

MANUELA (ALEX) O. VASILESCU

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[Quora Tensor Tutorial Answers](#)

Biography

M. Alex O. Vasilescu received her education at the Massachusetts Institute of Technology and the University of Toronto. She was a research scientist at the MIT Media Lab from 2005-07 and at New York University's Courant Institute of Mathematical Sciences from 2001-05 and a senior fellow at UCLA's Institute of Pure and Applied Mathematics (IPAM) in 2021.

Vasilescu pioneered the tensor algebraic framework for computer vision, computer graphics, and machine learning. She addressed causal inference questions by framing computer graphics and computer vision problems as multilinear tensor problems, and demonstrated how the causal factors of data formation could be algorithmically disentangled. Causal inferencing in a tensor framework facilitates the analysis, recognition, synthesis, and interpretability of sensory data. The development of the tensor framework has been spearheaded with premier papers, such as: Human Motion Signatures(2001), TensorFaces(2002), Multilinear Independent Component Analysis(2005), TensorTextures(2004), and Multilinear Projection for Recognition (2007, 2011).

Vasilescu's face recognition research, known as TensorFaces, has been funded by the TSWG, the Department of Defense's Combating Terrorism Support Program, Intelligence Advanced Research Projects Activity (IARPA) and NSF. She was awarded approximately \$3M in funding (approximately 50% a single PI). Her work was featured on the cover of Computer World, and in articles in the New York Times, Washington Times, etc. MIT's Technology Review Magazine named her to their TR100 list of honorees, and the National Academy of Science co-awarded the Keck Futures Initiative Grant.

Research Interests Causal inference, tensor-based modeling, and physics based modeling demonstrated in the context of computer vision, computer graphics, machine learning and data science.

Education

UNIVERSITY OF TORONTO

Toronto, ON

Dissertation Committee: Alan Jepson, Amnon Shashua, David Fleet, Geoff Hinton

Dissertation Advisor: Demetri Terzopoulos

Doctor of Philosophy in Computer Science, Nov. 2009.

PhD dissertation: A Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics and Machine Learning.

The dissertation introduced a multilinear (tensor) algebraic framework for computer vision (TensorFaces, Human Motion Signatures), computer graphics (TensorTextures, Human Motion Signatures), machine learning (Multilinear (Tensor) ICA, Multilinear Kernel Manifold Learning), and made contribution to tensor algebra (Multilinear Projection, Mode-m Tensor Pseudo-Inverse, Mode-m Identity Tensor, mode-m product generalization).

This dissertation re-framed data analysis, recognition, and synthesis as multilinear tensor factorization problems in order to explicitly represent and disentangle the causal factors of data formation. The cause-and-effect model was computed by employing

- (i) a M -mode SVD - a multilinear tensor decomposition where each causal factor is modeled by second order statistics
- (ii) a M -mode ICA - a novel multilinear (tensor) independent components analysis where independent components for each causal factor are computed based on higher order statistics, and
- (iii) novel multilinear kernel manifold learning models.

However, the above interaction models of cause-and-effect do not prescribe a solution for how one might determine multiple causal factors from one (or more) unlabeled test image(s), ie for how one might solve a many-to-one problem. This led to the introduction of

- (iv) the multilinear projection (MP) that maps one (or more) unlabeled test image from the measurement (pixel) space to the multiple causal factor vector spaces associated with data formation and which required defining
- (v) the mode-m tensor pseudo-inverse, (vi) the mode-m identity tensor, and (vii) a generalized mode-m product.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Cambridge, MA

Academic Advisor: Marvin Minsky

Dissertation Advisors: W. Eric L. Grimson, and Demetri Terzopoulos

Master of Science and Eng. (June 1997) in Electrical Engineering and Computer Science with *minor in finance/applied math.*

MS and Eng. dissertation: Adaptive Dynamic Meshes for Visual Reconstruction.

Developed dynamic mesh models based on rectangular and triangular mass/spring/damper elements for adaptive reconstruction. The reconstruction algorithm allows static or time-varying data to induce forces that deform the mesh in accordance with Newtonian mechanics. Devised a discontinuity detection and preservation algorithm suitable for the adaptive mesh model. Developed techniques for adaptive hierarchical subdivision of polygonal mesh elements. Applied adaptive meshes to the reconstruction and visualization of image and 3D surface data.

Positions	<p>Tensor Vision Technologies Los Angeles, CA</p> <ul style="list-style-type: none"> • Nov. 2013-<i>Chief Science Officer</i> - Responsible for raising funds from investors and government sources, and developing the utility of research products conceptualized in the fields of image science, machine learning, and artificial intelligence. <p>UNIVERSITY OF CALIFORNIA - Department of Computer Science Los Angeles, CA</p> <ul style="list-style-type: none"> • 2021 Spring: <i>Senior Fellow</i> at IPAM • 2012-2014: <i>Steering Committee Member</i>, Startup UCLA • 2012: <i>Director</i>, UCLA 48-hr Startup • 2011 – 2013: <i>Associate Director Computer Graphic and Vision Lab</i> • 2009 – 2013, 2014, 2017, 2018: <i>Assistant Research Scientist, Lecturer</i> <p>STONY BROOK UNIVERSITY - Department of Computer Science Stony Brook, NY</p> <ul style="list-style-type: none"> • July 2007 – 2009 : <i>Lecturer</i> <p>MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Media Lab Cambridge, MA</p> <ul style="list-style-type: none"> • 2005- 2007: <i>Research Scientist</i> <p>NEW YORK UNIVERSITY – Media Research Lab New York, NY</p> <ul style="list-style-type: none"> • 2000 – 2005: <i>Research Scientist</i> <p>IBM CORPORATION – Almaden Research Center San Jose, CA</p> <ul style="list-style-type: none"> • Summer/Fall 2000: <i>Visiting Researcher</i> <p>COMPAQ – Cambridge Research Lab Cambridge, MA</p> <ul style="list-style-type: none"> • Spring/Summer 2000: <i>Visiting Researcher</i> <p>UNIVERSITY OF TORONTO – Department of Computer Science Toronto, ON</p> <ul style="list-style-type: none"> • 1997 – 2000: <i>Research Assistant</i> <p>INTEL CORPORATION – Microcomputer Research Labs Santa Clara, CA</p> <ul style="list-style-type: none"> • Summer 1997: <i>Visiting Research Assistant</i> <p>LEHMAN BROTHERS INC. New York, NY</p> <ul style="list-style-type: none"> • Summer 1996: <i>Summer Associate</i> Implemented trading strategy for the equity derivatives trading desk. Rotated through equity derivatives trading, fixed income derivatives trading, proprietary equities trading, etc. <p>MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Department of Computer Science Cambridge, MA <i>Recitation Instructor</i></p> <ul style="list-style-type: none"> • Fall '96 – Spring '97: <u>Discrete Math</u> – Taught three recitations per week to three classes each of 30 students. • Spring 1996: <u>Algorithms</u> – Taught two recitations per week to two classes each of 40 students. • Spring 1993: <u>Probabilistic System Analysis</u> – Taught one recitation per week to a class of 40 students. <p><i>Research Projects</i></p> <ul style="list-style-type: none"> • 1995: <u>Learning Robot Motor Tasks</u> – Developed and implemented a <i>reinforcement learning</i> algorithm that learns to control a robot manipulator to perform specified tasks.
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Research Grants Awarded	<p>Awarded approximately \$3M in funding, approximately 50% a single PI.</p> <p>April 2014 - April 2018 \$1.4 million. Intelligence Advanced Research Projects Activity (IARPA) Janus Program, “Multimodal Tensor Analysis for 3D-aided Facial Image Recognition”, M. Alex O. Vasilescu (awarded, but declined)</p> <p>May 2011 - June 2013 \$100,000, National Academies KeckFutures Initiative Grant, National Academies of Science D. Terzopoulos and M.A.O. Vasilescu “A Multilinear (Tensor) Algebraic Framework for Multifactor Manifold Learning With Applications to Image Science”</p> <p>August 1, 2009 - July 30, 2012 \$1.2 million, IIS - ROBUST INTELLIGENCE: NATIONAL SCIENCE FOUNDATION (NSF) , “Integrated Analysis and Synthesis for Data Mining in a Video Network”, D.Bir Bhanu, Amit Roy Chowdhury, D. Terzopoulos, M.A.O.Vasilescu</p> <p>March 2003 - Oct. 2004, \$464,532.00 “Multilinear Image Analysis for Face Identification” Undersecretary of Defense (USD), Technical Support Working Group (TSWG), D. Terzopoulos and M.A.O. Vasilescu</p>
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Awards	<p>National Academies of Science, Keck Futures Initiative Grant, May 2011.</p> <p>MIT's Technology Review 2003 TR100 Honoree, September 24, 2003.</p> <p>Veuve Clicquot Ponsardin La Grande Dame 2003 Woman of Distinction, October 8 2003, Diageo, Canada</p> <p>University of Toronto: University of Toronto Open Fellowship, 1997–2000</p> <p>MIT: Undergraduate scholarships worth over \$30,000</p> <p>MIT-ACM Undergraduate Computer Science Conference Award Winning Paper, 1989</p> <ul style="list-style-type: none"> • Title: “A NeWS-Based Window Object for Graph Interfaces” • Selection criteria: quality research done by MIT undergraduates. • Sponsors: MIT EECS, ACM and Microsoft.
Patents	<p>“Method, system, storage medium, and data structure for Multilinear Autoencoder-Decoder Factor Analysis”, US Patent Application No 63/210,144 filed June 14, 2021</p> <p>“Method, system, storage medium, and data structure for Compositional Hierarchical Tensor Factorization”, US Patent Application No. 62/857,795 filed June 5, 2019.</p> <p>“Multilinear (Tensor) Independent Component Analysis,” US Patent Application No. 7,693,299 B2 filed January 13, 2004.</p> <p>“TensorTextures”, US Patent Application No. 60/490,131 filed July 25, 2003.</p> <p>“Multilinear Image Analysis and Recognition”, US Patent Application No. 60/383,300 filed March 23, 2002.</p> <p>“Human Motion Signatures”, US Patent Application No. 60/337,912 filed December 6, 2001.</p>
Licenses	<p>Created and licensed interactive deformable models prototype software to be included in “Shapes” software package marketed by <i>XOX, Inc.</i>, Minneapolis, MN, 1995. Technology based on MS dissertation.</p>
Memberships	<p>Member, Institute for Electrical and Electronics Engineers (IEEE)</p> <p>Member of the Society for Women Engineers.</p>
Publications	<p>Book in Preparation:</p> <p>“A Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics and Machine Learning.” Springer, London</p> <p>Published:</p> <p>Causal Deep Learning” M. Alex O. Vasilescu <i>26th International Conference on Pattern Recognition (ICPR 2022)</i> Montreal, Canada, August 21-25, 2022.</p> <p>“CausalX: Causal eXplanations and Block Multilinear Factor Analysis”, M. Alex O. Vasilescu, Eric Kim, Xiao S. Zeng <i>25TH International Conference on Pattern Recognition (ICPR 2020)</i>, Milan, Italy (conference delayed to Jan 10-15, 2021)</p> <p>“Deepfake Representation with Multilinear Regression”, Sara Abdali, M. Alex O. Vasilescu, and Evangelos E. Papalexakis. <i>27th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD21): Misinformation and Misbehavior Mining on the Web (MIS2) Workshop</i>, Virtual. ACM, New York, NY, August 15, 2021.</p> <p>“Compositional Hierarchical Tensor Factorization: Representing Hierarchical Intrinsic and Extrinsic Causal Factors”, M.A.O. Vasilescu, E. Kim, <i>25TH ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD2019) Tensor Methods for Emerging Data Science Challenges Workshop</i>, August 5, 2019.</p> <p>“Face Tracking with Multilinear (Tensor) Active Appearance Models”, W. Si, K. Yamaguchi, M.A.O. Vasilescu, June 2013.</p> <p>“Multilinear Projection for Face Recognition via Canonical Decomposition”, M.A.O. Vasilescu, <i>IEEE International Face and Gesture Conf. (FG'11)</i>, 476-483, 2011.</p> <p>“Multilinear Projection for Face Recognition via Rank-1 Analysis”, M.A.O. Vasilescu, <i>CVPR, IEEE Computer Society and IEEE Biometrics Council Workshop on Biometrics</i>, June 18, 2010.</p> <p>“Head pose estimation using multilinear subspace analysis for robot human awareness”, T. Ivanov, L. Mathies, M.A.O. Vasilescu, <i>ICCV, 2nd IEEE International Workshop on Subspace Methods</i>, September, 2009.</p>

- “TensorTextures: Multilinear Image-Based Rendering”, in *CG Magic: The Landscape of Computer Graphics Technology*, Noriko Kurachi (ed.), AK Peters Ltd., Publishers of Science and Technology, 2008.
- “Multilinear (Tensor) Image Synthesis, Analysis and Recognition”, (invited paper) M.A.O. Vasilescu, D. Terzopoulos, *IEEE Signal Processing Magazine*, November 2007, 118123. Exploratory DSP Column.
- “Multilinear Projection for Appearance-Based Recognition in the Tensor Framework”, M.A.O. Vasilescu, D. Terzopoulos, *IEEE 11th International Conference on Computer Vision*, 2007.
- “Multilinear (Tensor) ICA and Dimensionality Reduction”, M.A.O. Vasilescu, D. Terzopoulos, in *Proc. 7th International Conference on Independent Component Analysis and Signal Separation (ICA07)*, London, UK, September, 2007, in *Lecture Notes in Computer Science*, **4666**, Springer-Verlag, New York, 2007, 818826.
- “A Multilinear (Tensor) Framework for HRTF Analysis and Synthesis”, G Grindlay, MAO Vasilescu, *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Honolulu, Hawaii, April 15-20, 2007.
- “Manifold Decomposition and Low Dimensionality Parameterization” M. Alex O. Vasilescu, *Proceedings of the Learning Workshop*, Snowbird, UT, April, 2006.
- “Incremental Multilinear SVD”, M.A.O. Vasilescu, in *TRICAP*, Crete, Greece, June 4 - June 9, 2006, extended abstract and presentation.
- “Multilinear Independent Components Analysis and Multilinear Projection Operator for Face Recognition”, M.A.O. Vasilescu, D. Terzopoulos, in *Workshop on Tensor Decompositions and Applications*, CIRM, Luminy, Marseille, France August 29 - September 2, 2005.
- “Multilinear Independent Components Analysis”, M.A.O. Vasilescu, D. Terzopoulos, in *Proceedings of the IEEE Computer Vision and Pattern Recognition Conf. (CVPR '05)*, San Diego, CA, June, 2005, vol.1, 547–553.
- “TensorTextures: Multilinear Image-Based Rendering”, M.A.O. Vasilescu, D. Terzopoulos, *ACM Transactions on Graphics*, **23**(3): 336–342, 2004. (*Proceedings ACM SIGGRAPH 2004 Conference*, Los Angeles, CA, August, 2004.)
- “Model-Based and Image-Based Methods for Facial Image Synthesis, Analysis and Recognition”, D. Terzopoulos, Yuecheng Lee and M.A.O. Vasilescu, *Proceedings of the Sixth International Conferences on Automatic Face and Gesture Recognition (F&G '04)*, Seoul, Korea, May 2004, pg. 3-8.
- “Multilinear Independent Components Analysis”, M.A.O. Vasilescu, D. Terzopoulos, *Learning 2004*, Snowbird, UT, April, 2004.
- “TensorTextures”, M.A.O. Vasilescu and D. Terzopoulos, *ACM SIGGRAPH 2003 Sketches and Applications*, San Diego, CA, July, 2003.
- “Multilinear Subspace Analysis for Image Ensembles”, M.A.O. Vasilescu, D. Terzopoulos, in *Proceedings of the IEEE Computer Vision and Pattern Recognition Conf. (CVPR '03)*, Madison, WI, June, 2003, 93–99.
- “Learning Multilinear Models of Images”, M.A.O. Vasilescu, D. Terzopoulos, *Learning 2003*, Snowbird, UT, April, 2003.
- “Multilinear Image Analysis for Facial Recognition”, M.A.O. Vasilescu, D. Terzopoulos, *Proceedings of the International Conference on Pattern Recognition (ICPR 2002)*, Quebec City, Canada, Aug, 2002, 511–514.
- “Human Motion Signatures for Action Recognition”, M.A.O. Vasilescu, *Proceedings of International Conference on Pattern Recognition (ICPR 2002)*, Quebec City, Canada, Aug, 2002.
- “Multilinear Analysis of Image Ensembles: TensorFaces”, M.A.O. Vasilescu, D. Terzopoulos, *2002 European Conference on Computer Vision (ECCV '02)*, Copenhagen, Denmark, May, 2002, pages 447–460.
- “An Algorithm for Extracting Human Motion Signatures”, M.A.O. Vasilescu, *Proceedings of Computer Vision and Pattern Recognition CVPR 2001*, Lihue, HI, December, 2001.
- “Human Motion Signatures for Character Animations”, M.A.O. Vasilescu, *ACM SIGGRAPH 2001 Sketches and Applications*, Los Angeles, CA, August, 2001.

“Recognition Action Events from Multiple View Points”, T. Sayed-Mahmood, M.A.O. Vasilescu, S. Sethi, in *Proceedings of the Workshop on Detection and Recognition of Events in Video, International Conference on Computer Vision (ICCV 2001)*, Vancouver, Canada, July 8, 2001.

“Adaptive meshes and shells: Irregular triangulation, discontinuities, and hierarchical subdivision”, M. Vasilescu, D. Terzopoulos, in *Proc. Computer Vision and Pattern Recognition Conf. (CVPR '92)*, Champaign, IL, June, 1992, pages 829–832.

“Sampling and Reconstruction with Adaptive Meshes”, D. Terzopoulos, M. Vasilescu, in *Proc. Computer Vision and Pattern Recognition Conf. (CVPR '91)*, Lahaina, HI, June, 1991, pages 70–75.

Invited Papers:

A Tensor Algebraic Approach to Image Synthesis, Analysis and Recognition, (invited paper) M.A.O. Vasilescu, D. Terzopoulos, *Proc. Sixth International Conference on 3D Digital Imaging and Modeling (3DIM07)*, Montreal, PQ, August, 2007, 39.

Multilinear (Tensor) Image Synthesis, Analysis and Recognition, (invited paper) M.A.O. Vasilescu, Terzopoulos, *IEEE Signal Processing Magazine*, November, 2007, 118123. Exploratory DSP Column.

“Model-Based and Image-Based Facial Synthesis, Analysis, and Recognition”, D. Terzopoulos, Y. Lee, M.A.O. Vasilescu, *6th IEEE International Conference on Automatic Face and Gesture Recognition*, Seoul, Korea, May, 2004, 3–8.

Chapters in Books:

“TensorTextures: Multilinear Image-Based Rendering”, in *CG Magic: The Landscape of Computer Graphics Technology*, Noriko Kurachi (ed.), Ohmsha Publisher of Science and Engineering Books, Tokyo, 2005, in press.

Dissertations:

“A Tensor Algebraic Framework for Computer Graphics, Vision and Machine Learning”, PhD Dissertation, Department of Computer Science, University of Toronto, 2009.

“Adaptive Dynamic Meshes for Visual Reconstruction”, MS Eng. Dissertation, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 1997.

Videos “TensorTextures”, selected for screening at the *New York City ACM SIGGRAPH and Metropolitan College Animation Festival*, September 30, 2003.

Scientific Leadership

PANEL/TUTORIAL/SPECIAL SESSION CHAIR

2020 SIGGRAPH Berthouzoz Women in Research,
 2020,2019,2018 Thesis Fast Forward Co-Chair, SIGGRAPH with Eftychios Sifakis
 2019, Tutorial Co-Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR'19) with Ali Farhadi
 2019 Ethics Co-Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR'19) with Derek Hoiem
 2015, Pannel Co-Chair 11th IEEE Conference on Automatic Face and Gesture Recognition with Karl Ricanek Jr.

AREA CHAIR

2016, Computer Vision Pattern Recognition (declined)
 2011, 9th IEEE Conference on Automatic Face and Gesture Recognition

SYMPOSIUM/WORKSHOP/TUTORIAL ORGANIZER :

2020 ICPR Tutorial, co-organizer with Ivan Oseledets on “Cause-and-Effect in a Tensor Framework”; Milan, Italy, January, 2021.

2019 CVPR Tutorial, co-organizer with Lieven DeLathauwer and Jean Kossaifi on “Tensor Decompositions and Deep Learning for Computer Vision and Machine Learning”; Long Beach, June 17, 2019.

2008 SIAM Symposium, organizer on “Tensor Algebraic Methods and Their Application to High-Dimensional Multi-Modal Data; San Diego, Ca, July 10, 2008.

2007 ICCV Tutorial, co-organizer with Amnon Shashua on “Tensor Methods for Machine Learning, Computer Vision, and Computer Graphics”, International Conference on Computer Vision (ICCV'07), Rio de Janeiro, Brazil, October 14, 2007.

2007 ICML Tutorial, co-organizer with Amnon Shashua on “Tensor Methods for Machine Learning, Computer Vision, and Computer Graphics”, International Conference on Machine Learning (ICML'07), Corvallis, OR, June 20, 2007.

2006 CVPR Tutorial, co-organizer with Fernando de la Torre on “Linear and Multilinear (Tensor) Methods for Vision, Graphics, and Signal Processing”, IEEE Conference on Computer Vision and Pattern Recognition (CVPR'06), New York, NY, June 17, 2006

SESSION CHAIR:

Workshop on Tensor Decompositions and Applications, 2005

PROGRAM COMMITTEE

2021 WACV

2020 CVPR: Challenges and Promises of Inferring Emotion from Image and Video

2016 Siggraph - Unified Jury

2009, 2007 International Conference on Computer Vision (ICCV)

2009-declined, 2008, 2007 Computer Vision and Pattern Recognition (CVPR)

CONFERENCE ORGANIZING ASSISTANT

2005 ACM SIGGRAPH/Eurographics Symposium on Computer Animation,

2001 Computer Vision and Pattern Recognition Conf. (CVPR 2001)

1999 International Conference on Computer Vision (ICCV 1999)

Refereeing

Applied Mathematical Modelling (APM 2015,2014,2013,2012)

ACM SIGGRAPH (2016,2007,2006,2005,2000)

ACM SIGGRAPH/Eurographics Symposium on Computer Animation, (2005)

Computer Vision and Pattern Recognition Conf.(CVPR 2021, 2020,2019,2016,2011,2007,2006,2005,2001,1998)

International Conference on Machine Learning (ICLR 2019,2018)

International Conference on Computer Vision (ICCV 2009,2007,2005,1999)

IEEE Transaction on Image Processing, (2005,2004)

IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI 2016,2015,2014,2011,2010,2006, 2005)

Image and Vision Computing Journal, 2003

Journal of Visual Communication and Image Representation (JVCI 2018)

Neural Information Processing Systems (NIPS/NeurIPS 2019,2018,2017)

Neural Computation (NECO 2019,2018,2017)

SIAM (2008,2006,2005)

NIH Small Business Innovation Research (SBIR) program, 2017

U.S. Civilian Research & Development Foundation (CRDF), "Next Steps to Market" Grants Program, 2003

**Entrepreneurship
Leadership****Judge**, California Nanosystems Institute (CNSI) Inventathon at UCLA, March 4-5, 2017**Steering Committee Member**, *Startup UCLA*, 2012–2014**Founding Director**, *UCLA 48-Hour Startup Competition*, 2011**Technical Due Dilligence:** Tech Coast Angels, Zuma Ventures**Board of Advisors**,

- AI Accelerator Institute, 2021
- Step Fund, 2007–2008
- Kokoche Inc, 2012–
- Regulars, LLC

Keynotes and Distinguished Lectures**2019 IEEE Global Conference on Signal and Information Processing (IEEE GlobalSIP)****Ottawa, Canada**

Symposium on Tensor Methods for Signal Processing and Machine Learning

November 13, 2019 Keynote: "Extracting Insight from Data: Cause-and-Effect in a Tensor Framework".

SSIMA International Summer School on Imaging for Medical Applications**Bucharest, Romania**

September 16, 2019 Keynote: "Representing Cause-and-Effect from Medical Data in a Tensor Framework".

MILA, Quebec Artificial Intelligence Institute and Microsoft Research**Montreal, Canada**

May 30, 2019 A.I. Distinguished Lecture Series: "Cause-and-Effect in a Tensor Framework".

University of Utah, Scientific Computing and Imaging Institute**Salt Lake City, UH**

November 10, 2017 Distinguished Lecture: "You've got Data, We've got Tensors: Linear and Multilinear Data Tensor Decomposition".

CVPR 2017, Tensor Models for Computer Vision Workshop**Honolulu, HI**

July 26, 2017 Keynote: "You've got Data, We've got Tensors: Linear and Multilinear Tensor Models".

TEDxUCLA**Los Angeles, CA**

Mar. 31, 2014 "Face Recognition: Facts vs. Fiction".

Institutul de Matematica al Academiei Romane	Bucharest, Romania
Diaspora in Scientific Research and Higher Education Conference	
September 27, 2012	Keynote: "A Tensor Framework for Computer Vision, Graphics and Machine Learning".
European Research Consortium on Informatics and Mathematics	Copenhagen, Denmark
April 1, 2005	Keynote: "A Tensor Framework for Computer Vision and Graphics".
University of Texas, Austin, Department of Electrical and Computer Engineering	Austin, TX
May 3, 2004	Distinguished Seminar Series: "A Multilinear (Tensor) Framework for Computer Vision and Graphics".

Entrepreneurship Keynotes

AI Accelerator Institute, Computer Vision Festival	Virtual
June 22, 2021	"Causal Data Driven Decisions".
Digital LA	Pasadena, CA
Mar. 6, 2015	"Pannel: How to find your CTO, developers? Or should you do it yourself?"
AT&T Aspire Mobile App Hackathon Education	Los Angeles, CA
February 8, 2013	Keynote: "Entrepreneurship and the Engineer".
University of California	Los Angeles, CA
April 13-15, 2012	Director, Startup Competition: "UCLA 48hr Startup Competition".

Other Invited Talks

Georgia Tech	Virtual
April 26, 2021	"Causal Data Driven Decisions in a Tensor Framework".
Massachusetts Institute of Technology, Center for Biological and Computational Learning	Cambridge, MA
May 3, 2021	"Forward and Inverse Causal Inference in a Tensor Framework".
UC Riverside, Department of Computer Science	Riverside, CA
Apr 16, 2021	"Forward and Inverse Causal Inference in a Tensor Framework".
Illinois Institute of Technology, Department of Computer Science	Chicago, IL
Apr 8, 2021	"Forward and Inverse Causal Inference in a Tensor Framework".
University of Baltimore, Baltimore County, Department of Computer Science	Baltimore, MD
Mar 29, 2021	"Forward and Inverse Causal Inference in a Tensor Framework".
University of California, Los Angeles, Institute of Pure and Applied Mathematics	Los Angeles, CA
Mar 16, 2021	"Generalized Block Multilinear Factor Analysis: Representing Parts and Wholes" "Generalized Block Multilinear Factor Analysis: Representing Parts and Wholes"
University of California, Los Angeles, Institute of Pure and Applied Mathematics	Los Angeles, CA
Mar 11, 2021	"Forward and Inverse Causal Inference with Multilinear Factor Analysis" "Forward and Inverse Causal Inference with Multilinear Factor Analysis"
Halicioglu Data Science Institute, University of California, San Diego, Intertrack Seminar	San Diego, CA
Apr 16, 2020	"Representing Cause-and-Effect in a Tensor Framework".
Pennsylvania State University, Departmental CS Colloquium	State Park, PA
Feb 26, 2020	"Representing Cause-and-Effect in a Tensor Framework".
IBM, Foundation in AI Seminar	Yorktown Heights, NY
Dec 6, 2019	"Representing Cause-and-Effect in a Tensor Framework".
SRI	Princeton, NJ
Dec 4, 2019	"Representing Cause-and-Effect in a Tensor Framework".
New York University, Department of Computer Science Colloquium	New York, NY
Dec 3, 2019	"Representing Cause-and-Effect in a Tensor Framework".
McGill University, Department of Computer Science	Montreal, QC
May 29, 2019	"Cause-and-Effect in a Tensor Framework".
Salk Institute, University of California	San Diego, CA
Nov. 11, 2015	"From Face Signatures to Brain Signatures: Tensor Framework for Biometric Signatures"
Intelligence Advanced Research Projects Activity, Janus	Washington, DC
Jun. 13, 2013	Proposer's Day Presentation

- IMA, University of Minnesota** Twin Cities, Minnesota
Oct. 26-30, 2008 “Multilinear (tensor) manifold data modeling”
- 2008 SIAM Symposium on “Tensor Decompositions and Applications** San Diego, Ca
July 11, 2008 “Multilinear Projection for Recognition in a Tensor Framework”
- 2008 SIAM Symposium on “Tensor Algebraic Methods and Their Application to High-Dimensional Multi-Modal Data** San Diego, Ca
July 10, 2008 “Multilinear (Tensor) Independent Component Analysis”
- Boston University** Boston, MA
November 15, 2007 “Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics”.
- IBM** Almaden, CA
August 14, 2007 “Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics”.
- RICOH** Palo Alto, CA
August 13, 2007 “Tensor Framework for Perceptual Signatures”
- University of Massachusetts, Dartmouth** Dartmouth, MA
November 1, 2006
- Workshop on Mathematics of Visual Analysis.** Mathematical Sciences Research Institute; Berkeley, California
October 16-17, 2006
- Workshop on Mathematical Methods in Computer Vision** Banff International Research Station, Alberta, CA
Sept. 30 - 5 Oct., 2006 “Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics”.
- Workshop on Algorithms for Modern Massive Data Sets,** Palo Alto, CA
June 21-24, 2006 “A Tensor Approach to Image Analysis (Vision) and Synthesis (Graphics)”.
Stanford University and Yahoo! Research.
- Cornell University, Center for Applied Mathematics** Ithaca, NY
April 21, 2006 Colloquia: “A Tensor Approach to Image Analysis (Vision) and Synthesis (Graphics)”.
- Tufts University, Department of Mathematics and Computer Science** Medford, MA
December 2, 2005 Colloquia: “A Multilinear (Tensor) Framework for Image Analysis (Vision) and Synthesis (Graphics)”.
- Workshop on Tensor Decomposition and Applications,** Marseille, France
August, 2005 “Multilinear Independent Components Analysis and Multilinear Projection Operator for Face Recognition”.
- New York University, Courant Institute of Mathematical Sciences** New York, NY
December 8, 2004 Harmonic Analysis and Signal Processing Seminar: “A Tensor Approach to Image Analysis (Vision) and Synthesis (Graphics)”.
- SIAM Conference on Computational Science and Engineering** Orlando, FL
February 12, 2005 “A Tensor Approach to Image Analysis (Vision) and Synthesis (Graphics)”.
Minisymposium on Computational Science Applications of Tensor Decompositions.
- New York University, Courant Institute of Mathematical Sciences** New York, NY
December 8, 2004 Harmonic Analysis and Signal Processing Seminar: “A Tensor Approach to Image Analysis (Vision) and Synthesis (Graphics)”.
- University of California, Berkeley, Department of Computer Science** Berkeley, CA
November 18, 2004 Graphics Seminar: “TensorTextures: Multilinear Image-Based Rendering”.
- University of California, Los Angeles, Department of Computer Science** Los Angeles, CA
November 9, 2004 Departmental Seminar: “TensorTextures: Multilinear Image-Based Rendering”.
- Mitsubishi Electric Research Lab** Cambridge, MA
October 1, 2004 “A Tensor Framework for Computer Vision and Graphics”.
- Massachusetts Institute of Technology, Computer Science and Artificial Intelligence Lab** Cambridge, MA
September 29, 2004 Graphics Seminar: “TensorTextures: Multilinear Image-Based Rendering”.
- American Institute of Mathematics** Palo Alto, CA
July 22, 2004 Tensor Decomposition Workshop: “A Tensor Framework for Computer Vision and Graphics”.
- Identix, Inc.** Jersey City, NJ
July 9, 2004 “TensorFaces: A Tensor Framework for Face Recognition”.
- Canadian Information Processing Society** Toronto, ON
May 13, 2004 Beyond Technology Panel: “Emerging Technologies: TensorFaces & TensorTextures”.

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- California Institute of Technology**, Department of Computer Science **Pasadena, CA**
April 20, 2004 Vision Seminar: "A Multilinear (Tensor) Framework for Computer Vision and Graphics".
- University of Southern California**, Department of Computer Science **Los Angeles, CA**
April 19, 2004 Departmental Seminar: "A Multilinear (Tensor) Framework for Computer Vision and Graphics".
- University of Massachusetts**, Department of Computer Science **Amherst, MA**
April 14, 2004 Vision Seminar: "A Multilinear (Tensor) Framework for Computer Vision and Graphics".
- Stanford University**, Department of Computer Science **Pasadena, California**
April 12, 2004 Departmental Seminar: "A Tensor Framework for Computer Vision and Graphics".
- Princeton University**, Department of Computer Science **Princeton, NJ**
February 16, 2004 Graphics Seminar: "A Multilinear Approach to Image Based Rendering: TensorTextures".
- University of Toronto**, Department of Computer Science **Toronto, ON**
December 16, 2003 Vision Seminar: "Multilinear Analysis for Vision and Graphics".
- York University**, Department of Computer Science **Toronto, ON**
December 12, 2003 Computer Science Seminar: "Multilinear Representations of Image Ensembles for Compression and Recognition".
- Technology Transfer Institute / Vanguard** **Phoenix, AZ**
December 4-5, 2003 Panel on NextGen Technologies: "Emerging Technologies: TensorFaces & TensorTextures".
<http://www.ttvanguard.com>
- University of Pennsylvania**, Department of Computer Science **Philadelphia, PA**
November 13, 2003 Graphics Colloquium: "TensorTextures".
- Harvard University**, Department of Computer Science **Cambridge, MA**
September 26, 2003 Graphics Seminar: "TensorTextures".
- University of California at San Diego**, Department of Computer Science **San Diego, CA**
August 1, 2003 Machine Learning Seminar: "TensorFaces".
- CardTech/SecurTech Conference** **Orlando, FL**
May 12, 2003 Panel on Advances in Biometric Technology and Testing: "Breakthroughs in Face Recognition Technologies: TensorFaces".
- University of Maryland**, Department of Computer Science **College Park, MD**
April 23, 2003 Vision Seminar: "Multilinear Representation of Image Ensembles for Compression and Recognition – TensorFaces".
- Yale University**, Department of Computer Science **New Haven, CT**
February 7, 2003 Vision Seminar: "TensorFaces: Multilinear Representation of Image Ensembles for Compression and Recognition".
- Columbia University**, Department of Computer Science **New York, NY**
November 25, 2002 "TensorFaces: Multilinear Representation of Image Ensembles for Compression and Recognition".
- Carnegie Mellon University**, Department of Computer Science **Pittsburgh, PA**
October 24, 2002 VASC Seminar: "TensorFaces: Multilinear Representation of Image Ensembles for Face Recognition"
- Technical Support Working Group (TSWG) Meeting**, Undersecretary of Defense
Combating Terrorism Funding Panel, Carnegie Mellon University,
October 23, 2002 "TensorFaces: Multilinear Representation of Image Ensembles for Face Recognition".
- University of Toronto**, Department of Computer Science **Toronto, ON**
October 6, 1998 Vision Seminar: "Mass-Spring Systems and Adaptive Meshes".

Teaching Experience	<p>UNIVERSITY OF CALIFORNIA – Department of Computer Science Los Angeles, CA</p> <ul style="list-style-type: none"> ● Winter 2014, Spring 2014, Fall 2017, Winter 2018: <ul style="list-style-type: none"> – <u>Introduction to Computer Graphics</u> - CS 174A, undergraduate course <p>STONY BROOK UNIVERSITY – Department of Computer Science Stony Brook, NY</p> <ul style="list-style-type: none"> ● Fall 2007: <u>Advanced topics in Statistical Learning</u> - CSE 692, graduate course ● Spring 2008: <u>Introduction to Computer Vision</u> - CSE 527, graduate course ● Fall 2008: <ul style="list-style-type: none"> – <u>Computational Photography</u> - CSE 391, undergraduate course – <u>Computational Photography</u> - CSE 591, graduate course – <u>Research Topics on Computer Graphics and Computer Vision</u> - CSE 656, graduate research seminar ● Spring 2009: <u>Introduction to Computer Vision</u> - CSE 527, graduate course <p>MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Department of Computer Science Cambridge, MA <i>Recitation Instructor</i></p> <ul style="list-style-type: none"> ● Fall 1996 – Spring 1997: <u>Discrete Math</u> – Taught three recitations per week; each classes of 30 students. ● Spring 1996: <u>Algorithms</u> – Taught two recitations per week; classes of 40 students. ● Spring 1993: <u>Probabilistic System Analysis</u> – Taught one recitation per week; a class of 40 students.
Guest Lectures	<p>University of California, Santa Barbara – Electrical and Computer Engineering Sanata Barbara, CA</p> <ul style="list-style-type: none"> ● November 19, 2020, “Hierarchical Block Multilinear Factor Analysis and Causal Explanations”, Tensor Computation for Machine Learning and Big Data, ECE 594BB/ECE194BB Instructor: Zheng Zang <p>University of California – Department of Computer and Electrical Engineering Los Angeles, CA</p> <ul style="list-style-type: none"> ● March 1, 2018, “Tensors for Digital Image Processing”, Digital Image Processing, ECE 211A, Instructor: Fabien Scalzo, University of California, Los Angeles. <p>STONY BROOK UNIVERSITY – Department of Computer Science Stony Brook, NY</p> <ul style="list-style-type: none"> ● April 30, 2009, “Computational Photography”, Computer Vision, CSE327, Instructor: D. Samaras, Stony Brook University. ● February 20, 2009, “Discrete Linear Systems”, Instructor: Radu Grosu, Stony Brook University. ● November 1, 2007, “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision, Instructor: Prof. D. Samaras, Stony Brook University, Department of Computer Science ● October 25, 2006, “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision, Instructor: Prof. D. Samaras, Stony Brook University, Department of Computer Science. <p>MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Media Arts and Sciences Cambridge, MA</p> <ul style="list-style-type: none"> ● November 20, 2006, “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Pattern Recognition and Analysis MAS622J, Instructor: Prof. R. Picard, Massachusetts Institute of Technology, Media Arts and Sciences. <p>NEW YORK UNIVERSITY – Department of Computer Science New York, NY</p> <ul style="list-style-type: none"> ● February 3, 2005, “Simulation of Mass-Spring-Damper Systems”, Artificial Life for Computer Graphics G22.3033-006, Instructor: Prof. D. Terzopoulos, New York University, Computer Science Department. ● February 12, 19, 2003, “Deformable Models: Mass-Spring Systems”, Visual Modeling G22.3033-005, Instructor: Prof. D. Terzopoulos, New York University, Computer Science Department. ● December, 2002, “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision G22.2271-001, Instructor: Prof. D. Geiger, New York University, Computer Science Department. ● March 12, 19, 2002, “Deformable Models: Mass-Spring Systems”, Visual Modeling G22.3033-005, Instructor: Prof. D. Terzopoulos, New York University, Computer Science Department ● May 8, 2002, “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision G22.2271-001, Instructor: Prof. D. Geiger, New York University, Computer Science Department

Students

MASTER OF SCIENCE

University of California, Los Angeles

December 2017 - 2019: Xiao (Steven) Zeng

September 2014 - 2016: Eric Kim, followed by a position at Pinterest

Dissertation: "A Part-based, Multiresolution, TensorFaces Approach to Image-based Facial Verification"

UNDERGRADUATE INTERNS

University of California, Los Angeles

Summer 2017: Bo-Kun Wang, followed by PhD at UC, Davis

2015 - 2016: Kate Bell, followed by MS at UC. Berkley

Fall 2015 - Winter 2016: Shubham Joshi, followed by MS at USC

BACHELOR OF SCIENCE

Massachusetts Institute of Technology

2006-2007: Ali Ghajarnia; Dissertation: "Facial Feature Tracking with Tensors", June 2007

2005-2006: Felix O. Santiago; Dissertation: "Human Motion Synthesis", February 2006

UNDERGRADUATE RESEARCH OPPORTUNITY PROJECTS

Massachusetts Institute of Technology

Fall 2005: Marjorie Cheng

Fall 2005: Jiwon Kim

Spring 2006: Fan Yang

Spring 2006: Alan Browning

INTERNSHIP

Tensor Vision, Los Angeles

Shubham Joshi, UCLA BS candidate - "Explorations in Linear and Multilinear Face Morphing"

Kim, Eric

Ivanov, Tonislav

INDEPENDENT STUDIES

Courant Institute, New York University

Svetlana Stenchenkova, MS candidate - "Realtime TensorTextures Rendering"

Steven Gutstein, PhD candidate - "Motion Capture Data Segmentation"

Zhihua Wang, PhD candidate - "Motion Capture Data Processing"

Tonislav Ivanov, Stuyvesant high school senior "TensorFaces: A Multilinear Model for Computerized Face Recognition and Image Processing"