Samuel **Davenport**

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Born
24/03/1994

Citizenship
British and German

Research Interests

Work

2021-Present **University of California San Diego - Postdoctoral research fellow**
Working on developing new statistical methodology for analyzing brain imaging and genetics data. Current projects include 1) Creating new methods for analysing brain imaging data which increase the power of fMRI inference, 2) Working on methods to increase the speed of resampling in large datasets, 3) Developing statistical gaurantees for heritability estimation in genetics and 4) Developing inference methods for performing image segmentation using deep learning. I am also co-supervising 3 PhD students.

2021 **University of Toulouse - Postdoctoral research fellow**
Worked with Professors Pierre Neuvial and Bertrand Thirion on post-hoc selection in multidimensional linear models with applications to brain imaging and transcriptomics.

2020-2021 **University of Oxford - Postdoctoral research fellow**
Worked with Professor Thomas E. Nichols on statistical inference using Random Field Theory and resampling methods.

Education

2016-2020 **University of Oxford - DPhil in Statistics on the OxWaSP program**
Supervised by Professors Thomas E. Nichols and Chris Holmes. During the PhD I worked on developing statistical methods for image analysis with applications in Neuroimaging. Focused on Random Field Theory, Multiple Testing and Selective Inference. In this capacity I lead classes for courses on modern statistical methods and tutored students in Analysis and Probabilty and Measure theory.

2012-2016 **University of Cambridge - BA and Masters in Mathematics**
Distinction, coming 20th in the year out of 240 students and 1st in my college. Thesis on Network Changepoint Detection in fMRI data.

2010-2012 **IB (International Baccalaureate) Diploma: 43/45 points**
Higher Level Mathematics, Physics and Chemistry all 7 (highest mark).

Reviewing

Journal of Computational and Graphical Statistics, Electronic Journal of Statistics, Statistical Methods and Applications, Human Brain Mapping, Neuroimage (6 articles), Imaging-Neuroscience, Psychometrika, Biometrics and Frontiers in Neuroscience
I have been a reviewer for these journals and in this capacity have reviewed a number of articles on statistical methods on multiple testing, Random Field Theory, neuroimaging and other related areas.

Organized Workshops and courses

University of California, San Diego - March 2024
I gave a 2-part lecture course on performing surface and cluster based inference in neuroimaging. This included an introduction to surface based data (including the spin test), multiple testing in neuroimaging, cluster inference and bounds on the extent of activity within a given cluster. This was followed by practical sessions in MATLAB.

University of Padova - November 2023
I gave a 3 hour lecture course on statistical inference using Random Field Theory in neuroimaging. This was a 2 part course which involved a theory and MATLAB practical session.

OHBM, Montreal - July 2023
I co-organized the 2023 OHBM workshop on Beyond Blobology, which was a full-day course on the latest statistical methods in neuroimaging. This involved inviting and organizing speakers and practicals as well including giving a lectures on the theory and practice of performing TDP inference in linear models.

University of Oxford - July 2021
I organized a mini-conference on Random Field Theory based inference, inviting 3 speakers to talk about their work on calculating an using the expected Euler characteristic to perform inference.

Research

Samuel Davenport, Riccardo De Santis, Jesse Hemerik, Jelle J. Goeman and Livio Finos. Smooth logistic mass univariate inference for MS lesion data using sign-flipping, Società Italiana di Statistica, 2024.

Samuel Davenport, Bertrand Thirion and Pierre Neuvial. FDP control in multivariate linear models using the residual bootstrap, 2nd round of submissions at EJS, 2024.

Riccardo De Santis, Jelle J. Goeman, **Samuel Davenport**, Jesse Hemerik and Livio Finos. Permutation-based multiple testing when fitting many generalized linear models. ArXiv preprint arXiv:2403.02065, 2024.

Samuel Davenport, Armin Schwartzman, Thomas E. Nichols and Fabian JE Telschow. Riding the SuRF to Continuous Land - Part 2: Precise FWER control in Neuroimaging using Random Field Theory. In submission at JASA Applications and Case studies, 2024.

Fabian JE Telschow and **Samuel Davenport**. Riding the SuRF to Continuous Land - Part 1: Precise FWER Control for Gaussian related random fields. In submission at JASA Theory and Methods, 2024.

Samuel Davenport, Thomas E. Nichols and Armin Schwartzman. Confidence regions for the location of peaks of smooth random fields. In submission, 2023.

Samuel Davenport and Fabian JE Telschow. On the finiteness of the second moment of the number of critical points of Gaussian random fields. ArXiv preprint arXiv:2201.01591, 2022.

Fabian Telschow, **Samuel Davenport** and Armin Schwartzman. Functional delta residuals and applications to functional effect sizes, JMVA, 2022.

Samuel Davenport. Statistical Inference in fMRI using Random Field Theory and Resampling Methods, University of Oxford PhD Thesis, 2021.

Samuel Davenport and Thomas E. Nichols. The expected behaviour of random fields in high dimensions: contradictions in the results of Bansal and Peterson (2018), Magnetic Resonance Imaging, 2021.

Samuel Davenport and Thomas E. Nichols. Selective peak inference: Unbiased estimation of raw and standardized effect size at local maxima, NeuroImage, 2020.

Software

I have created and maintain a number of freely available software packages:

StatBrainz: The Statbrainz package contains Matlab code to perform statistical inference and visualization of brain imaging data. This includes functions to perform resampling and multiple testing. In particular methods for clustersize inference (including associated TDP bounds), and both single and simultaneous CoPE (coverage of probability sets) are provided. The package also provides code for reading and visualizing volumetric and surface brain imaging data. Detailed tutorials exploring these features are provided.

pyperm: This package contains python code to perform inference in high-dimensional linear and generalized linear models using permutation and the bootstrap. In particular it provides post-hoc inference for multiple testing methods when considering multiple contrasts.

RFTtoolbox: The RFTtoolbox contains Matlab code to perform voxelwise RFT analysis, LKC estimation, generation of convolution fields, perform Gaussizianization to improve Gaussianity, provide confidence regions for the location of peaks of random fields and many other features. These can be used to perform multiple testing and general study of multi-dimensional imaging data. Tutorials exploring these features are provided.

Computer Languages

Very experienced in Matlab and Python and experienced in using large language models for assisting in coding. Proficient in R and Git, bash and in SPM, FSL and freesurfer.

Spoken Languages

Native English speaker. Proficient Italian and French.

Research Visits

11/23-11/23	**University of Padova** I spent a week in Padova visiting Professor Livio Finos working on developing permutation models for logistic regression of MS lesion data.

06/23-06/23	**University of Toulouse**
	I went to Toulouse to visit Professor Pierre Neuvial to work on non-parametric TDP interference.
07/21-08/21	**Technion - Israel Institute of Technology**
	I visited Dr. David Azriel in Haifa, Israel to work on heritability estimation methods and peak detection in cryo-EM data.
10/19-10/19	**KAUST - King Abdul Salman University of Science and Technology**
	I went to Saudi Arabia to visit Professor Hernando Ombao and give a talk on clustersize inference using Random Field Theory.
01/19-03/19	**University of California, San Diego**
	I spent 2 months working with Professor Schwartzman at UCSD on developing confidence regions for the locations of peaks in a random field.

Selected Invited Talks

Full details of all talks given including slides and associated papers and code are available on my website at https://sjdavenport.github.io/talks. Here are some selected talks:

June 2024 (to come)	**OHBM, Seoul, South Korea**
	Invited talk on why Clustersize inference is more informative than TFCE.
December 2023	**CMStatistics, Berlin, Germany**
	Invited talk on Controlling False positive rates in Neuroimaging.
July 2023	**Conference on Neuroimaging Statistics, Montreal, Canada**
	Invited talk on Accurate voxelwise FWER control in fMRI using Random Field Theory.
June 2023	**University of Toulouse, Toulouse, France**
	Invited talk on voxelwise inference using Random Field Theory.
August 2022	**MCP Conference, Bremen, Germany**
	Talk on FDP control in multivariate linear models using the bootstrap.
August 2022	**Compstat, Bologna, Italy**
	Invited talk on Confidence regions for the location of peaks of a smooth random field.

| March 2022 | **Sansouci Conference, University of Toulouse, France** |
| | Invited talk on FDP control in multivariate linear models using the bootstrap. |

| May 2021 | **Parietal Group, Centre Inria-Saclay, France** |
| | Invited talk on Selective peak inference - Unbiased estimation of the effect size at local maxima |

| October 2019 | **King Abdul Salman University of Science and Technology, Saudi Arabia** |
| | Invited talk on clustersize inference using Random Field Theory. |

Acknowledged in

Blain et al 2022,Bowring et al 2019,Afyouni et al 2019,Teleschow and Schwartzman 2019,Sommerfield et al 2018

Internships

07/16-08/16	**Mercedes and the University of Cambridge**
	I worked with the Mercedes Racing Team fitting mixed effects models to help understand tyre degradation.
06/15-07/15	**STATSLAB - Department of Statistics at the University of Cambridge**
	I worked with Professor Chris Rogers on a project that involved analyzing the distribution of financial time series and backtesting statistical trading strategies.
06/14-08/14	**STATSLAB - Department of Statistics at the University of Cambridge**
	I worked with Professor Nathanael Berestycki on analysis of the adjacent transposition shuffle.

Awards

| 2016 | **King's College Cambridge - Part III Mathematics Prize** |

| 2011 | **Silver Medal - British Mathematics Olympiad** |
| | Came 29th out of around 1100 participants. |

Other Interests

I dance Lindy Hop and Boogie woogie competitively and play squash, tennis and ultimate frisbee.