

## Faculty of Science and Engineering

### Profile Report: Mathematical Statistics (Mathematische Statistiek)

Discipline: Statistics  
Level: Tenure-track Assistant professor/Associate professor/Full professor  
Fte: 1.0

#### 1 Scientific discipline

This position concerns the field of Mathematical Statistics, which is characterized by the embedding of statistical procedures within a mathematical framework and comprises statistical modelling, inferential statistics, design of experiments, and statistical computation.

#### 2 Vacancy

This position is opened by the Board of the Faculty (PT/gl/18/0425) and will be embedded in the Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence. The research group (basic unit) will be the Probability and Statistics group. The position will be tenure-track, on the level of assistant professor, or tenured, on the level of associate or full professor. The position 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

Prof.dr. J.B.T.M. Roerdink	Scientific director Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence and professor Scientific Visualization and Computer Graphics (Chair)
Prof.dr. ir. R.W.C.P Verstappen	Program director Mathematics and professor Computational and Numerical Mathematics
Prof.dr. M.K. Camlibel	Associate professor of Systems and Control
Prof.dr. T. Müller	Professor Combinatorics and Probability
Dr. W.J. Post	Associate professor Applied Statistics
C. Kool	Student member
Prof.dr. M.-C. van Lieshout	Professor of Statistics, University of Twente

#### HR advisor:

Mr. L.A. Boomsma, Human Resources Department

#### 4 Research area

Mathematical statistics is a very broad field that includes, for instance, theoretical statistics, statistical modelling, inferential statistics, design of experiments, and statistical computation. Statistics has a central role in science, and sophisticated statistical methodology is becoming ever more important in almost all fields of science and society at large. For example, statistics is absolutely crucial in genomics, finance, international security, climate change, and to inform government policies.

Some of the major challenges facing the field today include: developing new statistical methods to deal with high-dimensional data and complex networks with their interactions in scientific and social sciences; developing methods for adequately dealing with missing data; dealing with sparsity and compressed sensing. Here the setting is that of the extraction of a signal from a noisy environment. Examples are finding the gene or combination of genes responsible for a congenital disorder, cleaning a biomedical image, and identifying SPAM emails. Often we seek a sparse representation of the signal, as just a few components, and aim to compress the data as tightly as possible without losing its essence; developing methodology for inference about the "shape" of a dataset, for example using methods from algebraic topology; deriving higher order asymptotics for dependent data or for non-regular problems; developing and applying methodology for dealing with various forms of "big data". For instance, in the health sciences huge amounts of data on individual patients (electronic records with patient self-reports, observations made by health care professionals, continuous monitoring that can be done through smart phones and electronic bracelets, and genetic data) are

recorded.

This vacancy has arisen after the previous chair of Mathematical Statistics left the institute. There is a strong urgency to fill this position, given the high demands for statistical expertise in (collaborative) research and education within the institute, the university and society.

### **5 Embedding: institute (and basic unit)**

The position will be embedded in the basic unit Probability and Statistics, which currently consists of one full professor in probability (Tobias Müller), one tenure-track assistant professor (Marco Grzegorzczuk) in statistics and several PhD students and postdocs. In addition, we are in the process of hiring an additional professor in either probability or statistics at the assistant, associate, or full professor level.

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 Bernoulli Institute comprises five mathematics programmes, six computer science programmes, and four artificial intelligence programmes. The constituting programmes 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.

### **6 Local and (inter)national position**

The research of the probability and statistics group in Groningen has as its strengths research in random graphs, percolation, graph theory and combinatorics, as well as in Mathematical Statistics and its applications to Systems Biology and Bioinformatics.

At the national level the Mathematics group of the Bernoulli Institute participates in the Dutch mathematics Research Schools for Fluid Mechanics (J.M. Burgerscentrum) and the National Graduate School for Systems and Control (DISC). It is also involved in the NWO research clusters “Discrete, Interactive and Algorithmic Mathematics, Algebra and Number Theory” (DIAMANT), “Geometry and Quantum Theory” (GQT), “Nonlinear Dynamics of Natural Systems” (NDNS+) and “Stochastics – Theoretical and Applied Research” (STAR) and in the national research school WONDER. Locally, the Systems, Control and Applied Analysis basic unit is part of the Jan C. Willems Center for Systems and Control, that furthermore consists of the control engineers in the engineering institute ENTEG, also part of the Faculty of Science and Engineering. At the international level the Bernoulli Institute is involved in several EU research projects (e.g., Statistical Network Science), has established collaborations with technological institutes (Astron, TNO, NLR, ECN), and has cooperation and exchange programmes with many universities (e.g., Rome, Leipzig, Birmingham, Barcelona, Ghent, ESIEE-Paris, Tampere). The Bernoulli Institute has a strong position in national and international mathematics, as evidenced by participation in NWO and EU projects (e.g. HYCON2, Cosmic Web, CA15109), publications in renowned journals and conferences, memberships of editorial boards (e.g. EJC, *Indagationes Mathematicae*, *J Stat Phys*), boards of mathematical societies (e.g. IBS, Bernoulli) and program committees, conference chairing (e.g. MTNS 2014, IWSM 2017), etc. Mathematics research in Groningen is strongly focused on mathematical systems, in particular, Nonlinear Dynamical Systems, Mathematical Physics and Systems & Control.

Within the Netherlands mathematical statistics has a high degree of national organization. This is illustrated by a long tradition of the Dutch Society for Statistics (VVS-OR), regular national seminars (Van Dantzig Seminars) and meetings (Stochastics Meeting Lunteren). Mathematical Statistics is embedded in the national NWO cluster STAR. The candidate is expected to become active in these national research clusters. Also internationally there is a strong participation in activities, such as within the Bernoulli Society. The candidate should continue and strengthen the Groningen involvement in this.

### **7 Expected contribution to research**

The candidate is expected to bring in an internationally leading research track record in Mathematical Statistics, establishing an autonomous research programme within the Bernoulli Institute. The research should lead to publications in high impact scientific journals and to contributions to major conferences in the field of expertise. Supervision of PhD students and postdocs is an important part of the research activities. Obtaining

substantial external funding for PhD and postdoc projects is crucial. An involvement in some of the research themes, such as Data Science and Systems Complexity, Fundamentals of the Universe, or Cognitive Systems, is expected. Interaction with other domains within and outside the institute, especially those with a societal relevance component, is very important.

### **8 Expected contribution to teaching**

The successful candidate is expected to contribute to the teaching programmes of the bachelor and master programmes of Mathematics at the Faculty of Science and Engineering. He/she will contribute both to teaching existing courses, and to the development of new courses in statistics. This includes the supervision of bachelor and master theses. The teaching tasks amount to 30% of the total employment time for a tenure-track assistant professor. For the positions of associate professor/full professor these tasks amount to 40%.

### **9 Expected contribution to the organisation**

It is expected that he/she will play an important role in the general organisation of various tasks of the Bernoulli Institute, the (under)graduate school and the Faculty. This will involve participation in formal and ad hoc committees, the organization of relevant events and general leadership in the development of the profile of the research group, the institute, the faculty, and the university.