontiadis L., Chatzichristos C., Hadjidimitriiy S., ``Clinical AI is not (yet) trustworthy-but it could be'', *Journal of Medical Internet Research*, vol. 26, 2026, e85433 p.
Lirias number: 4417067.
26-91
Garcia Ciudad J., Micca L., Kornum B.R., Gilat M., Alfeo A.L., Cimino M.G.C.A., De Vos M., ``Prototype-based sleep micro-structure learning for explainable and robust multimodal recognition of sleep-related conditions'', *Research Square*, 2026, pp. 1-18.
Lirias number: 4417165.
26-92
Usman F., Zandvoort C.S., Robinson S., Peck M., Cobo M.M., Adjei T., Baxter L., Fry R.E., Hauck A.G.V., Rogers R., Schmidt Mellado G., Scrivens A., van der Vaart M., De Vos M., Adams E., van den Anker J., Hartley C., ``Brain activity as a candidate biomarker for personalised caffeine treatment in premature neonates'', *Frontiers in Pediatrics*, 2026, pp.

1-12.
Lirias number: 4419088.

26-93

Chen C., Khong S.Z., Sepulchre R., ``Soft and Hard Scaled Relative Graphs for Nonlinear Feedback Stability'', Technical Report 26-93, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026. Accepted for publication in *IEEE Transactions on Automatic Control*, pp. 1-8.
Lirias number: 4423473.

26-94

Chaffey T., Kharitenko A., Forni F., Sepulchre R., ``A homotopy theorem for incremental stability'', *IEEE Transactions on automatic control*, vol. 71, no. 4, Apr. 2026, pp. 2740-2745.
Lirias number: 4417397.



Update your profile - Unsubscribe