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# Justin Solomon

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## Education

- 2010-2015 **Ph.D. in Computer Science, Stanford University** (Advisor: Leonidas Guibas) *Stanford, CA*  
Geometric Computing Group, Department of Computer Science  
• Dissertation: “Transportation Techniques for Geometric Data Processing”  
• Distinction in Teaching (completed 2013)  
• Hertz Foundation Graduate Fellowship, National Science Foundation (NSF) Graduate Research Fellowship, and National Defense Science & Engineering Graduate (NDSEG) Fellowship
- 2010-2012 **Master of Science in Computer Science, Stanford University** (Advisor: Leonidas Guibas) *Stanford, CA*  
Qualifying exam in Computer Science Theory (topic: “PDE Approaches to Graph Analysis”)
- 2006-2010 **Bachelor of Science, Stanford University** (Advisors: Leonidas Guibas and Richard Schoen) *Stanford, CA*  
Double major in Computer Science (honors) and Math (honors); GPA: 4.138
- 2002-2006 **Thomas Jefferson High School for Science and Technology (TJHSST)** *Alexandria, VA*

## Research Experience

- 2016-Present **MIT, Department of Electrical Engineering & Computer Science** *Cambridge, MA*  
*X-Consortium Career Development Assistant Professor (2016-2020), Associate Professor (2020-Present):* Lead the Geometric Data Processing group in MIT’s Computer Science and Artificial Intelligence Laboratory (CSAIL), studying processing, analysis, and editing of geometric data; teach and develop undergraduate and graduate courses.
- 2015-2016 **Princeton University, Program in Applied & Computational Mathematics** *Princeton, NJ*  
*Postdoctoral fellow:* Helped design optimization algorithms for cryo-electron microscopy (PI: A. Singer); research and collaboration in geometry processing, computer graphics, machine learning, and other disciplines; presented findings at academic conferences and symposia.
- 2010-2015 **Stanford University, Geometric Computing Group** *Stanford, CA*  
*Graduate Research Assistant:* Developed algorithms for geometry processing, machine learning, and graphics using techniques from continuous differential geometry, partial differential equations, and optimization; collaborated with researchers at Stanford and other universities; presented findings at academic conferences and group meetings; led instruction and development of course materials.
- 2014 **University of Southern California, Department of Computer Science** *Los Angeles, CA*  
*Visiting Research Fellow:* Studied numerics for Markov chain Monte Carlo (MCMC) sampling and performance capture with machine learning and graphics groups; led seminars and discussions on optimal transportation and geometric PDE; guest lecturer in introductory computer graphics course.
- 2007-2012 **Pixar Animation Studios, Tools Research Group** *Emeryville, CA*  
*Summer Intern (2007, 2008, 2009), Part Time Research Assistant (2008-10, 2012):* Designed efficient algorithms for image processing using local histograms; examined alternatives to the bilateral filter for computational photography, stylization, and painterly rendering; implemented filters on the GPU and in Pixar’s compositing software; prepared SIGGRAPH submissions and other papers. *Summer Intern (2007):* Designed specialized linear solvers with fast rates of convergence for cloth simulation; demonstrated these algorithms using Pixar’s physics simulation system.
- 2008-2010 **Stanford University, Geometric Computing Group** *Stanford, CA*  
*Research Assistant:* Formulated methods for replicating regular surface features and detecting intrinsic symmetries; developed algorithms for approximating Killing vector fields to represent continuous surface self-isometries using machinery from discrete and continuous Riemannian geometry.
- 2010 **British Library Sound Archive, Edison Fellowship Program** *London, UK*  
*Visiting Researcher:* Studied the history of Elgar’s Cello Concerto using traditional and computerized techniques; developed software to visualize differences between various cellists’ interpretations of the concerto.
- 2007-2008 **Stanford University, Fedkiw Group** *Stanford, CA*  
*Research Assistant:* Supported research in hair simulation by implementing hair rendering and reflectance models; contributed to testing frameworks for computational geometry methods.
- 2006 **Mitsubishi Electric Research Laboratory, Computer Vision Applications & Devices** *Cambridge, MA*  
*Summer Intern:* Designed multilinear models for representing face shape and reflectance simultaneously.
- 2005-2007 **MITRE Corporation** *McLean, VA*  
*Technology Intern (part time on call):* Developed a framework for iris recognition using multi-camera input; presented the system to engineers consulting for the US Department of Homeland Security.
- 2005 **Massachusetts Institute of Technology (MIT), Computer Graphics Group** *Cambridge, MA*  
*Mentorship (Research Science Institute):* Applied multilinear modeling to face shape estimation from reflectance/video.

2005	<b>Computer Science Department, George Mason University</b> <i>Computer Vision Mentorship</i> : Proposed and implemented methods estimating obstacle rate of approach from video.	Fairfax, VA
2004	<b>Naval Research Laboratory, Virtual Reality Department</b> <i>Summer Intern</i> : Devised algorithms for surface analysis for face recognition from shape.	Washington, DC

## Teaching Experience

<b>Shape Analysis (6.838)</b> <i>Instructor (Spring 2017, Spring 2019, Spring 2021)</i> : Designed, organized, and presented a new course on low- and high-dimensional geometric algorithms including topics from graphics, vision, and machine learning.	MIT
<b>Introduction to Computer Graphics (6.837)</b> <i>Co-Instructor (Fall 2016), Instructor (Fall 2017, Fall 2018, Fall 2019, Fall 2020)</i> : Gave weekly course lectures; managed two course assistants (with W. Matusik in 2016).	MIT
<b>Introduction to Algorithms (6.006)</b> <i>Co-Instructor (Spring 2020)</i> : Gave lectures and problem sessions, alternating with other instructors; assisted in problem set and exam design (with E. Demaine and J. Ku).	MIT
<b>Modeling and Optimization for Machine Learning</b> <i>Co-Instructor (Summer 2018, 2019, 2020)</i> : Taught a week-long intensive course covering large-scale optimization algorithms and modeling strategies for machine learning; included lectures, interactive demonstrations, and group laboratories (with S. Sra).	MIT Professional Education
<b>Introduction to Machine Learning (6.036)</b> <i>Co-Instructor (Spring 2018)</i> : Part of team of four faculty instructors; lead two sections through interactive exercises; assisted in course material revision and development.	MIT
<b>Symposium on Geometry Processing Graduate School</b> <i>Lecturer (Summer 2015, 2016, 2019)</i> : Introduced modern optimization algorithms applied to shape analysis in a tutorial "Optimization Techniques for Geometry Processing" (with D. Bommes, S. Claiici). <i>Lecturer (Summer 2014)</i> : Introduced applications of the Laplace-Beltrami operator in a tutorial "Laplace-Beltrami: The Swiss Army Knife of Geometry Processing" (with K. Crane and E. Vouga). <i>Lecturer (Summer 2012)</i> : Introduced shape descriptors and matching to new researchers in geometry processing.	Several locations
<b>Mathematical Methods for Computer Vision, Robotics, and Graphics (CS 205A)</b> <i>Instructor (Fall 2013, Spring 2015)</i> : Redesigned and developed new materials for a course on numerical techniques with applications focus; gave weekly lectures; managed four course assistants; wrote comprehensive course notes that have been expanded into a textbook (40+ students in 2013, 100+ students in 2015).	Stanford University
<b>Differential Geometry for Computer Science (CS 468)</b> <i>Co-instructor (Spring 2013)</i> : Developed and taught research-level course; weekly lecturer on discrete differential geometry, alternating with theoretical discussions; developed practical and written assignments to accompany lectures (15 students, with A. Butscher).	Stanford University
<b>Computer Graphics: Geometric Modeling (CS 348A)</b> <i>Course assistant (Winter 2013)</i> : Led weekly section and office hours; redesigned assignments and project to reflect developments in geometry processing; guest lecture on polar forms, derivatives, and continuity.	Stanford University
<b>Introduction to Computer Graphics and Imaging (CS 148)</b> <i>Instructor (Summer 2012)</i> : Reorganized course to reflect a broader view of graphics; created assignments, lectures, and exams; mentored students after end of the course in research; managed course assistants; held office hours; included speakers from industry; shared materials with colleagues seeking new graphics curriculum (32 students).	Stanford University
<b>Computer Graphics: Geometric Modeling (CS 348A)</b> <i>Course assistant (Winter 2012)</i> : Led weekly section on class material, student questions, and extensions (e.g. shared structure between Bézier curves and elliptic curve cryptography; Plücker coordinates; subdivision); held office hours; guest lecturer on parameterization.	Stanford University
<b>Programming Methodology (CS 106A)</b> <i>Section leader (Winter 2009)</i> : Led weekly section (~10 students); met individually with students to discuss assignments.	Stanford University

## Publications

### Textbook

**Numerical Algorithms**, Justin Solomon (published by AK Peters/CRC Press, 2015; 392 pages)

### Papers and Articles

- D. Smirnov & JS. **HodgeNet: Learning Spectral Geometry on Triangle Meshes**. SIGGRAPH 2021, online.
- Y. Wang & JS. **Fast Quasi-Harmonic Weights for Geometric Data Interpolation**. SIGGRAPH 2021, online.
- L. Makatura, M. Guo, A. Schulz, JS, & W. Matusik. **Pareto Gamuts: Exploring Optimal Designs Across Varying Contexts**. SIGGRAPH 2021, online.
- N. Girard, D. Smirnov, JS, & Y. Tarabalka. **Regularized Building Segmentation by Frame Field Learning**. Computer Vision and Pattern Recognition (CVPR) 2021, online.
- G. Beugnot, A. Genevay, K. Greenewald, & JS. **Improving Approximate Optimal Transport Distances using Quantization**. *ArXiv* 2102.12731, 2021.
- D. Smirnov, M. Bessmeltsev, & JS. **Learning Manifold Patch-Based Representations of Man-Made Shapes**. International Conference on Learning Representations (ICLR) 2021, online.

- A. Korotin, L. Li, JS, & E. Burnaev. **Continuous Wasserstein-2 Barycenter Estimation without Minimax Optimization**. International Conference on Learning Representations (ICLR) 2021, online.
- A. Becker & JS. **Redistricting Algorithms**. Chapter in *Political Geometry*, 2021 (to appear).
- D. Mukherjee, A. Guha, JS, Y. Sun, & M. Yurochkin. **Outlier-Robust Optimal Transport**. *ArXiv* 2012.07363, 2020.
- JS, K. Greenewald, & H. Nagaraja.  **$k$ -Variance: A Clustered Notion of Variance**. *ArXiv* 2012.06958, 2020.
- L. Najt, D. DeFord, & JS. **Empirical Sampling of Connected Graph Partitions for Redistricting**. *ArXiv* 2012.04564, 2020.
- L. Li, A. Genevay, M. Yurochkin, & JS. **Continuous Regularized Wasserstein Barycenters**. NeurIPS 2020, online.
- Y. Wang, A. Fathi, J. Wu, T. Funkhouser, & JS. **Multi-Frame to Single-Frame: Knowledge Distillation for 3D Object Detection**. ECCV Workshop on Perception for Autonomous Driving 2020, online.
- Y. Wang, A. Fathi, A. Kundu, D. Ross, C. Pantofaru, T. Funkhouser, & JS. **Pillar-Based Object Detection for Autonomous Driving**. European Conference on Computer Vision (ECCV) 2020, online.
- Z. Marschner, P. Zhang, D. Palmer, & JS. **Hexahedral Quality Evaluation via SOS Relaxations**. Symposium on Geometry Processing (SGP) 2020, online.
- P. Zhang, D. DeFord, & JS. **Medial Axis Isoperimetric Profiles**. Symposium on Geometry Processing (SGP) 2020, online.
- S. Claiici, M. Yurochkin, S. Ghosh, & JS. **Model Fusion with Kullback–Leibler Divergence**. International Conference on Machine Learning (ICML) 2020, online.
- N. Girard, D. Smirnov, JS, & Y. Tarabalka. **Regularized Building Segmentation by Frame Field Learning**. IEEE International Geoscience and Remote Sensing Symposium (IGARSS) 2020, Waikoloa.
- D. DeFord, M. Duchin, & JS. **A Computational Approach to Measuring Vote Elasticity and Competitiveness**. *Statistics and Public Policy*, 2020.
- C. Frogner, S. Claiici, E. Chien, & JS. **Incorporating Unlabeled Data into Distributionally Robust Learning**. *ArXiv* 1912.07729, 2020.
- P. Zhang, J. Vekhter, E. Chien, D. Bommes, E. Vouga, & JS. **Octahedral Frames for Feature-Aligned Cross-Fields**. *Transactions on Graphics* 39.3, 2020.
- D. Palmer, D. Bommes, & JS. **Algebraic Representations for Volumetric Frame Fields**. *Transactions on Graphics* 39.2, 2020.
- T. Abrishami, N. Guillen, P. Rule, Z. Schutzman, JS, T. Weighill, and S. Wu. **Geometry of Graph Partitions via Optimal Transport**. *SIAM Journal on Scientific Computing* 42.5, 2020.
- S. Claiici, A. Genevay, & JS. **Wasserstein Measure Coresets**. *ArXiv* 1805.07412, 2018.
- D. DeFord, M. Duchin, & JS. **Recombination: A Family of Markov Chains for Redistricting**. *ArXiv* 1911.05725, 2019.
- Yu Wang & JS. **Intrinsic and Extrinsic Operators for Shape Analysis**. Chapter 2 of *Processing, Analyzing and Learning of Images, Shapes, and Forms: Part 2* (Ron Kimmel and Xue-Cheng Tai, editors), 2019.
- Y. Wang & JS. **PRNet: Self-Supervised Learning for Partial-to-Partial Registration**. NeurIPS 2019, Vancouver.
- P. Monteiller, S. Claiici, E. Chien, F. Mirzazadeh, JS, & M. Yurochkin. **Alleviating Label Switching Using Optimal Transport**. NeurIPS 2019, Vancouver.
- M. Yurochkin, S. Claiici, E. Chien, F. Mirzazadeh, & JS. **Hierarchical Optimal Transport for Document Representation**. NeurIPS 2019, Vancouver.
- R. Barnes & JS. **Gerrymandering and Compactness: Implementation Flexibility and Abuse**. *Political Analysis* (to appear), 2019.
- D. Deford, H. Lavenant, Z. Schutzman, & JS. **Total Variation Isoperimetric Profiles**. *SIAM Journal on Applied Algebra and Geometry* 3.4, 2019.
- L. Najt, D. DeFord, & JS. **Complexity and Geometry of Sampling Connected Graph Partitions**. *ArXiv* 1908.08881, 2019.
- T. Henderson & JS. **Audio Transport: A Generalized Portamento via Optimal Transport**. International Conference on Digital Audio Effects 2019 (DAFx-19), Birmingham.
- Yue Wang, Y. Sun, Z. Liu, S. Sarma, M. Bronstein, & JS. **Dynamic Graph CNN for Learning on Point Clouds**. *Transactions on Graphics* 38.5, 2019.
- Yue Wang & JS. **Deep Closest Point: Learning Representations for Point Cloud Registration**. International Conference on Computer Vision (ICCV) 2019, Seoul.
- JS & A. Vaxman. **Optimal Transport-Based Polar Interpolation of Directional Fields**. SIGGRAPH 2019, Los Angeles.
- D. Smirnov, M. Fisher, V. Kim, R. Zhang, & JS. **Deep Parametric Shape Predictions using Distance Fields**. Computer Vision and Pattern Recognition (CVPR) 2019, online.
- S.M. Abulnaga, E.A. Turk, M. Bessmeltsev, P.E. Grant, JS, & P. Golland. **Placental Flattening via Volumetric Parameterization**. International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2019, Shenzhen.
- C. Frogner, F. Mirzazadeh, & JS. **Learning Embeddings into Entropic Wasserstein Spaces**, ICLR 2019, New Orleans.
- Yu Wang, V. Kim, M. Bronstein, & JS. **Learning Geometric Operators on Meshes**. Representation Learning on Graphs and Manifolds (ICLR workshop), New Orleans.
- D. DeFord, M. Duchin, & JS. **Comparison of Districting Plans for the Virginia House of Delegates**. *MGGG technical report*, 2019.
- D. Ezuz, JS, & M. Ben-Chen. **Reversible Harmonic Maps between Discrete Surfaces**. *Transactions on Graphics* 38.2, 2019.
- Yu Wang, M. Ben-Chen, I. Polterovich, & JS. **Steklov Spectral Geometry for Extrinsic Shape Analysis**. *Transactions on Graphics* 38.1, 2019.
- M. Bessmeltsev & JS. **Vectorization of Line Drawings via PolyVector Fields**. *Transactions on Graphics* 38.1, 2019.
- E. Rodolà, Z. Löhner, Z. Bronstein, M. Bronstein, & JS. **Functional Map Representation on Product Manifolds**. *Computer Graphics Forum* 38.1, 2019.
- H. Lavenant, S. Claiici, E. Chien, & JS. **Dynamical Optimal Transport on Discrete Surfaces**. SIGGRAPH Asia 2018, Tokyo.

- M. Li, D. Kaufman, V. Kim, JS, & A. Sheffer. **OptCuts: Joint Optimization of Surface Cuts and Parameterization**. SIGGRAPH Asia 2018, Tokyo.
- H. Liu, P. Zhang, E. Chien, JS, & D. Bommes. **Singularity-Constrained Octahedral Fields for Hexahedral Meshing**. SIGGRAPH 2018, Vancouver.
- A. Schulz, H. Wang, E. Grinspun, JS, & W. Matusik. **Interactive Exploration of Design Trade-Offs**. SIGGRAPH 2018, Vancouver.
- S. Claiici, E. Chien, & JS. **Stochastic Wasserstein Barycenters**. ICML 2018, Stockholm.
- A. Gehre, M. Bronstein, L. Kobbelt, & JS. **Interactive Curve Constrained Functional Maps**. Symposium on Geometry Processing 2018, London.
- L. Wang, A. Gehre, M. Bronstein, & JS. **Kernel Functional Maps**. Symposium on Geometry Processing 2018, London.
- JS. **Optimal Transport on Discrete Domains**. AMS Short Course on Discrete Differential Geometry 2018, San Diego.
- M. Essid & JS. **Quadratically-Regularized Optimal Transport on Graphs**. *SIAM Journal on Scientific Computing*, 2018.
- JS. **Computational Optimal Transport**. *Snapshots of Modern Mathematics from Oberwolfach*, 2017.
- M. Staib, S. Claiici, JS, & S. Jegelka. **Parallel Streaming Wasserstein Barycenters**. NIPS 2017, Long Beach.
- G. Peyré, L. Chizat, F. Vialard, & JS. **Quantum entropic regularization of matrix-valued optimal transport**. *European Journal of Applied Mathematics* 2017.
- S. Claiici, M. Bessmeltsev, S. Schaefer, & JS. **Isometry-Aware Preconditioning for Mesh Parameterization**. Symposium on Geometry Processing 2017, London.
- D. Ezuz, JS, V. Kim, & M. Ben-Chen. **GWCNN: A Metric Alignment Layer for Deep Shape Analysis**. Symposium on Geometry Processing 2017, London.
- JS, A. Vaxman, & D. Bommes. **Boundary Element Octahedral Fields in Volumes**. *Transactions on Graphics* 36.3, 2017.
- E. Corman, JS, M. Ben-Chen, L. Guibas, & M. Ovsjanikov. **Functional Characterization of Intrinsic and Extrinsic Geometry**. *Transactions on Graphics* 36.2, 2017.
- S. Berkiten, M. Halber, JS, C. Ma, H. Li, & S. Rusinkiewicz. **Learning Detail Transfer based on Geometric Features**. Eurographics 2017, Lyon.
- T. Glozman, JS, F. Pestilli, & L. Guibas. **Shape Attributes of Brain Structures as Biomarkers for Alzheimer's Disease**. *Journal of Alzheimer's Disease* 56.1, 2017.
- JS, G. Peyré, V. Kim, & S. Sra. **Entropic Metric Alignment for Correspondence Problems**. SIGGRAPH 2016, Anaheim.
- M. Tao, JS, & A. Butscher. **Near-Isometric Level Set Tracking**. Symposium on Geometry Processing 2016, Berlin.
- G. Peyré, M. Cuturi, & JS. **Gromov-Wasserstein Averaging of Kernel and Distance Matrices**. ICML 2016, New York City.
- JS, R. Rustamov, L. Guibas, & A. Butscher. **Continuous-Flow Graph Transportation Distances**. *ArXiv* 1603.06927, 2016.
- JS, F. de Goes, G. Peyré, M. Cuturi, A. Butscher, A. Nguyen, T. Du, & L. Guibas. **Convolutional Wasserstein Distances: Efficient Optimal Transportation on Geometric Domains**. SIGGRAPH 2015, Los Angeles.
- W. Chao, JS, D. Michels, & F. Sha. **Exponential Integration for Hamiltonian Monte Carlo**. ICML 2015, Lille.
- JS, R. Rustamov, L. Guibas, & A. Butscher. **Earth Mover's Distances on Discrete Surfaces**. SIGGRAPH 2014, Vancouver.
- B. Zhu, E. Quigley, M. Cong, JS, & R. Fedkiw. **Codimensional Surface Tension Flow on Simplicial Complexes**. SIGGRAPH 2014, Vancouver.
- JS, R. Rustamov, L. Guibas, & A. Butscher. **Wasserstein Propagation for Semi-Supervised Learning**. ICML 2014, Beijing.
- F. Pestilli, JS, A. Butscher, & B. Wandell. **Model-Based Neuroanatomy: Tractography Validation, White-Matter Connections and Geometrical Organization**. ISMRM 2014 accepted abstract, Milan.
- JS, K. Crane, A. Butscher, & C. Wojtan. **A General Framework for Bilateral and Mean Shift Filtering**. *ArXiv* 1405.4734, 2014.
- JS, L. Guibas, & A. Butscher. **Dirichlet Energy for Analysis and Synthesis of Soft Maps**. Symposium on Geometry Processing 2013, Genoa.
- JS, A. Nguyen, A. Butscher, M. Ben-Chen, & L. Guibas. **Soft Maps Between Surfaces**. Symposium on Geometry Processing 2012, Tallinn.
- JS, E. Vouga, M. Wardetzky, & E. Grinspun. **Flexible Developable Surfaces**. Symposium on Geometry Processing 2012, Tallinn.
- M. Ovsjanikov, M. Ben-Chen, JS, A. Butscher and L. Guibas. **Functional Maps: A Flexible Representation of Maps Between Shapes**. SIGGRAPH 2012, Los Angeles.
- A. Vacavant, A. Albouy-Kissi, P. Menguy, & JS. **Fast Smoothed Shock Filtering**. International Conference on Pattern Recognition 2012, Tsukuba.
- JS, M. Ben-Chen, A. Butscher, & L. Guibas. **As-Killing-As-Possible Vector Fields for Planar Deformation**. Symposium on Geometry Processing 2011, Lausanne.
- JS, M. Ben-Chen, A. Butscher, & L. Guibas. **Discovery of Intrinsic Primitives on Triangle Meshes**. Eurographics 2011, Llandudno.
- M. Kass and JS. **Smoothed Local Histogram Filters**. SIGGRAPH 2010, Los Angeles.
- M. Ben-Chen, A. Butscher, JS, & L. Guibas. **On Discrete Killing Vector Fields and Patterns on Surfaces**. Symposium on Geometry Processing 2010, Lyon.
- JS. **Programmers, Professors, & Parasites: Credit and Co-Authorship in Computer Science**. *Science and Engineering Ethics* 15.4 (2009): 467-489.
- . **Deconstructing the Definitive Recording: Elgar's Cello Concerto and the Influence of Jacqueline du Pré**. *The Hoefler Prizes for Excellence in Undergraduate Writing* 2009.
- . **Fast and Accurate Estimation of Principal Curvatures and Directions for Morphable Models**. SIGGRAPH 2007 posters, San Diego.
- . **Putting the Science in Computer Science**. *ACM Inroads Magazine* 39.2 (2007), 46-49.



- **Programming as a Second Language.** *Learning & Leading with Technology* 32.4 (2004-05), 34-39.
- **Ready, Set, Code** (two-part series in *Learning & Leading with Technology*): **Starting a Computer Team in Your School** (34.7, 2007, pp. 35-6); **Computer Team Competitions** (34.8, 2007, pp. 32-3).
- Articles in *ACM Crossroads*: **Introduction** for 16.1 (September 2009), 15.4 (June 2009), 15.3 (March 2009), 15.2 (December 2008), 15.1 (September 2008), 14.4 (June 2008), 14.3 (March 2008), 14.2 (December 2007); **The Science of Shape** 13.4 (June 2007); **SIGGRAPH 2006: Exploring the Art and Science of Computer Graphics** 13.3 (March 2007)

## Patents

**Painterly Filtering** (US 12/493,208, filed June 28, 2009)

Michael Kass, Justin Solomon (original assignee: Pixar)

**Smoothed Local Histogram Filters for Computer Graphics** (US8406518 B2, filed June 28, 2009)

Michael Kass, Justin Solomon, Rick Sayre (original assignee: Pixar)

**Methods and Systems of Comparing Face Models for Recognition** (US 12/416,716, filed April 1, 2009)

Mark Alan Livingston, Justin M. Solomon (original assignee: The United States Of America; Secretary Of The Navy)

## Invited Talks

- 2021 **Optimization and Learning of Localized Geometric Structures**  
MIT Aerospace Computational Design Laboratory Seminar Series
- 2021 **Transport Methods for Aligning Uncertain Models and Data**  
Computational and Applied Mathematics Colloquium, University of Chicago
- 2020 **Geometry, Probability, and Computation**  
Christie Lecture, NES Fall Meeting, Mathematical Association of America
- 2020 **Summarizing and Analyzing Data using Optimal Transport**  
MIT-IBM Watson AI Lab Monthly Seminar Series; Institute for Mathematics and its Applications
- 2020 **Sampling-Based Algorithms for Optimal Transport Problems**  
Optimal Transport, Topological Data Analysis and Applications to Shape and Machine Learning, Ohio State University
- 2020 **Fusion with Optimal Transport**  
Optimal Transport And Applications To Machine Learning And Statistics, Mathematical Sciences Research Institute
- 2020 **Approximating and Manipulating Probability Distributions with Optimal Transport**  
Learning Under Complex Structure, MIT Institute for Foundations of Data Science; Duke Department of Mathematics
- 2020 **Probabilistic Representations for Geometric Computation**  
Stanford Computer Science
- 2019 & 20 **Expanding the Scope and Dimensionality of Field Design**  
Inria Sophia Antipolis-Méditerranée, MIT IAP Mathematics Lecture Series
- 2019 & 20 **Counterexamples in Political Redistricting**  
NYU Mathematics and Democracy Seminar; Voting Rights Data Institute, MIT & Tufts;  
Duke Conference on Quantitative Investigations of Gerrymandering and Redistricting
- 2019 **Establishing a Computational Toolbox for Geometric Data Processing**  
MIT EECS faculty meeting
- 2019 **Approximating and Manipulating Probability Distributions with Transport**  
First Workshop on Practical Bayesian Methods for Big Data
- 2019 **Linking the Theory and Practice of Optimal Transport**  
Workshop on Foundations of Computational Science, Harvard Center of Mathematical Sciences and Applications,  
Institut de Mathématiques de Toulouse
- 2019 **Tutorial on Optimal Transport**  
MIT Biomedical Imaging and Analysis Seminar
- 2019 **Optimal Transport for Geometric Data Processing**  
Peter Hall Conference on Statistics and Machine Learning, UC Davis
- 2019 **The Last Mile: Bringing Optimal Transport to Applications**  
Economics Meets the Mathematical Sciences Workshop, Fields Institute; Adobe Seattle
- 2019 **Volumetric Challenges in Shape Analysis**  
MIT Center for Computational Engineering Symposium
- 2019 **Sensible Deep Learning for 3D Data**  
TRI Joint University Workshop, University of Michigan;  
Workshop on Boosted Object Phenomenology, Reconstruction and Searches in HEP
- 2019 **Transport, Geometry, and Computation**  
MIT IAP Mathematics Lecture Series
- 2019 **Sparse Linear Algebra and Geometry Processing**  
Workshop on Compiler Techniques for Sparse Tensor Algebra
- 2018 **Sampling Districting Plans**  
MGGG/LCCR joint workshop (with M. Duchin, D. DeFord)
- 2018 **Correspondence and Optimal Transport for Geometric Data Processing**

LIRIS Seminar, CNRS/INSA Lyon/Université C. Bernard Lyon 1/Université Lumière Lyon 2/École Centrale de Lyon

- 2018 **Beneath the Surface: Bringing Geometry Processing and Shape Analysis to Volumes**  
Visual Computing Group Seminar Series, Brown University
- 2018 **Simulation and Transfer Learning for Deep 3D Geometric Data Analysis**  
Skoltech–MIT Conference (with E. Burnaev)
- 2018 **Correspondence and Optimal Transport for Geometric Data Processing**  
Colloquium, Harvard Center of Mathematical Sciences & Applications; Ohio State University Topology, Geometry, and Data Analysis Seminar; Yandex School of Data Analysis
- 2018 **Boundary Element Frame Fields for Hexahedral Meshing**  
Interdisciplinary Advances in Boundary Element Methods, World Congress on Computational Mechanics
- 2018 **Optimal Transport on Surfaces, Graphs, and Point Clouds**  
UCLA Applied Math & Computer Science
- 2018 **Correspondence and Embedding for Geometric Data**  
Geometry in Machine Learning (GiMLi) workshop, International Conference on Machine Learning (ICML)
- 2018 **Computational Applications of Spectral Geometry**  
Spectral Geometry: Theory, Numerical Analysis and Applications (BIRS)
- 2018 **Geometric Algorithms for Redistricting and Optimal Transport for Redistricting**  
Voting Rights Data Institute, MIT & Tufts
- 2018 **Learning & Optimization on Geometric Data**  
Workshop on Human and Machine Learning, Indiana University
- 2018 **Scaling & Broadening the Scope of Computational Transport**  
Applied Math Colloquium, MIT Department of Mathematics
- 2018 **Tutorial on Optimal Transport**  
MIT–IBM Watson AI Lab
- 2018 **Geometric Optimization Algorithms for Variational Problems**  
Weizmann Institute of Science Vision & Robotics Seminar
- 2017 & 18 **Algorithms for Geometrically-Structured Optimization**  
Tufts ECE Seminar, KAUST Conference on Visual Computing, Technion CGGC Seminar
- 2017 & 18 **Beneath the Surface: Geometry Processing at the Intrinsic/Extrinsic Interface**  
Quebec Mathematical Sciences Colloquium; keynote, Geometry and Computational Design (GCD 2017, Vienna, Austria); & keynote, Geometric Modeling & Processing (GMP 2018, Aachen, Germany)
- 2017 **A Primer on Optimal Transport (with M. Cuturi)**  
NIPS 2017 tutorial
- 2017 **The Theory and Practice of Geometric Data Processing**  
Keynote, MIT IEEE Undergraduate Research Technology Conference
- 2017 **Volumetric Shape Analysis from Boundary Representations**  
Geometry Workshop, Obergurgl, Austria
- 2017 **What Mathematicians Reveal about Gerrymandering**  
Science for the Public Contemporary Science Issues and Innovations program
- 2017 **Metric Geometry and Gerrymandering**  
Free and Open Source Software for Geospatial (FOSS4G)
- 2017 **Geometry & Data: Algorithmic Approaches to Redistricting**  
Geometry of Redistricting Workshop
- 2017 **Geometric Data Processing**  
Schlumberger–Doll Research
- 2017 **Intelligent Processing & Navigation of Geometric Data**  
CSAIL Systems that Learn board meeting & Samsung Research America
- 2017 **Scalable Optimization Algorithms for Geometry**  
Laboratoire d'Informatique (LIX), École Polytechnique
- 2017 **Regularized Optimal Transport on Graphs: Rank-1 Hessian Updates for Quadratic Regularization**  
Dagstuhl Seminar: Functoriality in Geometric Data
- 2016 **Structured Assignment: Practical Linear & Quadratic Matching**  
Google Vision Group
- 2016 **Toward Quadratic Optimal Transport on Graphs**  
Workshop on Computational Optimal Transportation, Centre de Recherches Mathématiques
- 2016 **Computational Spectral Geometry: Tutorial and Modern Applications**  
Montréal Analysis Seminar
- 2016 **Entropic Metric Alignment for Correspondence Problems**  
Tristate Workshop on Imaging and Graphics
- 2016 **Practical Tools for Applied Linear and Quadratic Matching**  
Data Science Meets Optimization Workshop, RWTH Aachen
- 2016 **Optimal Transportation for Practical Geometric Problems**

- 2015 NYU Applied Math Seminar & Technion CGGC Seminar  
**Convolutional Wasserstein Distances for Geometry Processing**  
 Geometry Workshop, Seggau, Austria
- 2014 & 15 **Transportation Techniques for Geometric Data Processing**  
 Several institutions
- 2014 **Embracing Uncertainty in Geometric Data Analysis**  
 Computer Science Colloquium, University of Southern California
- 2014 **Dual Spaces and Functional Maps**  
 Networks of Shapes, Images, and Programs, workshop for Stanford Computer Forum
- 2013 **Representations of Maps Between Surfaces**  
 Computer Science Faculty Lunch, Stanford University
- 2013 **Computing and Analyzing Soft Maps**  
 Geometry Workshop, Strobl, Austria
- 2012 **Coping with Symmetry in Shape Analysis**  
 Industrial Light and Magic, San Francisco
- 2011 **Killing Vector Fields: Infinitesimal Isometries from a Linear Solve**  
 Geometry Workshop, Obergurgl, Austria & Institute of Science and Technology, Klosterneuburg, Austria
- 2006 **Algorithmic Gymnastics**  
 National Educational Computing Conference, San Diego
- 2004 & 05 **Programming as a Second Language**  
 National Educational Computing Conference, New Orleans (2004) and Philadelphia (2005)

## Professional Activities

### Organization and Service

- Associate editor, IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI) (2020-present)
- Research Career Development Chair, ACM SIGGRAPH (2020-2023)
- Research mentor, African Master's in Machine Intelligence (2020 class)
- Area chair, Computer Vision and Pattern Recognition (CVPR) 2021
- AI+D Curriculum Committee, MIT EECS 2020
- 6.0002 special offering steering committee, MIT Computational Science & Engineering 2020
- NeurIPS Workshop program committee, 2020
- Conflict of interest coordinator, SIGGRAPH Asia 2020
- Area chair, NeurIPS 2019, 2020
- Designated Editor, International Mathematics Research Notices, 2020-present
- Admissions committee, MIT Master of Science Program in Computation for Design and Optimization (CDO) 2018, 2020
- ACM SIGGRAPH Executive Committee strategy meeting 2019
- Technical papers program committee, SIGGRAPH 2016, 2017, 2020
- Area chair, ICML 2019, 2020, 2021
- Program chair, Geometric Modeling and Processing (GMP) 2020
- Area chair, AISTATS 2019, 2020, 2021
- Program committee, Shape Modeling International (SMI) 2016, 2017, 2020
- Instructor, Machine Learning Summer School 2019 (Moscow, Russia)
- Best paper awards committee, Symposium on Geometry Processing 2019
- Organizing committee, International Workshop on Data-Centric Engineering
- Co-organizer, Erwin Schrödinger International Institute (ESI) 2019 Thematic Programme on Optimal Transport
- Co-organizer, Shape Analysis workshop, UCLA Institute of Pure and Applied Math (IPAM) 2019
- Co-chair for vision and graphics, MIT EECS PhD admissions 2018, 2019
- Co-director, Voting Rights Data Institute 2018, 2019
- Technical papers program committee, SIGGRAPH Asia 2018, 2019
- International Program Committee (IPC), Eurographics 2017, 2018, 2019
- Organizer and creator, New England Symposium on Graphics 2017, 2018, 2019
- NSF Review Panelist 2017, 2019
- Program committee, Symposium on Geometry Processing (SGP) 2016, 2017, 2018, 2019
- Organizer, Banff International Research Station (BIRS) 2018 workshop on Spectral Geometry: Theory, Numerical Analysis and Applications (with I. Polterovich and N. Nigam)
- NIPS 2017 Tutorial: A Primer on Optimal Transport (with M. Cuturi)
- Co-organizer, NIPS 2017 Workshop on Optimal Transport & Machine Learning
- Hackathon director & panel speaker, Geometry of Redistricting Wisconsin Workshop 2017
- Organizing committee & hackathon director, Geometry of Redistricting Summer School 2017
- Co-Chair, Symposium on Geometry Processing Graduate School 2017
- CSAIL Lab Branding Committee 2017
- Program committee, Geometric Modeling and Processing (GMP) 2017

- NDSEG PhD Fellowship Scholarship Evaluation Panel, 2017
- Organizer, NIPS 2014 Workshop on Optimal Transport & Machine Learning (with M. Cuturi and G. Peyré)

## Reviewer

*A complete list of recent journal/conference reviewing engagements can be provided on request.*

## Membership

- Sigma Xi, Scientific Research Honor Society (full member)
- Association for Computing Machinery
- Computer Science Teachers Association

## Honors and Awards

2020	Junior Bose Award for Excellence in Teaching, MIT School of Engineering
2018	NSF BIGDATA Award (with P. Rigollet)
2018	NeurIPS Top Reviewer Award
2018	Amazon Research Award
2018	MIT-IBM Watson AI Lab Exploratory Grant
2017-20	Prof. Amar G. Bose Research Fellowship
2017	ACM Future of Computing Academy
2017	Army Young Investigator Award (proposal: "Smooth Modeling of Flows on Graphs")
2017	Forbes 30 Under 30: Science
2015-2016	NSF Mathematical Sciences Postdoctoral Research Fellowship
2011 & 16	U.S. Junior Oberwolfach Fellow, National Science Foundation
2014	George E. Forsythe Memorial Award for Excellence in Student Teaching
2010-2015	Hertz Foundation Fellowship (inaugural Hertz-Google Fellow) & NSF Graduate Research Fellowship
2011-14	Bio-X Travel Subsidy Awardee, Stanford Bio-X Interdisciplinary Program
2010-14	Stanford Applied Music Scholarship
2010-13	National Defense Science and Engineering Graduate (NDSEG) Fellowship
2010	Second Place, Symposium on Geometry Processing (SGP) Best Paper Awards
2010	Edison Visiting Fellowship, British Library
2010	Frederick E. Terman Award for Scholastic Achievement in Engineering, Stanford University
2010	J.E. Wallace Sterling Award for Scholastic Achievement, Stanford University
2010	Outstanding Summerfield Scholar & Undergraduate of the Year, Phi Kappa Psi Foundation
2010	Firestone Medal for Excellence in Undergraduate Research
2009	Pixar Animation Studios Inventor Recognition Award
2009	Hoefler Prize for Excellence in Undergraduate Writing, Stanford University
2008	Barry M. Goldwater Scholarship & Tau Beta Pi Engineering Honor Society
2007	Boothe Prize for Excellence in Writing, Stanford University
2007	Finalist, Stanford CS 248 Video Game Design Competition (Project: "Paper Airplane 3D")
2007	Student Research Competition Finalist and poster presenter, SIGGRAPH 2007
2007	President's Award for Academic Excellence in the Freshman Year, Stanford University
2007	Team Finalist, ACM Intercollegiate Programming Contest (ICPC), Tokyo, Japan
2006	Finalist, Intel Science Talent Search (Project: Three-Dimensional Face Recognition from Video)
2004-2006	Scholarships: National Merit, Naval Research, Micron Science & Tech., Intel Excellence in CS
2006	Awards: Mu Alpha Theta Award; USA Today All-USA High School First Academic Team (5/18/06)
2006	Third Place (National) and First Place (State), Math/CS, Junior Science and Humanities Symposium
2005 & 06	First (05) and Second (06) Grand Prize, Computer Science, International Science and Engineering Fair
2005	Research Science Institute, Massachusetts Institute of Technology (Top Project Presentation Award)
2005	Fellowships: Davidson Institute for Talent Development, Department of Homeland Security
2004	Outstanding Intern Award, Naval Science & Engineering Apprenticeship Program (SEAP)

## Other Activities

2018-Present	Cellist, No-Name Orchestra of Boston (2019 soloist: Elgar cello concerto)
2017-Present	Cellist, New Philharmonia Orchestra
2016-Present	Metric Geometry and Gerrymandering Group (MGGG)
2016-Present	Faculty mentor, Research Science Institute (RSI)
2018-2019	Faculty host, MIT Vest Scholarships
2015-2016	Cellist, Bravura Philharmonic Orchestra & Westminster Community Orchestra
2015	Attendee, Fall NSF Grants Conference
2010-2015	Cellist, Stanford University chamber music program
2010-2014	Cellist (symphony and chamber music), Palo Alto Philharmonic (principal, 2013-2014)
2006-2014	Applied Music Lessons, Stanford Department of Music (cello 2006-2014; piano 2006-2010)
2013	Cellist, Stanford Symphony Summer Tour "In Beethoven's Footsteps"



2012, 13 Mentor, Stanford CS Undergraduate Research Internship (CURIS)  
 2010 Organizer, "A Taste of Palo Alto" (to benefit Ecumenical Hunger Program, East Palo Alto)  
 2009-2010 Treasurer and Financial Manager (09-10), Phi Kappa Psi Fraternity, Stanford University  
 2009-2010 Undergraduate Representative, Department of Computer Science Curriculum Committee  
 2006-2010 Cello Tutor, Tutti Program, Stanford Alliance for Service Through the Arts  
 2009 Student Presenter, Stanford Music Symposium 2009: Reactions to the Record II  
 2008-2009 Head Peer Academic Coordinator, Otero House, Stanford Residential Education  
 2006-2009 Managing Editor (07-09), Associate Editor (06-07), *ACM Crossroads Magazine*  
 2006-2009 Associate Editor (06-07), Section Editor (07-08), Editor in Chief (08-09), *Stanford Undergraduate Research Journal*  
 2008 Speaker and Panelist, Scout Entrepreneurship Seminar, Kauffman Foundation, Kansas City  
 2007 Stanford Freshman Peer Mentor Program  
 2006, 07, 08 Cellist, MIT Summer Philharmonic Orchestra (06), UC Berkeley Summer Symphony (07, 08)  
 2004-2006 Cellist, Washington Metropolitan Philharmonic Orchestra (piano finalist, 2005 Concerto Competition)  
 2002-2006 TJ Computer Team (Freshman Capt. 02-03; Senior Capt. 05-06; Invitational Computing Olympiad 05)  
 2005 Presenter, Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), Orlando  
 1999-2005 Boy Scout Troop 152 (Eagle, Philmont Venture Crew, Order of the Arrow), Vienna VA