

Faculty of Science and Engineering

Profile report: Artificial Intelligence - Machine Learning (3 vacancies)

- Discipline: Artificial Intelligence

- Level: Full professor, associate professor, assistant professor (tenure track)

- Fte: 0,8-1,0 fte

1. Scientific discipline

Machine learning is a subdiscipline of artificial intelligence in which methods are studied and applied that can derive algorithms from data. It has become one of the main success factors of the AI discipline, and is at the forefront of developments in the field.

2. Vacancy

The three positions are opened by the Board of the Faculty (ref. PT/gl/22/00155) and will be embedded in the Bernoulli Institute, basic unit Artificial Intelligence. The positions falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for [criteria and conditions](#).

3. Selection committee (BAC)

Prof. dr. N.A. Taatgen (chair) Scientific director Bernoulli Institute and Professor Cognitive Modeling

Prof. dr. H.B. Verheij Head of department Artificial Intelligence and Professor Artificial Intelligence and Argumentation

Dr. F. Cnossen Director of Education Artificial Intelligence & Computational Cognitive Science

Prof. dr. K. Bunte Professor in Intelligent Systems

Prof. dr. L.C. Verbrugge Professor of Logic and Cognition

Prof. dr. E. Postma Professor Artificial Intelligence (Tilburg University)

(Student member) ...

HR advisor: N.F. Clemencia-Lokai

Adviseur:

Prof. dr. L.R.B. Schomaker Professor Artificial Intelligence

4. Area of expertise

Current results in machine learning are impressive in many applications, and are in the center of attention in society, industry and government. Significant results have been achieved through a combination of tremendous human effort, large computing resources and the availability of (mostly labeled) big data.

Despite, or maybe because, the successes, several challenges have arisen. Although machine learning is very successful on properly constrained problems with large amounts of labeled data, it struggles when the quality of the data is poor, or when inferences outside of the scope of the data have to be made. Collaboration between machine and human intelligence leads to better results, but is only possible if the human can understand how the machine came to a conclusion, which means that AI systems need to be able to explain themselves. Not all machine learning algorithms can be implemented in novel, parallel (neuromorphic) hardware, requiring further research on how to adapt or innovate to make this possible.

The three positions are opened for talented candidates, both junior and established, with an ambitious research program for innovating machine learning in artificial intelligence, either by deepening the knowledge of the state of the art, or by addressing the current challenges such as online 'always on' learning, transparency of trained systems, generalisability outside of training context, computational efficiency, and human-machine alignment. Candidates connect in their research to these and related fundamental challenges in the field.

5. Embedding: institute (and base unit)

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 modelling, computation, and cognition with a focus on science and technology, keeping a balanced mix of fundamental and applied aspects. The institute participates 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 has a leading role in the cross-disciplinary research theme on Data Science and Systems Complexity (DSSC) and in the Center "Groningen Cognitive Systems and Materials" (CogniGron) within the Faculty of Science and Engineering.

The positions will be embedded in the Autonomous Perceptive Systems group in the Department of Artificial Intelligence of the Bernoulli Institute. The Autonomous Perceptive Systems group has a strong experience in large-scale pattern-recognition problems, in reinforcement learning and robot behavior control. The experimental and application platforms span a wide spectrum, ranging from image-based retrieval in historical documents, machine learning in service robots, intelligent control of prosthetic legs and the development of linear sensors for underwater object detection.

6. Local and (inter)national position

The Bernoulli Institute has expertise in Cognitive Engineering, Visualization, Cognitive Modeling, Multi-agent systems and Machine Learning. These provide the local context for the position. In addition, there are strong collaborations with the UMCG. Furthermore, the Bernoulli Institute will participate in the new Jantina Tammes school for Digital society, technology and artificial intelligence, bridging the various faculties of the university.

Within the Netherlands, there is a growing interest in Machine Learning as formulated in the NWO AI Research Agenda. Also the 10 year NWO Gravitation project Hybrid Intelligence (a collaboration between seven Dutch universities, with the Groningen AI department in a leading role) emphasizes the topic with a focus on collaborative, adaptive, responsible and explainable methods. In addition, both the EU and the Dutch Government are expected to invest significantly in AI research.

International collaboration includes a large-scale facility for on-line machine learning in historical manuscript collections, Monk. This system functions as a label-harvesting engine for machine-learning researchers while offering text clustering, dating and search to humanities researchers, worldwide, such as the Radcliffe Institute, Harvard, the Israel Antiquities Authority and many others. Collaboration in robotics concerns the universities of Twente, Nijmegen, Bologna and others (H2020 project MyLeg). Industrial collaborations are with Liebherr and several other companies, in the area of predictive maintenance (H2020 project Mantis). The development of lateral-line sensing arrays is done in H2020 project Lakshmi, together with Tallinn university of technology, Estonia, Heriot-Watt university and several companies.

8. Expected contributions to research

Fitting a candidate's career stage, candidates are expected to set up their own research line and research group in machine learning in artificial intelligence, in close cooperation with staff members of the department. Research should aim at contemporary developments in machine learning fitting and extending the institute. In particular, the institute is interested in developing methods to make Machine Learning more general (i.e., by incorporating transfer), and/or making it less reliant on massive amounts of data by incorporating knowledge (a more hybrid approach). This can translate into continuous, online machine learning, the interface between learning and robotics, or explainable machine learning. The research should compete on a worldwide level and lead to publications in top journals. 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 within the Bernoulli Institute of machine learning in artificial intelligence.

8. Expected contributions to teaching

The Groningen AI study programs (BSc Artificial Intelligence, MSc Artificial Intelligence, MSc Computational Cognitive Science) attract talented national and international students, and cover the interdisciplinary landscape of AI expertise. Candidates are asked to contribute to curriculum development, teach courses and supervise thesis projects (BSc and MSc level) in the area of machine learning in artificial intelligence.

Candidates are expected to teach courses in the domain of Machine Learning and AI, and contribute to curriculum development in Machine Learning in the programme. Candidates should co-create an educational culture where Artificial Intelligence and Computational Cognitive Science students feel supported and teachers foster personal growth in students. Candidates are expected to add to a supportive and collaborative environment between colleagues.

Candidates support the development of relevant courses in Machine Learning within the BSc and MSc programmes in Artificial Intelligence, and, to a lesser degree, the MSc programme Computational Cognitive Science. Bachelor students should acquire knowledge and skills both in general machine learning and pattern recognition, as well as receiving an introduction to deep learning and spiking neural networks. The exact topics of courses developed and taught co-depend on the expertise and interests of candidates.

Candidates supervise Machine Learning graduation projects in the BSc and MSc programmes. Candidates innovate and streamline the current BSc and MSc curriculums in terms of Machine Learning throughout the programmes (learning lines).

9. Expected contributions to the organization

Candidates are expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of FSE, candidates will contribute to the organization of the faculty, for example by participating in working groups and committees in the areas of research, education and organization. Candidates will participate in relevant national and international organizations.