

# Stanford

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## Gunnar Carlsson

Ann and Bill Swindells Professor, Emeritus  
Mathematics

 Curriculum Vitae available Online

### Bio

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#### BIO

Dr. Carlsson has been a professor of mathematics at Stanford University since 1991. In the last ten years, he has been involved in adapting topological techniques to data analysis, under NSF funding and as the lead PI on the DARPA “Topological Data Analysis” project from 2005 to 2010. He is the lead organizer of the ATMCS conferences, and serves as an editor of several Mathematics journals

#### ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Mathematics
- Member, Institute for Computational and Mathematical Engineering (ICME)

#### BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, Scientific Advisory Board, WASP initiative, Wallenberg Foundation, Sweden (2018 - present)

#### PROFESSIONAL EDUCATION

- Ph.D., Stanford University , Mathematics (1976)
- B.A., Harvard University , Mathematics (1973)

### Teaching

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#### STANFORD ADVISEES

##### Doctoral Dissertation Co-Advisor (NonAC)

Naomi Kraushar

### Publications

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#### PUBLICATIONS

- **Fibers of Failure: Classifying Errors in Predictive Processes** *ALGORITHMS*  
Carlsson, L. S., Vejdemo-Johansson, M., Carlsson, G., Jonsson, P. G.  
2020; 13 (6)
- **A Topology Layer for Machine Learning**  
Brueel-Gabrielsson, R., Nelson, B. J., Dwaraknath, A., Skraba, P., Guibas, L. J., Carlsson, G., Chiappa, S., Calandra, R.  
ADDISON-WESLEY PUBL CO.2020: 1553–62
- **Bounded G-theory with fibred control** *JOURNAL OF PURE AND APPLIED ALGEBRA*  
Carlsson, G., Goldfarb, B.

2019; 223 (12): 5360–95

- **Parametrized homology via zigzag persistence** *ALGEBRAIC AND GEOMETRIC TOPOLOGY*  
Carlsson, G., de Silva, V., Kalisnik, S., Morozov, D.  
2019; 19 (2): 657–700
- **Towards a new approach to reveal dynamical organization of the brain using topological data analysis** *NATURE COMMUNICATIONS*  
Saggar, M., Sporns, O., Gonzalez-Castillo, J., Bandettini, P. A., Carlsson, G., Glover, G., Reiss, A. L.  
2018; 9: 1399
- **Hierarchical clustering of asymmetric networks** *ADVANCES IN DATA ANALYSIS AND CLASSIFICATION*  
Carlsson, G., Memoli, F., Ribeiro, A., Segarra, S.  
2018; 12 (1): 65–105
- **Admissible Hierarchical Clustering Methods and Algorithms for Asymmetric Networks** *IEEE TRANSACTIONS ON SIGNAL AND INFORMATION PROCESSING OVER NETWORKS*  
Carlsson, G., Memoli, F., Ribeiro, A., Segarra, S.  
2017; 3 (4): 711–27
- **Uncovering precision phenotype-biomarker associations in traumatic brain injury using topological data analysis.** *PLoS one*  
Nielson, J. L., Cooper, S. R., Yue, J. K., Sorani, M. D., Inoue, T., Yuh, E. L., Mukherjee, P., Petrossian, T. C., Paquette, J., Lum, P. Y., Carlsson, G. E., Vassar, M. J., Lingsma, et al  
2017; 12 (3)
- **Representable Hierarchical Clustering Methods for Asymmetric Networks**  
Carlsson, G., Memoli, F., Ribeiro, A., Segarra, S., Palumbo, F., Montanari, A., Vichi, M.  
SPRINGER INTERNATIONAL PUBLISHING AG.2017: 83–95
- **Symmetric and r-symmetric tropical polynomials and rational functions** *JOURNAL OF PURE AND APPLIED ALGEBRA*  
Carlsson, G., Verovsek, S. K.  
2016; 220 (11): 3610-3627
- **On modules over infinite group rings** *INTERNATIONAL JOURNAL OF ALGEBRA AND COMPUTATION*  
Carlsson, G., Goldfarb, B.  
2016; 26 (3): 451-466
- **The ring of algebraic functions on persistence barcodes** *Homology, homotopy, and applications*  
Adcock, A., Carlsson, E., Carlsson, G.  
2016; 18 (1): 381-402
- **Topological data analysis for discovery in preclinical spinal cord injury and traumatic brain injury** *NATURE COMMUNICATIONS*  
Nielson, J. L., Paquette, J., Liu, A. W., Guandique, C. F., Tovar, C. A., Inoue, T., Irvine, K., Gensel, J. C., Kloke, J., Petrossian, T. C., Lum, P. Y., Carlsson, G. E., Manley, et al  
2015; 6
- **NUDGED ELASTIC BAND IN TOPOLOGICAL DATA ANALYSIS** *TOPOLOGICAL METHODS IN NONLINEAR ANALYSIS*  
Adams, H., Atanasov, A., Carlsson, G.  
2015; 45 (1): 247-272
- **Evasion paths in mobile sensor networks** *INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH*  
Adams, H., Carlsson, G.  
2015; 34 (1): 90-104
- **Topological methods reveal high and low functioning neuro-phenotypes within fragile X syndrome.** *Human brain mapping*  
Romano, D., Nicolau, M., Quintin, E., Mazaika, P. K., Lightbody, A. A., Cody Hazlett, H., Piven, J., Carlsson, G., Reiss, A. L.  
2014; 35 (9): 4904-4915
- **Classification of hepatic lesions using the matching metric** *COMPUTER VISION AND IMAGE UNDERSTANDING*  
Adcock, A., Rubin, D., Carlsson, G.  
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- **A Klein-Bottle-Based Dictionary for Texture Representation** *INTERNATIONAL JOURNAL OF COMPUTER VISION*  
Perea, J. A., Carlsson, G.  
2014; 107 (1): 75-97
- **Topological pattern recognition for point cloud data** *ACTA NUMERICA*  
Carlsson, G.  
2014; 23: 289-368
- **Topology of viral evolution** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
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- **BIG-DATA VISUALIZATION FOR TRANSLATIONAL NEUROTRAUMA**  
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- **Classifying Clustering Schemes** *FOUNDATIONS OF COMPUTATIONAL MATHEMATICS*  
Carlsson, G., Memoli, F.  
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- **Extracting insights from the shape of complex data using topology** *SCIENTIFIC REPORTS*  
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- **Building Markov state models with solvent dynamics** *11th Asia Pacific Bioinformatics Conference (APBC)*  
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- **Persistent topology and metastable state in conformational dynamics.** *PloS one*  
Chang, H., Bacallado, S., Pande, V. S., Carlsson, G. E.  
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- **Alternative Axiomatic Constructions for Hierarchical Clustering of Asymmetric Networks** *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*  
Carlsson, G., Memoli, F., Ribeiro, A., Segarra, S.  
IEEE.2013: 791–794
- **Hierarchical Clustering Methods and Algorithms for Asymmetric Networks** *47th Asilomar Conference on Signals, Systems and Computers*  
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IEEE.2013: 1773–1777
- **AXIOMATIC CONSTRUCTION OF HIERARCHICAL CLUSTERING IN ASYMMETRIC NETWORKS** *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*  
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- **A Topological Paradigm for Hippocampal Spatial Map Formation Using Persistent Homology** *PLOS COMPUTATIONAL BIOLOGY*  
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- **Computational topology for configuration spaces of hard disks** *PHYSICAL REVIEW E*  
Carlsson, G., Gorham, J., Kahle, M., Mason, J.  
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- **Topology based data analysis identifies a subgroup of breast cancers with a unique mutational profile and excellent survival** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*

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  - **Derived representation theory and the algebraic K-theory of fields** *JOURNAL OF TOPOLOGY*  
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  - **CONTROLLED ALGEBRAIC G-THEORY, I** *JOURNAL OF HOMOTOPY AND RELATED STRUCTURES*  
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  - **Covering homology** *ADVANCES IN MATHEMATICS*  
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  - **Statistical Topology via Morse Theory Persistence and Nonparametric Estimation** *AMS Special Session on Algebraic Methods in Statistics and Probability*  
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  - **Constructing multi-resolution Markov State Models (MSMs) to elucidate RNA hairpin folding mechanisms.** *Pacific Symposium on Biocomputing. Pacific Symposium on Biocomputing*  
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  - **The Theory of Multidimensional Persistence** *23rd Annual Symposium on Computational Geometry*  
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- **Computing Multidimensional Persistence** *20th International Symposium on Algorithms and Computations (ISAAC 2009)*  
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- **Zigzag Persistent Homology and Real-valued Functions** *25th Annual Symposium on Computational Geometry*  
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- **Topological analysis of population activity in visual cortex** *JOURNAL OF VISION*  
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- **epsilon-entropy of piecewise polynomial functions and tree partitioning compression** *33rd IEEE International Conference on Acoustics, Speech and Signal Processing*  
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- **LORA: Robust and simple routing algorithms for ad hoc mobile wireless networks** *IEEE Global Telecommunications Conference (GLOBECOM 01)*  
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- **Admission control, power control and QoS analyses for ad hoc wireless networks** *IEEE International Conference on Communications*  
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- **Proper homotopy and transfers for infinite groups** *Algebraic Topology and its Applications*  
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- **On the homotopy fixed point problem for free loop spaces and other function complexes** *K-theory*  
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- **On the homology of finite free  $(\mathbb{Z}/2)^n$ -complexes** *Inventiones Mathematicae*  
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- **On the rank of abelian groups acting freely on  $(S^n)^k$**  *Inventiones Mathematicae*  
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- **A counterexample to a conjecture of Steenrod** *Inventiones Mathematicae*  
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- **Some restrictions on groups acting freely on  $(S^n)^k$**  *Transactions of the American Mathematical Society*  
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- **SOME EXACT SEQUENCES IN THE THEORY OF HERMITIAN FORMS** *JOURNAL OF PURE AND APPLIED ALGEBRA*  
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- **Wu invariants of Hermitian forms** *Journal of Algebra*  
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- **On the Witt group of a 2-adic group ring** *Quarterly Journal of Mathematics*  
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- **On the stable splitting of  $bo^{bo}$  and torsion operations in connective K-theory** *Pacific Journal of Mathematics*  
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