Bubacarr Bah

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Positions

Scientist (postdoc), Laboratory for Information and Inference Systems, EPFL, 09/12–current
Besides research, I contributed to a successful research proposal, guided student projects, assisted in teaching a PhD course, interviewed candidates, and was Technical Chair of SPARS '13 conf.

Graduate Assistant, University of The Gambia, Mathematics & Physics, 11/04–08/07
I taught 1st year undergraduate math courses, conducted Math and Physics tutorials and labs

Education

PhD in Applied & Computational Mathematics, University of Edinburgh (UoE), UK, Aug. 2012
Thesis: *Restricted Isometry Constants in Compressed Sensing,* (Supervisor: Jared Tanner)

MSc in Mathematical Modeling & Scientific Computing, Univ. of Oxford, UK, September 2008
Dissertation: *Diffusion Maps: Analysis and Applications,* (Supervisor: Erban Radek)

BSc in Mathematics & Physics, *summa cum laude*, Univ. of The Gambia (UTG), August 2004

Journal Publications

1. *Improved restricted isometry constant bounds for Gaussian matrices*; SIAM Journal on Matrix Analysis, Vol. 31(5) (2010) 2882-2898 (with J. Tanner).

2. *Bounds of restricted isometry constants in extreme asymptotics: formulae for Gaussian matrices*; accepted to Linear Algebra and its Applications, January 2013 (with J. Tanner).

3. *Vanishingly Sparse Matrices and Expander Graphs, with application to compressed sensing*; IEEE Transactions on Information Theory, Vol. 59(11) (2013) 7491-7508 (with J. Tanner).

Conference Proceedings

1. *On construction and analysis of sparse random matrices and expander graphs with applications to compressed sensing.*; 10th International Conference on Sampling Theory and Applications (SampTA 2013), pages 5-8, Bremen, Germany, July 2013 (with J. Tanner).

2. *Energy-aware adaptive bi-Lipschitz embeddings*; 10th International Conference on Sampling Theory and Applications (SampTA 2013), pages 360-363, Bremen, Germany, July 2013 (with A. Sadeghian and V. Cevher).

3. *Model-based Sketching and Recovery with Expanders*; accepted to SODA 2014, ACM-SIAM Symposium on Discrete Algorithms, January 2014 (with L. Baldassarre and V. Cevher).

4. *Metric learning with rank and sparsity constraints*; submitted to ICASSP 2014, IEEE Intl. Conf. on Acoustics, Speech, & Signal Processing (with S. Becker, V. Cevher, and G. Baran).

Research areas of interest

Design, analysis, and application of operators and algorithms in applied and computational mathematics, specifically focusing on compressed sensing (CS). Experience in numerical analysis, random matrix theory, signal processing and inverse problems; but currently work on sparse CS sensing matrices and recovery algorithms for model-based CS, and dimension reduction of data.

Research Award

SIAM Best Student Paper Prize, 2010
Awarded to the paper: *Improved restricted isometry constant bounds for Gaussian matrices.*
Awarded annually by SIAM to the best three papers submitted to the competition.

Selected Conference and Seminar Talks

Energy-aware adaptive bi-Lipschitz embeddings. 10^{th} International Conference on Sampling Theory and Applications (SampTA 2013), Jacobs University, Bremen, July 2013.

On construction and analysis of sparse matrices and expander graphs with applications to CS. 10^{th} International Conference on Sampling Theory and Applications (SampTA 2013), Jacobs University, Bremen, July 2013.

Model-based Sketching and Recovery with Expanders. 25^{th} Biennial Numerical Analysis Conference (NACONF 2013), University of Strathclyde, Glasgow, June 2013.

Compressed Sensing with Sparse Matrices from Expander Graphs. SIAM National Student Chapter Conference 2012 (SNSCC12), University of Manchester, May 2012.

Restricted Isometry Constants in Compressed Sensing. Systems, Information, Learning and Optimization (SILO) Seminar, University of Wisconsin, November 2011.

Random matrix theory questions arising in Compressed Sensing and related areas. FoCM'11 Workshop on Random matrix theory, computations and applications, Budapest, July 2011.

On Bounds of Restricted Isometry Constants for Gaussian Random Matrices. Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS'11), Edinburgh, June 2011.

Bounds and asymptotics of restricted isometry constants (RIC) for Gaussian random matrices. South African Symposium on Applied and Numerical Maths conference, U. of Stellenbosch, South Africa, March 2011.

Improved bounds on RICs for Gaussian matrices. Presented at the following meetings:

- Maxwell Symposium on Computational Mathematics, ICMS, Edinburgh, October 2010.
- Second IMA Conference on Numerical Linear Algebra and Optimization, U. of Birmingham, UK, September 2010.
- SIAM Annual Meeting 2010, Pittsburgh, Pennsylvania, USA, July 2010.
- British Maths Colloquium and British Applied Maths Colloquium (Maths2010), Edinburgh, UK, April 2010.

Compressed Sensing: RIC Bounds for Gaussian Matrices. Third Annual Oxford SIAM Student Chapter Conference, Oxford, February 2010.

Improved RIC Bounds for Gaussian Matrices, with applications in Compressed Sensing. Postgraduate Colloquium, School of Mathematics, UoE, February 2010.

Led a discussion on the following papers at the E-CoS Reading Group Seminars

- *A simple proof of the Restricted Isometry Property for Random Matrices* by Baraniuk et. al., March 2010.
- *Average Performance Analysis for Thresholding* by Schnass and Vandergheynst, Feb. 2009.

Invitations and Visits

Visiting Scholar at IMA, University of Minnesota, to take part in the seminar series on the "IMA Thematic Year of Mathematics of Information", Fall 2011.

Graduate Summer School on Image Processing, Park City Mathematics Institute (PMCI), Park City, Utah, June–July 2010.

Summer School on Theoretical Foundations and Numerical Methods for Sparse Recovery, RICAM (Linz, Austria), August 2009.

Honors and Awards

SIAM Certificate of Recognition, May 2011
Awarded by SIAM to one member of a SIAM Student Chapter.

Edinburgh University Scholarship, September 2008
UoE Principal's scholarships for outstanding new PhD intakes.

Commonwealth Scholarship, 2007–2008 academic year
Awarded by the Commonwealth Scholarship Commission – only 3 awards to Gambia that year.

Overall Best Student Award, December 2005
Awarded to only one student of every graduating class of the UTG.

Best Student of the Faculty of Science & Agriculture Award, December 2005
Awarded to only one student of every graduating class of each Faculty, UTG.

Vice Chancellor's Award, December 2005
Awarded to the best student of every graduating class of the UTG by the Vice Chancellor.

Teaching Experience

I conducted recitations, prepared, guided and corrected assignments and student projects in the *Theory and Methods for Linear Inverse Problems* (a PhD course), EPFL, first semester 2013.

I taught the second part of *Facets of Applied Maths* (a year 3 undergrad. maths course), UoE, second semester 2012.

I stood-in for a lesson on *Numerical Algorithms* (a year 3 undergrad. maths course), UoE, second semester 2011.

I taught (lectured and conducted lab sessions) an *Introduction to MATLAB* (a 3 weeks course) as part of the MSc Financial Maths and the MSc Financial Maths & Optimization at UoE, February 2011.

I tutored the following courses at UoE during the period of my PhD:

- Mathematical Communication and Computation Skills (MAT-3-MCC)
- Numerical Algorithms (MAT-3-NuA)
- Numerical Differential Equations (MAT-2-NuD)
- Practical Calculus (MAT-1-PCa) & Solving Equations (MAT-1-SEq)
- Applicable Maths 1 (MAT-1-am1) & Math. Methods 1 (MAT-1-mm1)
- Probability (MAT-2-Prb)

As a Graduate Assistant at the UTG (2004–2007), my teaching duties included:

- ***Lectures:*** Introduction to Probability & Statistics, Calculus 101 and Calculus 102.
- ***Tutorials and Labs:*** Calculus 101 & 102, Differential Equations, Vector Calculus, Statistics & Probability, Optics, and Experimental Optics I & II.

I taught *Mathematics* and *Social & Environmental Studies* (SES) in secondary (high) in The Gambia, 1997 to 2000.

I underwent teacher training, did *Higher Teachers' Certificate* (HTC) course specializing in Mathematics and SES, Gambia College, 1995 to 1997.

Other Professional Experiences and Skills

EDUCATIONAL:

Took the following two SMSTC courses in the first year of my PhD and scored A grades in both Mathematical Models and Probability

ORGANIZATIONAL:

Technical Chair (played a central role in the technical organization) and Webmaster of SPARS'13 hosted by EPFL in Lausanne in July 2013.

Webmaster of the website of the Laboratory for Information and Inference Systems (LIONS) at EPFL from July 2013.

Helped in the organization of SPARS'11 hosted by the Edinburgh Compressed Sensing Group (E-CoS) in Edinburgh in June 2011.

Co-founder of the Edinburgh SIAM Student Chapter, holding the office of President (2010) and Vice President (2009), and organized the following meetings.

- *Inaugural Chapter conference, March 2010,* with speakers Prof Sir David Wallace CBE FRS FREng, Director, Isaac Newton Institute for Mathematical Sciences and Dr Robert Leese, Director, Smith Institute for Industrial Mathematics & System Engineering; attended by Prof Steve Chapman, Principal Heriot-Watt University and Prof Nigel Brown, Vice Principal and Head of College of Science & Engineering, UoE.
- *Second annual Chapter conference, February 2011,* with speakers Prof Roger Fletcher FRS FRSE, University of Dundee and Dr Kevin Painter, Heriot Watt University.
- *Annual Chapter seminar, June 2011,* with speaker Prof Gilbert Strang, MIT.

OUTREACH:

I took part in the following outreach activities of the School of Mathematics, UoE, as a tutor or demonstrator:

- Lothian Equal Access Programme for Schools (LEAPS) Summer School (introducing students to university maths), June 2010 and 2011;
- Higher and advanced higher maths revision sessions for students (15–17 year olds) from high schools in Edinburgh, March 2009 and 2010;
- Edinburgh Science Festival mathematics exhibition "Winning Ways", April 2011.

COMPUTING:

Matlab, C++, Maple, LaTeX, Unix (Linux), Windows, Mac OS, Graphics and Web Design.

LANGUAGES:

Fluent in English, Fula, Wollof and Mandinka; speaks some French, Jola and Manjago.