Natalia Bochkina

Nationalities: British, Russian
Email: N.Bochkina@ed.ac.uk
Home page: www.maths.ed.ac.uk\~nbochkin

Profile:

My recent research has been focused on the following areas:

- Theory of Bayesian inference: contraction rates and Bernstein – von Mises theorem (wavelet nonparametric regression, Bayesian nonparametric and semiparametric density estimation, nonregular models, inverse problems; model misspecification)
- Estimation and modelling of high dimensional genomic data (bulk and single cell mRNA gene expression, protein 2D gels, metabolic NMR data, including gene networks via graphical models)

Programming Languages: R, JAGS.

Employment and Research History:

Reader in Statistics (August 2019 – present), School of Mathematics, University of Edinburgh.

Faculty Fellow (Oct 2016 – August 2019), The Alan Turing Institute, London

June 2017 – May 2018 – maternity leave

Lecturer in Statistics (July 2007 – July 2019), School of Mathematics, University of Edinburgh.

Research Associate in Biostatistics and Bioinformatics (Nov 2003 – June 2007), Imperial College London, Faculty of Medicine, with Prof. Sylvia Richardson.
Statistical analysis and integration of transcriptomics, proteomics and metabonomics data for the BAIR (Biological Atlas of Insulin Resistance) project (until October 2006); BBSRC "Exploiting Genomics" grant (November 2006 –February 2007); Value In People Wellcome Trust award, working on analysis of metabolic spectral data (February – June 2007).   Conference travel grant (awarded by UK Resource Centre for women in SET; April 2006)

Statistician, reporting to Director of Biometrics and Bioinformatics (Feb 2002 – Sep 2003), Oxford GlycoSciences (UK) Ltd, based in Abingdon, Oxon.
- Oxford GlycoSciences (UK) Ltd. was a biopharmaceutical company applying integrated proteomics and genomics to the discovery, development and commercialisation of therapeutic products.
- **Main responsibilities:** analysis of protein expression data to discover potential protein biomarkers for various diseases; general consultancy to the company, presentations to clients; involvement in analysis of preclinical trials.

Education:

PhD in Statistics, with Prof. B.Silverman, University of Bristol (Oct 1998 – Nov 2001).
Funded by University of Bristol scholarship and Overseas Research Student award.
  "Wavelet methods for nonparametric regression and the test of significance"

Undergraduate degree (~ BSc+MSc), Faculty of Mathematics and Mechanics, St.Petersburg State University, Russia (Sept 1993 – July 1998; funded by Faculty Dean's grant, St.-Petersburg State University).

First Class Diploma (equivalent to 1st class BSc+MSc) including a research project with a team of statisticians and neurophysiologists at the Sechenov Research Institute of Evolutional Physiology and Biochemistry**,** modelling the process of transmission of impulses from the spinal cord to muscles via neuronal cells; worked on it exclusively during the last year.

Publications (since 2010)

In submission

1. Huizi Zhang, Natalia Bochkina, Sara Wade. Quantifying uncertainty in RNA velocity. (in submission). biorxiv

2. N. Bochkina. "Besov regularity of functions with sparse random wavelet coefficients" (Bernoulli, invited resubmission)

Published

3. Jinlu Liu, Sara Wade, Natalia Bochkina (2024) Shared Differential Clustering across Single-cell RNA Sequencing Datasets with the Hierarchical Dirichlet Process. Econometric and Statistics. https://doi.org/10.1016/j.ecosta.2024.02.001 also on arxiv: https://arxiv.org/abs/2212.02505

4. N.Bochkina and Jenovah Rodrigues (2022). Bayesian inverse problems with heterogeneous variance. Scandinavian Journal of Statistics (paper: http://doi.org/10.1111/sjos.12622)

5. A. Caballe, N.Bochkina and Claus Mayer (2018) "Selection of the regularisation parameter in graphical models given complex network structures" Journal of Computational and Graphical Statistics, 27:2, 323-333

6. Carolina Costa Mota Paraiba, Natalia Bochkina, Carlos Alberto Ribeiro Diniz (2018) "Bayesian truncated beta nonlinear models." Applied Statistics, 45:2, 320-346

7. Nina V. Bordovskaia, Charles Anderson, Natalia Bochkina, Elena I. Petanova (2018) "The Adaptive Capabilities of Chinese Students Studying In Chinese, British and Russian Universities". International Journal of Higher Education, Vol 7, No 4

8. N.Bochkina and J.Rousseau (2017) "Adaptive density estimation based on a mixture of Gammas" Electronic Journal of Statistics, Volume 11, Number 1, 916-962. arXiv:1605.08467

9. N.Bochkina (2016) "Selection of KL neighbourhood in robust Bayesian inference" Statistical Science, Volume 31, Number 4, 499-502.

10. Natalia A. Bochkina and Peter J. Green (2014) The Bernstein-von Mises theorem and non-regular models. Annals of Statistics, 42:5, 1850-1878.

11. N.Bochkina (2013) "Consistency of posterior distribution in generalised linear inverse problems" Inverse Problems, 29, 095010

Book chapters

12.   N.Bochkina (2021) Bernstein - von Mises theorem and misspecified models: a review. In Foundations of Modern Statistics, Editors Belomestny et al . Springer (https://arxiv.org/abs/2204.13614)

13. N.Bochkina, A.Lewin. (2011) "Classification for differential gene expression using Bayesian hierarchical models" (book chapter, in "Bayesian methods in Bioinformatics", eds D.Dey, S.Ghosh and B.Mallick)

14. N.Bochkina, Y.Ritov. (2011) "Bayesian Perspectives on Sparse Empirical Bayesian Analysis"
(book chapter, in "Inverse Problems and High Dimensional estimation", Springer Lecture Notes in Statistics, eds. P. Alquier and E.Gautier)

Refereed Scopus-listed conference proceedings

15.   A. Hayes, L. Neyton, T. Murray, X. Zheng, N. Bochkina, J. Iredale, D. Mole and the KMO Team (2021) Kynurenine monooxygenase regulates inflammation during critical illness and recovery in experimental acute pancreatitis. HPB, Volume 23, SUPPLEMENT 1, S218

16. Bordovskaia N., Koshkina E., Tikhomirova M., Bochkina N., (2017) Consistency between pedagogical assessment and self-assessment of educational results in the context of professional and personal development of students. EDULEARN17, Refereed conference proceedings, pp. 7372-7380.

17. Bordovskaia N., Koshkina E., Bochkina N., (2017) Method of studying the level of terminological competence of students. ICERI17, Refereed conference proceedings, pp. 2521-2527

18. Nina V. Bordovskaia, Natalia A. Bochkina and Elena A. Koshkina (2016) "Use of didactic terminology by teachers at various stages of professional communication" SHS Web of Conferences, Volume 29, article 01013. 2016 International Conference "Education Environment for the Information Age" (EEIA-2016)

19. M. Tikhomirova, N. Bordovskaia, E. Koshkina, N. Bochkina, O. Zhebrovskaia (2016) Features of assimilation of educational information by students with different levels of psychological well-being. EDULEARN16 Proceedings, pp: 8234-8242. ISBN: 978-84-608-8860-4

20. Elena Koshkina, Nina Bordovskaia, Natalia Bochkina (2016) "Didactic Terminology Operated by Russian Future and Practising Teachers: Comparative Analysis", Procedia - Social and Behavioral Sciences, V. 217, p. 42–48

21. P.McNabb, N.Bochkina, D.Wilson and J.Bialek. (2010) "Oscillation source location using wavelet transforms and generalized linear models", *Transmission and Distribution Conference and Exposition, IEEE PES (Conference Proceedings)*

22. P.McNabb, N.Bochkina and J.Bialek. (2010) "Oscillation source location in power systems using logic regression", *Innovative Smart Grid Technologies Conference Europe (ISGT Europe), IEEE PES (Conference Proceedings)*

Other.
22. Adria Caballe, Natalia Bochkina, Claus Mayer, Ioannis Papastathopoulos. Testing for equal correlation matrices with application to paired gene expression data. arXiv: 1803.06669
23.   Adria Caballe, Natalia Bochkina, Claus Mayer (2018) Joint Estimation of Sparse Networks with application to Paired Gene Expression data. arXiv: 1608.05533.

<u>Seminars</u> (since 2010)

November 2019 University of Glasgow

October 2019 University of Manchester

September 2019 University of Verona, Italy

30 August 2018 University of Melbourne (Australia) "Adaptive density estimation based on a mixture of gammas"

March 2018 University of Leiden (Netherlands) "The Bernstein - von Mises theorem for nonregular ill-posed possibly misspecified models

18 November 2016 University of Leeds "Estimation and testing for correlation and partial correlation matrices in paired gene expression data"

26 October 2016 Heriot Watt University (Edinburgh) "Estimation and testing for correlation and partial correlation matrices in paired gene expression data"

24 August 2016 Isaac Newton Institute (Cambridge) "Estimation and testing for correlation and partial correlation matrices in paired gene expression data"

2 June 2016 Astronomy group, University of Glasgow. "Bayesian inverse problems with application to image recovery"

15 April 2015, WIAS Berlin, Germany. "The Bernstein - von Mises theorem for possibly misspecified models"

7 April 2015. University of Kent at Canterbury, UK. "The Bernstein - von Mises theorem for nonregular and misspecified models"

21 June 2013, Universite Paris V, France

20 June 2013 CREST (Research Institute in Statistics and Economics), Paris, France

25 April 2013, University of Valencia, Spain

15 March 2013, University of Glasgow, UK

21 February 2013, University of York, UK

May 2012, Collegio Carlo Alberto, Torino, Italy

26 January 2011 University of Cambridge, UK

May 2011 Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany

November 2010. Bocconi University, Milan, Italy.

June 2010 Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany

25 March 2010 Universite Joseph Fourier, Grenoble, France

Invited conference and workshop talks - International (since 2013)

7-12 December, 2025 BIRS-funded workshop "Bayesian Uncertainty Quantification in Large Models", Chennai Mathematical Institute (CMI) , India (invited participation).

16-20 December 2024 - conference "New challenges in high-dimensional statistics", CIRM, Luminy, France (invited participation)

13 November 2024 – workshop "Foundations of Modern Statistics", Berlin, Germany.

June 2024 - ICON STARF 2024: International Conference on Statistics and Related Fields in honour of Vladimir Koltchinskii, Bertinoro, Italy (invited participation)

December 2023 - conference "Statistical thinking in the age of AI: robustness, fairness and privacy ", CIRM, Luminy, France (invited participation)

July 2023 – 54 Journées de Statistique de la SFdS (Conference of the French Statistical Society), Brussels, Belgium
July 2023 – European Meeting of Statisticians, Warsaw, Poland (postponed from 2022).

June 2023 – "Approximation Methods in Bayesian Analysis" Luminy, France

December 2022 - conference "Meeting in Mathematical Statistics", CIRM, Luminy, France (invited participation)

20-24 June 2022 - INTERNATIONAL SYMPOSIUM ON NONPARAMETRIC STATISTICS (postponed from 2020)

December 2021 - conference "Meeting in Mathematical Statistics", CIRM, Luminy, France (invited participation)

3 – 7 May 2021 – Oberwolfach workshop "Foundations of Bayesian Inference for Complex Statistical Models" (invited participation)

1-5 March 2021 – SIAM 2021 conference

19-21 December 2020 – conference "Meeting in Mathematical Statistics", CIRM, Luminy, France (invited participation and talk)

14-18 December 2020 – CMStatistics 2020 conference

13-16 July 2020 –Newton Institute Workshop "Mathematical and Statistical Challenges in Uncertainty Quantification" (invited participation)

27 – 31 January 2020 – Oberwolfach workshop "Machine learning and statistics" (invited participation)

24-28 June 2019 12th Bayesian Nonparametric Conference, Oxford, UK

29 June – 2 July 2019 – Objective Bayes conference (Warwick, UK)

6-11 May 2019 "Statistical and Computational Aspects of Learning with Complex Structure" Oberwolfach conference (invited participation)

11-15 March 2019 "Quantifying uncertainty" Oberwolfach conference (invited participation and talk)

26-30 August 2018. Joint International Society for Clinical Biostatistics and Australian Statistical Conference, Melbourne, Australia

6-10 June 2018 Conference of the Nonparametric Statistics Society, Salerno, Italy. Special invited speaker.

31 May – 1 June 2018 Exploratory seminar "Statistics when the model is wrong", Radcliffe Institute for Advanced Study, Harvard University.

18 – 22 December 2017 - Meeting in Mathematical Statistics, CIRM, Luminy, France.

27 July – 3 August 2017 – Joint Statistical Meeting (JSM), Baltimore "Rates of contraction in heterogeneous inverse problems" (had to refuse the invitation due to maternity leave)

12-17 June 2016 ISBA Conference (International Society for Bayesian Analysis, Sardinia, Italy).

December 2015, Methods of Mathematical Statistics Frejus, France (invited participation and talk). Talk title "Bayesian estimation of possibly unbounded densities"

December 2015, 7th International Conference of Computational and Methodological Statistics (CMStatistics 2015) London. Talk title: "Density estimation of unbounded densities via a mixture of Gammas"

June 2015, ISBA Objective Bayes Conference, Valencia, Spain. Talk title: "The Bernstein-von Mises theorem and possibly misspecified nonregular models"

December 2014, 7th International Conference of the ERCIM WG on Computational and Methodological Statistics (ERCIM 2014) Pisa, Italy

December 2013, 6th International Conference of the ERCIM WG on Computational and Methodological Statistics (ERCIM 2013) London. Talk title: "Convergence of posterior distribution in inverse problems with non-Gaussian noise"

I was also invited to organise a session and to give a talk at the IASSL International Conference in Colombo, Sri Lanka (28-30 December 2014) organised by Institute of Applied Statistics Sri Lanka; I was unable to go due to other commitments.

Invited conference and workshop talks - National (since 2013)

6-9 June 2022 – British Mathematics Colloquium, London, Morning Lecture.

4-7 April 2017 –Workshop "Learning Graphical Models in High-Dimensional Settings", ICMS, Edinburgh

28-30 March 2017 – Probability and Statistics Workshop, Lancaster. "Adaptive density estimation based on a mixture of gammas"

7-9 November 2016 UK-Japan Frontiers of Science Symposium (Royal Society) Talk title "Theoretical guarantees for statistical inference in high dimensional and nonparametric models"

6-8 September 2016 Royal Statistical Society Conference (Manchester)

July 2016 Isaac Newton Institute Conference "Bayesian methods for networks" (Cambridge).

4-6 April 2016, Statistical analysis of manifold data and beyond (Nottingham).
29 February 2016, LMS day on inverse problems (Nottingham).

5 - 8 May 2015. ICMS workshop "Solving big data challenges from modern science through statistical modelling", Edinburgh (part of the EPSRC-DST Indo-UK Initiative in Applied Mathematics). Talk title: "Selection of the regularization parameter in sparse high dimensional graphical models"

November 2014. Joint annual meeting of the Royal Statistical Society Highland group / St Andrews, UK

Grants

Oct 2016 – Sept 2019 LMS Joint Research Groups in UK Scheme 3 (as supporter) "Inverse Problems: Theory and applications" workshop and events funding, joint with Sean Holman (Manchester) and Marta Betcke (UCL), £1200 for 2016-17, £2000 for 2017-18 (with possible extension)

Jan 2016 –Dec 2018 "Interdisciplinary approach to research and development of terminological competence of teachers in the area of didactics", funded by RGNF (Russian Research Funding Body for Humanitarian Sciences), CoI (PI: Prof N.V.Bordovskaya) (Total amount £22,500)

2014-17 Royal Society International exchange grant, for work with Prof Judith Rousseau (Paris) (£10950)

May 2012 ICMS (International Centre for Mathematical Sciences) grant from EPSRC

Feb – June 2007 Wellcome Trust VIP (Value In People) award

April 2006 Conference travel grant (awarded by UK Resource Centre for women in SET)

Awards

Oct 1998 – Oct. 2001 University of Bristol scholarship.

Oct 1998 – Oct. 2001 ORS (Overseas Research Student) award.
Awarded by the Committee of Principals and Vice-Chancellors, UK.

Sept 1993 – July 1998 Faculty Dean's grant, St.-Petersburg State University.

Society and other membership

1. **International Society for Bayesian Analysis (ISBA) – since 2008**; Member of the ISBA Prize Committee (2024-), member of the Program Committee of Bayesian Nonparametrics Section (2022); member of ISBA Board (2017-2019); nomination committee for the Objective Bayes Section; member of the Savage Award Committee (2016).
2. **Royal Statistical Society (RSS) - since 2004**
   Member of Research Section (2019-2023, responsible for selection of discussion papers)
   Council and founding member of Young Statisticians Section –2008-2011, responsible for introduction and running of Pre-Ordinary Meetings
   Member of the local organising committee for RSS 2009 conference
3. **Institute of Mathematical Statistics (IMS)** – since 2004.
   Committee to Select Administrative Officers (senior academic statisticians): 2014/15 – member, 2015/16 –chair.
4. Edinburgh Mathematical Society (from 2008)
5. Honorary fellow of Heriot Watt University

Conference, Workshop and Session Organising

1. Member of the Program Committee of CMStatistics, December 2021, 2022, 2023
2. Member of the Program Committee for 13th World Meeting of Bayesian Nonparametrics (October 2022, moved from 2021)
3. Session organizer for CMStatistics 2020
4. Co-organiser of annual international conference of the International Society for Bayesian Analysis to take place in Edinburgh in 2018, jointly with Chris Holmes (Oxford), Miguel de Carvalho (Edinburgh), Vanda Inacio de Carvalho (Edinburgh), Mark Girolami (Imperial College), Chris Williams (Edinburgh), Judith Rousseau (Oxford).
5. LMS days on inverse problems (4 meetings in 2017, 2018, 2019), jointly with Sean Holman (Manchester) and Marta Betcke (UCL) (LMS grant)

6. 8-10 May 2017, Turing workshop "Inverse problems and data science" jointly with Carola Schoenlieb (Cambridge), Sean Holman (Manchester) and Marta Betcke (UCL) (funded by LMS and the Alan Turing Institute)
7. Co-organiser of an EPSRC-sponsored meetings "Inverse problems and applications", Edinburgh November-December 2015, March 2016
8. Session organiser "Calibration of misspecified Bayesian models" at 7th International Conference of Computational and Methodological Statistics (CMStatistics 2015) December 2015, London.
9. Session organiser "Inference in nonregular statistical models" 7th International Conference of the ERCIM WG on Computational and Methodological Statistics (ERCIM 2014) Pisa, Italy, December 2014
10. Workshop "Bayes Lectures 2014", Edinburgh, 28-29 May 2014 - co-organised with Colin Aitken and Chris Williams (Edinburgh)
11. EM3 programme "Uncertainty Quantification Using Bayesian Methods" (October 2013 –2015) initiative sponsored by EM3 (Edinburgh Multidisciplinary Multiscale Modelling, University of Edinburgh), to bring together researchers in Edinburgh who use Bayesian methods, and to have a workshop on Bayesian climate models (jointly with Prof G. Hegerl, School of GeoSciences).
12. Workshop "Bayes 2013: Workshop on Bayesian Spatio-Temporal models", Edinburgh, 8-9 October 2013 – co-organised with Colin Aitken and Guido Sanguinetti (Informatics)
13. Mini-workshop on Bayesian climate models, 7 October 2013 – co-organised with Prof G.Hegerl (GeoSciences)
14. Member of Programme Committee, International Conference on Artificial Intelligence and Statistics, AISTATS 2011-2015
15. Workshop "Bayes Lectures", Edinburgh, August 2012 - co-organised with Colin Aitken, Iain Murray and Chris Williams (University of Edinburgh)
16. Workshop "Sparse structures: statistical theory and practice" with Li Chen and Peter Green (University of Bristol), June 2010.
17. Member of the local organizing committee for RSS 2009 conference

Postgraduate supervision

Currently supervising 1 PhD student.

Niamh Graham (2020-24) "Statistical modelling of biological periodic processes" (passed viva voce subject to corrections)

PhD awarded:

Jenovah Rodrigues (2015-21) "Bayesian inverse problems with heterogeneous variance"

Johan van der Molen Moris (2015-20) "Bayesian Semiparametric estimation of densities with unknown support"

Adria Caballe Mestres (2013-2017) "Statistical methods for the testing and estimation of linear dependence structures on paired high-dimensional data: application to genomic data"

Advised a PhD student in the School of Engineering (2008-2010) (2 joint publications), and a visiting PhD student (2015; 1 joint publication). Co-supervised a PhD student from Precision medicine CDT (2019-2023)

PhD examination: Maxim Panov (Moscow, Russia), 19 January 2016, PhD advisor Prof V.Spokoiny
Emily Hamilton (University of Cardiff), 2009, PhD advisor Prof Zhigljavsky

Invited Lecture series / Short courses

1. Lecture series "Bayesian wavelet estimators in nonparameteric regression" (4 lectures), School of Mathematics, University of Bristol, March - April 2011.
2. Short course "Introduction to Bayesian inference" (6 lectures), Laboratoire de Analysis, Topologie et Probabilite, Universite de Provence, Marseille, France, May - June 2011.

Refereeing and Editorial

Member of Research Section Committee of the Royal Statistical Society (responsible for discussion papers, 2019-2023)
Associate editor of Bernoulli (2019 - 2021)
Associate editor of the Electronic Journal of Statistics (2015)
Regular referee for the Annals of Statistics, Electronic Journal of Statistics, JASA;
referee for Machine Learning: Bayesian analysis, Science and Technology , Journal of Machine Learning, Stochastic Processes and their Applications, PLOS One, Biostatistics, Biometrika, Computational Statistics and Data Analysis, Scandinavian Journal of Statistics, Annals of Economics and Statistics, papers for AISM 2010 conference (Artificial Intelligence and Statistical Modelling), IEEE, papers for AISTAT 2011-2016 (Conference on Artificial Intelligence and Statistics), NIPS 2014; EPSRC & MRC grant applications.