Faculty of Science and Engineering

Profile report: Intelligent Systems

- Discipline: Computer Science
- Level: Tenure-track Assistant professor
- Focus: Research
- Fte: Full time (0.8-1.0 FTE)

1. Scientific discipline
Intelligent Systems is a core area of Computer Science that aims to give computers and cyber-physical systems the abilities to perceive, analyze and learn from data, make decisions, and enhance human capabilities.

2. Vacancy
This position is opened by the Board of the Faculty (PT/gl/23/00122) and will be embedded in the Intelligent Systems basic unit of the Bernoulli Institute. The position falls within the framework of the faculty's career system Career Paths in Science and Engineering. As the focus domain of the position is research, the criteria of the career path with a focus on research apply. Please see the link for more information.

3. Selection committee (BAC)

Prof.dr. N. Taatgen	Scientific director Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence (Chair)
Prof.dr. A. Lazovik	Programme and Education Director for Computing Science
Prof.dr. D. Karastoyanova	Professor Information Systems
Prof.dr. K. Bunte	Associate professor, Intelligent Systems
Prof.dr. M. Biehl	Associate professor, Intelligent Systems
Prof.dr. H. Jaeger	Professor in Artificial Intelligence
Prof.dr. Barbara Hammer	External member, Professor in Machine Learning, Bielefeld University
Channa Dias Perera	Student member

Advisors:

M. Laning, MSc	HR advisor
A.G. Gringhuis, MSc	Policy Officer Bernoulli Institute and secretary to the selection committee

4. Research area
Intelligent Systems aim to give computers and cyber-physical systems the abilities to perceive, analyze and learn from data, make decisions, and enhance human capabilities. The research area has experienced tremendous growth in recent years, especially due to the increase in incorporation of intelligent systems into nearly every aspect of our lives. The societal relevance of sustainability, efficiency, robustness, understanding and guarantees of algorithms is gaining more and more importance, not only in software but also in combination with cyber-physical systems. Relevant aspects are: the theory of machine learning, artificial intelligence and the mathematics of computing (ACM Computing Classification System, 2012 Revision).

For this position, possible research directions include (but are not limited to) the theory and application of novel machine learning and artificial intelligence methods with an emphasis on solving pressing open questions, such as efficiency, transparency and interpretability, fairness, the integration of multi-modal and complex heterogeneous data, causal inference, continuous machine learning, generative and dynamic systems. Complex problems demand an increasing amount of interdisciplinary and cross-domain knowledge. Therefore, backgrounds in information theory, probabilistic representations, causality and computational geometry are also welcome to apply.

5. Embedding: institute (and base unit)

The position will be embedded in the Intelligent Systems research unit. Our research areas include biologically inspired computational modeling, the theory of machine learning and algorithmic development, as well as image processing with mathematical morphology, machine learning and AI. National and international research collaborations span a multitude of application domains, including medical sciences and health care, natural sciences (astronomy, bioinformatics), remote sensing, computer vision, robotics, smart industry and engineering.

The Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence is part of the Faculty of Science and Engineering (FSE). The profile of the institute centers around modeling, computation, and cognition with a focus on science and technology, keeping a balanced mix of fundamental and applied aspects. The Bernoulli Institute comprises five mathematics research groups, seven computer science groups, and three groups in the field of artificial intelligence. The constituting research groups participate in various national research schools and most of the PhD students are enrolled in an educational programme and take part in other activities offered by these schools. The Bernoulli Institute aims to strengthen the current research portfolio in Mathematics, Computer Science and Artificial Intelligence by expanding both in fundamental areas that have a prominent role in education as well as in directions that are essential for new technological and societal developments.

The Bernoulli Institute has a leading role in the cross-disciplinary research theme on Data Science and Systems Complexity (DSSC) within the Faculty of Science and Engineering. This concerns a research cluster of 60+ researchers in a number of basic disciplines (mathematics, computer science, artificial intelligence, systems & control, engineering, astronomy) and various scientific application domains. The ambition is to understand and solve Big Data problems by exploiting the joint perspectives from both data science and complexity science. The institute is also heavily involved in the Groningen Cognitive Systems and Materials Center (CogniGron), which is a joint venture between the Bernoulli Institute and the Zernike Institute for Advanced Materials. It comprises researchers from materials science, physics, chemistry, mathematics, computer science and artificial intelligence. The center provides structure, coherence, and visibility for a joint research program in the direction of cognitive systems and materials. Healthy aging and energy are two other important university-wide research topics that the Bernoulli Institute is involved in.

6. Local and (inter)national position

Locally, the Computer Science Department of the Bernoulli Institute has a strong position in several research areas related to intelligent systems: pervasive middleware (with applications in the areas of office buildings and smart factories); energy and water distribution infrastructures; architecting of software-intensive systems and object-oriented

software design; information systems, middleware and business process management; data science and data engineering, information visualization, visual analytics, machine learning, and intelligent systems. We furthermore contribute to the Jantina Tammes School interdisciplinary centre dedicated to digital society, technology and artificial intelligence (AI), to explore how societies can optimally benefit and contribute to digitalization, digital technologies and AI, in both educational and research aspects. Moreover, we exhibit overlapping aims and collaboration opportunities with the three other schools, namely for governance, politics and sustainable processes (Rudolph Agricola School), for energy transition and climate (Wubbo Ockels School), and for public health (Aletta Jacobs School).

At the national level, the department participates in the School for Information and Knowledge Systems (SIKS), which is the most relevant for the position, in the Dutch computer science research schools Advanced School for Computing and Imaging (ASCI), Dutch Research School in Logic (OZSL) and the Dutch Research School in Programming and Algorithmics (IPA).

At the international level the department is involved in several EU research projects (*e.g.*, Human Brain Project, Smart Homes, GreenerBuildings, AIMS5.0), has established collaborations with major companies (Philips Research, IBM) and technological institutes (Astron, TNO, NLR, ECN), and has cooperation and exchange programmes with many universities (*e.g.*, Rome, Wuerzburg, Birmingham, Barcelona, Ghent, ESIEE-Paris, Tampere, Mittweida, Cologne). In Computer Science, the Bernoulli Institute has a strong position (as evidenced by participation in NWO and EU projects, publications in renowned journals and conferences, memberships of editorial boards and program committees, conference chairing, *etc.*) in intelligent systems (biologically inspired computational modeling, machine learning, morphological image processing, statistical physics of learning); pervasive middleware and energy distribution infrastructures; architecting of software-intensive systems and object-oriented software design; information systems (adaptive information systems, middleware and service oriented architectures, security, information retrieval); data and information visualization, and visual analytics.

7. Expected contributions to research

The candidate is expected to initiate and develop an internationally leading research program in the field of Intelligent Systems. The research should have visibility on the national and worldwide level and lead to publications in top journals and conferences. Further, it is expected that the new professor will take a leading role in the field of Computer Science within the Netherlands. Obtaining substantial external funding for PhD projects is crucial. Supervision of PhD students is an important part of the research activities. The research is expected to strengthen the existing efforts in the field of Computer Science within the Bernoulli Institute and should lead to a strengthening of the international reputation of the group, the CS department and the institute.

8. Expected contributions to teaching

The candidate is expected to contribute to the teaching programs in the bachelor and master degree programs within the School of Science and Engineering. The candidate is also expected to participate in the teaching programme of specialized courses in relation to Intelligent Systems and other related topics, *e.g.* theory of machine learning, data science, artificial intelligence with at least one societal relevant application area, such as smart industry, medicine, physics, chemistry, pharmacy, etc. Furthermore, the candidate will be involved in supervising bachelor, master and PhD students. Upon appointment, depending on experience and formal qualifications to date, the candidate may be required

to enter a nationally standardized tertiary teaching skills certification trajectory (BKO or Basis Kwalificatie Onderwijs), successful completion of which is a condition for contract extensions and tenure.

9. Expected contributions to the organization
The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. The candidate will furthermore contribute to the organization of the faculty, for example by participating in working groups and committees, in the domains of education, research and management. The candidate will contribute to relevant organizational activities on the national and international level.