

# Jason P. Smith

## Curriculum vitae

### Personal

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Email: [jason.smith@ntu.ac.uk](mailto:jason.smith@ntu.ac.uk)

Website: [jasonpsmith.github.io](http://jasonpsmith.github.io)

Phone: +447770390059

Citizenship: British

### Education

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2021 – 2022 Postgraduate Certificate in Higher Education  
*Distinction*. Nottingham Trent University, Nottingham, UK

2012 – 2015 PhD in Computer Science  
Topic: “The Möbius Function and Topology of the Permutation Poset”  
Advisor: Prof. Einar Steingrímsson  
Department of Computer and Information Sciences, University of Strathclyde, Glasgow, UK

2008 – 2012 Undergraduate and Masters Degree in Mathematics, MMath  
*First Class Honours*. University of Bath, Bath, UK

### Employment

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2021 – Senior Lecturer in Mathematics  
Department of Physics and Mathematics, Nottingham Trent University, Nottingham, UK

2020 – 2021 Lecturer in Mathematics  
Department of Physics and Mathematics, Nottingham Trent University, Nottingham, UK

2018 – 2020 Research Fellow  
Department of Mathematics, University of Aberdeen, Aberdeen, UK  
Project: Topological Analysis of Neural Systems (PI: Ran Levi)

2015 – 2018 Research Associate  
Department of Computer and Information Sciences, University of Strathclyde, Glasgow, UK  
Project: The Möbius Function of the Poset of Permutations (PI: Einar Steingrímsson)

### Grants

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2024 £45,739 EPSRC Mathematical Sciences Small Grants Project Lead  
Title: Random Models of Directed Simplicial Complexes

2017 £3,300 SICSA Postdoctoral and Early Career Researcher Exchange Grant Project Lead

### Research Interests

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Interdisciplinary applications of Combinatorics and Topology, particularly in Neuroscience.

My main focus is the application of graph theory and topology to connectomics, that is, the study of neural connections. Representing brains as complex networks, and higher-order variations, allows the application of powerful mathematical tools which uncovers important structural and functional properties of neural connections.

My research also focuses on theoretical areas of combinatorics and topology along with their applications in Biology, Physics and Computer Science. This includes work on topics such as: network complexity, simplicial complexes, poset topology, permutation patterns, and combinatorial tableaux.

## Teaching Roles

Jason P. Smith

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2024-	Module Leader	MATH10541: Discrete Mathematics	Nottingham Trent University
2024-	Module Leader	MATH10272: Foundations of Pure Mathematics	Nottingham Trent University
2020-	Module Leader	MATH30481: Combinatorics	Nottingham Trent University
2020-2024	Module Leader	MATH10271: Introduction to Abstract Algebra	Nottingham Trent University
2023-2024	Module Leader	MATH00021: Intermediate Mathematics	Nottingham Trent University
2019-2020	Module Leader	MA2010: Probability	University of Aberdeen
2015-2016	Lecturer	CS103: Machines, Languages and Computation	University of Strathclyde
2012-2015	Teaching Assistant	CS110: Combinatorics For Computer Science 1	University of Strathclyde
2014-2015	Teaching Assistant	CS215: Combinatorics for Computer Science 2	University of Strathclyde
2013-2015	Teaching Assistant	CS208: Logic And Algorithms	University of Strathclyde
2013-2014	Teaching Assistant	CS212: Topics in Computing 2	University of Strathclyde

## Additional Duties and Roles

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- PhD Supervisor to Karim Bibars (2024-).
  - Co-Organiser of AATRN Networks monthly online seminar.
  - Co-Organising of the BrainNet Workshops 2023 and 2024 and the British Combinatorial Conference 2017.
  - NTU Postgraduate Admissions tutor for Physics and Mathematics.
  - Author of open source C++ packages: flagser-count, tournser, deltser, and pathfinder.
  - Author of open source Python packages: connectome-analysis, pyflagsercount, and bigrandomgraphs.
  - Proficient in C++, Python, Java,  $\LaTeX$ , Linux and High Performance Computing.
  - Reviewed articles for: Demonstratio Mathematica, Journal of Complex Networks, Theoretical Computer Science, Tbilisi Mathematical Journal, Annals of Combinatorics, Discrete Applied Mathematics, Electronic Journal of Combinatorics, European Journal of Combinatorics, Journal of Combinatorial Theory, Series A, and AMS Mathematical Reviews.

## Memberships

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- Member of the Edinburgh Mathematical Society.
  - Member of EPSRC Peer Review College.
  - Fellow of Advance HE.

## Selected Presentations

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May 2024	<i>Invited Talk</i>	“Linear Extensions of Posets and an Application to Neuroscience”, Scottish Combinatorics Meeting, St Andrews.
Nov 2023	<i>Invited Talk</i>	“Brain Structure, Function, and Reliability Explored Using Combinatorial Topology”, Combinatorial Algebraic Topology and Applications, Pisa.
May 2022	<i>Invited Talk</i>	“Using Combinatorics to Classify Functional Brain Data”, Scottish Combinatorics Meeting, University of Glasgow (online).
Jul 2019	<i>Invited Talk</i>	“Using topological data analysis to classify stimuli in the Blue Brain reconstruction”, SIAM Applied Algebraic Geometry, University of Bern.
Jun 2018	<i>Invited Talk</i>	“A Poset of Graphs”, British Mathematics Colloquium, University of St Andrews.
Aug 2015	<i>Invited Talk</i>	“Combinatorial Algebraic Topology and its Applications to Permutation Patterns”, <i>Manchester Discrete Mathematics Seminar</i> , University of Manchester.

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- 2024 “Heterogeneous and higher-order cortical connectivity undergirds efficient, robust and reliable neural codes”, with Daniela Egas Santander, Christoph Pokorny, et al., accepted in *iScience*.
- 2024 “Statistical Complexity of Heterogeneous Geometric Networks”, with Keith Malcolm Smith, accepted in *PLOS Complex Systems*.
- 2024 “Modeling and simulation of rat non-barrel somatosensory cortex. Part I: Modeling anatomy”, with Michael W. Reimann, Sirio Bolaños Puchet, Daniela Egas Santander, et al., *eLife*, 99688.
- 2024 “On the homotopy type of multipath complexes”, with Luigi Caputi, Carlo Collari, and Sabino Di Trani, *Mathematika*, 70: e12235.
- 2022 “Topology of synaptic connectivity constrains neuronal stimulus representation, predicting two complementary coding strategies”, with Michael W. Reimann, Henri Riihimäki, Jānis Lazovskis, Christoph Pokorny, and Ran Levi, *PLOS ONE*, 17(1): e0261702.
- 2022 “An application of neighbourhoods in digraphs to the classification of binary dynamics”, with Pedro Conceição, Dejan Govc, Jānis Lazovskis, Ran Levi, and Henri Riihimäki, *Network Neuroscience*, 6(2): 528–551.
- 2022 “Asymptotic behaviour of the containment of certain mesh patterns”, with Dejan Govc, *Discrete Mathematics*, 345(5):112813.
- 2021 “Complexes of tournaments, directionality filtrations and persistent homology”, with Dejan Govc and Ran Levi, *Journal of Applied and Computational Topology*, 5(2):313-337
- 2020 “Computing persistent homology of directed flag complexes”, with Daniel Luetgehetmann, Dejan Govc and Ran Levi, *Algorithms*, 13(1):19.
- 2020 “The poset of mesh patterns”, with Henning Úlfarsson, *Discrete Mathematics*, 343(6).
- 2019 “Permutation graphs and the Abelian sandpile model, tiered trees and non-ambiguous binary trees”, with Mark Dukes, Thomas Selig and Einar Steingrímsson, *The Electronic Journal of Combinatorics*, 26: 3.29.
- 2019 “The poset of graphs ordered by induced containment”, *Journal of Combinatorial Theory, Series A*, 168:348-373.
- 2019 “The Abelian sandpile model on Ferrers graphs – A classification of recurrent configurations”, with Mark Dukes, Thomas Selig and Einar Steingrímsson, *European Journal of Combinatorics*, 81:221-241.
- 2019 “On the Möbius function and topology of general pattern posets”, *The Electronic Journal of Combinatorics*, 26: 1.49.
- 2019 “Modular decomposition of graphs and the distance preserving property”, with Emad Zahedi, *Discrete Applied Mathematics*, 265:192-198.
- 2017 “EW-tableaux, Le-tableaux, tree-like tableaux and the Abelian sandpile model”, with Thomas Selig and Einar Steingrímsson, *The Electronic Journal of Combinatorics*, 25: 3.14.
- 2017 “A formula for the Möbius function of the permutation poset based on a topological decomposition”, *Advances in Applied Mathematics*, 91:98-114.
- 2016 “Intervals of permutations with a fixed number of descents are shellable”, *Discrete Mathematics*, 339(1):118-126.
- 2014 “On the Möbius function of permutations with one descent”, *The Electronic Journal of Combinatorics*, 21: 2.11.