

Bogdan Toader

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RESEARCH INTERESTS

My research is focused on grid-free compressed sensing, or super-resolution. So far I have developed theory for the stability of the super-resolution problem with non-negative measures. Current and future work include extending the theory to the recovery of curves in two dimensions, working on algorithms for super-resolution and applying them to large scale data from scientific experiments.

More generally, I am interested in the broader fields of compressed sensing, mathematical signal processing, optimisation, machine learning and their application to problems arising in other scientific fields.

EDUCATION

- Oct 2018–present **Enrichment Student**, *Alan Turing Institute*, London, UK.
Six months placement at UK's national institute for data science and artificial intelligence.
- 2015–present **PhD candidate in Mathematics**, *University of Oxford*, Oxford, UK.
Industrially Focused Mathematical Modelling (EPSRC Centre for Doctoral Training) in collaboration with the National Physical Laboratory (NPL).
Main research project on **theory and algorithms for super-resolution**.
Expected end date: August 2019.
Advisors Prof Jared Tanner, Dr Andrew Thompson
Industrial supervisors Dr Stephane Chretien, Dr Peter Harris (NPL)
- 2009–2013 **BSc (Hons) Computer Science and Mathematics with Industrial Experience**, *University of Manchester*, Manchester, UK.
First class degree with final grade above 80%.
- 2005–2009 **Romanian Baccalaureate**, "*Gheorghe Munteanu Murgoci*" *National College*, Braila, Romania.
Final grade of 9.91 (out of a maximum of 10).

PUBLICATIONS

- Non-negative super-resolution is stable**
Armin Eftekhari, Jared Tanner, Andrew Thompson, Bogdan Toader and Hemant Tyagi
2018 IEEE Data Science Workshop, DSW 2018 - Proceedings page 100-104, 2018
- Sparse non-negative super-resolution – simplified and stabilised**
Armin Eftekhari, Jared Tanner, Andrew Thompson, Bogdan Toader and Hemant Tyagi
Submitted to *Applied and Computational Harmonic Analysis*, 2018
Preprint on arXiv: <https://arxiv.org/abs/1804.01490>
- The dual approach to non-negative super-resolution: impact on primal reconstruction accuracy**
Stephane Chretien, Andrew Thompson, Bogdan Toader
Submitted to *SampTA 2019*,
Preprint on arXiv: <https://arxiv.org/abs/1904.01926>

4. **A perturbation analysis of the super-resolution problem in the presence of noise**

Stephane Chretien, Andrew Thompson, Bogdan Toader

Work in progress

5. **An improved level method for super-resolution**

Stephane Chretien, Andrew Thompson, Bogdan Toader

Work in progress

OTHER RESEARCH EXPERIENCE

Jul–Sep 2016 **Deflating Magnetic Oscillations**, *Culham Centre for Fusion Energy*, Abingdon, UK.

Used deflation to find multiple periodic solutions to a system of ODEs that describes the behaviour of plasma. In collaboration with Culham Centre for Fusion Energy.

Supervisors Prof Patrick Farrell (Oxford), Dr Wayne Arter (CCFE)

May–Jul 2016 **Improved Source Reconstruction from Hydrophone Data**, *National Physical Laboratory*, London, UK.

Analysed how compressed sensing can be applied to a problem on ship localisation from measurements of the sound in the shipping lane, proposed by the National Physical Laboratory. An extension of this work to grid-free compressed sensing applied to the same problem has been the focus of my PhD project for the following three years.

Supervisors Prof Jared Tanner (Oxford), Dr. Andrew Thompson (Oxford), Dr Peter Harris (NPL), Dr Stephane Chretien (NPL)

2012–2013 **Formal Verification of Dynamical System**, *University of Manchester*, UK.

Final year undergraduate thesis on using the automatic theorem prover MetiTarski to analyse equilibrium and stability properties of dynamical systems.

Supervisor Dr Eva Navarro-López

PRESENTATIONS

Feb 2019 *InFoMM Group Meeting*, Oxford, UK – oral presentation

Jul 2018 *Curves and Surfaces Conference*, Arcachon, France – oral presentation

Jun 2018 *6th IMA Conference on Numerical Linear Algebra and Optimization*, Birmingham, UK – oral presentation

Jun 2018 *2018 IEEE Data Science Workshop*, Lausanne, Switzerland – poster presentation

Mar 2018 *InFoMM Annual Meeting 2018*, Oxford, UK – oral presentation

Mar 2018 *Numerical Analysis Seminar*, Oxford, UK – oral presentation

Feb 2018 *Research Workshop on Optimization and Big Data*, KAUST, Saudi Arabia – poster presentation

Jan 2018 *SIAM UKIE Annual Meeting*, Southampton, UK – poster presentation

May 2017 *InFoMM Group Meeting*, Oxford, UK – oral presentation

Mar 2017 *InFoMM Annual Meeting 2017*, Oxford, UK – poster presentation

OTHER ACADEMIC EVENTS

Jan 2019 *Mathematics of Imaging CIRM Winter School*, Marseille, France

Jun 2018 *142nd European Study Group with Industry*, Palanga, Lithuania

Worked on predicting the sustainable income of loan applicants according to rules from the central bank.

Jun 2017 *Summer School on Structured Regularization for High-Dimensional Data Analysis*, Henri Poincare Institute, Paris, France

- Dec 2016 *Data Study Group*, Alan Turing Institute, London, UK
Implemented network model to solve an air traffic prediction problem proposed by Airbus.
- May 2016 *116th European Study Group With Industry*, Durham, UK
Implemented mixed integer programming solution to problem on scheduling field trials proposed by Syngenta.
- Mar 2016 *InFoMM Graduate Modelling Camp*, Oxford, UK
Worked on calculating trajectory of footballs. Won IMA Best Team Performance prize.

AWARDS

- 2018 *Travel Award*, SIAM UKIE Annual Meeting, Southampton, UK
- 2016 *IMA Best Team Performance Prize*, InFoMM Graduate Modelling Camp, Oxford, UK
- 2015 *EPSRC InFoMM CDT Studentship*, Oxford, UK
- 2010 *Golden Anniversary Prize*, University of Manchester, UK
For excellence in first year studies, awarded to the students with the first five highest grades in the first year.
- 2006–2009 *Bronze Medal at the National Mathematical Olympiad*, Romania in 2007, 2008 and 2009
Won various prizes at other national and regional mathematics contests, including the national contest organised by the editors of the Romanian mathematical journal "Gazeta Matematica" for students who regularly send solutions to the problems published in the journal.

TEACHING EXPERIENCE

- 2016–2018 **Continuous Optimisation**, *University of Oxford*, Oxford, UK.
Teaching assistant for 4th year undergraduate course. Responsible with marking weekly assignments and solving problems on the board during classes, to groups of up to 15 students. Ran revision classes independently to groups of 30 students.
Lecturer Prof Coralia Cartis
- 2016–2018 **Integer Programming**, *University of Oxford*, Oxford, UK.
Teaching assistant for 3rd year undergraduate course. Responsible with marking weekly assignments and solving problems on the board during classes, to groups of up to 15 students. Ran revision classes independently to groups of 30 students.
Lecturer Prof Raphael Hauser
- 2016–2017 **Computational Mathematics**, *University of Oxford*, Oxford, UK.
Lab demonstrator for 1st year undergraduate Matlab classes. Presented new material in the form of live computer demo to groups of up to 20 students.
Lecturer Dr Andrew Thompson
- 2010–2011 **Peer Assisted Study Sessions Leader**, *University of Manchester*, Manchester, UK.
Weekly sessions with 1st year undergraduate students, in groups of around 6, assisting them with basic mathematics and programming.

INDUSTRY EXPERIENCE

- 2013–2015 **Technology Associate**, *Morgan Stanley*, London, UK.
Worked in the Pricing Technology team for the Interest Rate Derivatives business, where I used Scala and Perl to build and improve the pricing tools used by quantitative analysts and traders.
- Jun–Jul 2012 **Summer Internship, Technology**, *Credit Suisse*, London, UK.
Part of the team that maintains the Unix servers in the EMEA region. On top of handling daily requests from users, I improved my shell scripting skills.

2011-2012 **Industrial Placement, Technology**, *Morgan Stanley*, London, UK.

Worked as part of the Institutional Securities Group Technology division in one of the teams developing and supporting the equities trading systems. Acquired experience of working with large sets of data.

OUTREACH

2017-2018 **Lord Williams's School**, *Thame, Oxfordshire, UK*.

Ran two outreach sessions (in 2017 and in 2018 respectively) aimed at pre-final year students about doing research in applied mathematics. Presented material on the mathematics of machine learning.

COMPUTER SKILLS

Advanced MATLAB, PYTHON, JAVA, SCALA, LINUX, L^AT_EX
Intermediate C, C++, PERL

OTHER

Languages Romanian (native), English (fluent)

Hobbies Gliding, running, hiking, climbing, skiing, guitar