

M. ALEX O. VASILESCU

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[Quora Tensor Tutorial Answers](#)

Biography

M. Alex O. Vasilescu is a US citizen that received her education at the Massachusetts Institute of Technology and the University of Toronto. She introduced the tensor paradigm for computer vision, computer graphics, machine learning, and extended the tensor algebraic framework by generalizing concepts from linear algebra. Vasilescu has re-framed data analysis, recognition, synthesis, and interpretability of sensory data as a multilinear tensor factorization problems in order to mathematically represent cause-and-effect, and demonstratively disentangle the multi-causal factor structure of observable data. The tensor framework is a powerful paradigm whose utility and value has been further underscored by Amnon Shashua's team that have recently provided theoretical evidence that deep learning is a neural network approximation of multilinear tensor factorization. Vasilescu's face recognition research, known as TensorFaces, has been funded by the TSWG, the Department of Defenses Combating Terrorism Support Program, and by IARPA, Intelligence Advanced Research Projects Activity. Her work was featured on the cover of Computer World, and in articles in the New York Times, Washington Times, etc. MITs 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 reasoning, statistical 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: Amnon Shashua, Alan Jepson, David Fleet, Demetri Terzopoulos, Geoff Hinton

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 interaction model of cause-and-effect was computed by employing

- (i) a Tucker tensor (multilinear) decomposition where each causal factor is modeled by a Gaussian distribution
- (ii) a novel multilinear (tensor) independent components analysis where each causal factor is modeled 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 one-to-many 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

TENSOR VISION TECHNOLOGIES

Los Angeles, CA

Chief Science Officer - 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.

- **2017 – : Unsupervised and Semi-supervised Multilinear Tensor Factorization** – Multilinear (Tucker Tensor) Decomposition, Multilinear (Tensor) ICA, *etc.* are powerful approaches for data analysis that have been shown in the literature to be equivalent to deep learning models. However, the algebraic tensor decomposition approach has not gained wide adoption since it has required a fully labeled training data tensor. Our unsupervised and semi-supervised tensor factorization is a novel tensor factorization approach that addresses the aforementioned shortcoming and employs unlabeled, unstructured data tensor. Paper in preparation.
- **2014 – 2016 : Compositional Hierarchical Tensor Factorization** – Introduces a unified tensor model for a recursive hierarchy of wholes and parts, and develops a novel a compositional tensor factorization. The factorization computes a convolutional hierarchy of object features and represents an object as a compositional representation of wholes and parts that is invariant to extrinsic causal factors of object image appearance that hinder recognition, such as illumination (i.e. the location and types of light sources), and imaging (i.e. viewpoint, viewing direction, camera characteristics).

UNIVERSITY OF CALIFORNIA - Department of Computer Science

Los Angeles, CA

- **2012: Director**, UCLA 48-hr Startup
- **2011 – Associate Director Computer Graphic and Vision Lab**
- **2009 – 2013: Assistant Research Scientist**

Face Tracking using Coupled Multilinear (Tensor) Models – Tucker tensor decompositions explicitly represent the data variance due to various causal factors of data formation. Our coupled multilinear (tensor) active appearance contends with shape and texture data tensor that have different units of measure, and are of different order, i.e. the two data tensors share only a subset of causal the factors of data formations.

Multilinear Projection – While TensorFaces is a handy moniker for an approach that explicitly represents the interaction of the causal factors of data formation from a set of training images, with Multilinear (Tensor) ICA as an extension of that approach, neither interaction model prescribes a solution for how one might determine the causal factors of a single unlabeled test image.

Multilinear Projection addresses the question: How does one determine from a single unlabeled test image all the unknown causal factors of data formation, i.e. how does one solve for multiple unknowns from a single image equation? In the course of addressing this question, several concepts from linear (matrix) algebra were generalized, such as the mode-m identity tensor (which is also an algebraic operator that reshapes a matrix into a tensor and back again to a matrix), the mode-m pseudo-inverse tensor, the mode-m product in order to develop the multilinear projection algorithm.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Media Lab

Cambridge, MA

Research Scientist

- **2005- 2007: Listening in 3D – HRTF analysis and synthesis** – Developed a data-driven model capable of producing different personalized head related transfer functions (HRTF). HRTF characterizes how anatomy and sound source location affects how we perceive sound. The manner in which sound interacts with our auditory system is important in: pinpointing the location of sound sources that is vital for safe navigation in traffic, and achieving a realistic acoustic environment in gaming and home cinema set-ups.

NEW YORK UNIVERSITY – Media Research Lab

New York, NY

Research Scientist

- **2002 – 2004: Generative Tensor Framework – TensorTextures** – Introduced and developed a new image-based rendering method that learns the surface bi-directional texture function (BTF) from a sparse set of sample images. TensorTextures is based on a generative multilinear (tensor) algebraic framework. It can synthesize novel unseen view and light dependent textures that exhibit realistic effects, such as self-occlusion and self-shadowing, due to surface mesostructure.
- **2000 – 2005: TensorFaces/MICA** – Introduced an appearance-based recognition tensor approach that explicitly represents and disentangle the causal factors of data formation, by training on facial images captured under varying viewpoints, illuminations, and with different expressions. TensorFaces represents the causal factors based on second order statistics, while our new Multilinear (Tensor) ICA represents the causal factors based on higher order statistics.

UNIVERSITY OF TORONTO – Department of Computer Science

Toronto, ON

- **1998 – 2000: Human Motion Signature Extraction and Style Transfer** – Introduced and developed a new method for learning the distinctive characteristics of human motions (such as the Charlie Chaplin walk). Using *M-mode SVD*, “motion signatures” are extracted and employed for recognizing individuals from their motions and employed for synthesizing novel motions in the style of specific individuals.

IBM CORPORATION – Almaden Research Center

San Jose, CA

Summer Intern

- **Summer/Fall 2000: Event Recognition** – Recognition of the same event/motion viewed from different viewing directions by representing motion using generalized cylinders.

COMPAQ – Cambridge Research Lab

Cambridge, MA

Summer Intern

- **Spring/Summer 2000: HMM vs. SLDS** – Analyzed and compared hidden markov models with switching linear dynamic systems for human motion analysis and synthesis.

INTEL CORPORATION – Microcomputer Research Labs

Santa Clara, CA

Summer Intern

- **Summer 1997: 3D Sculpting Tool** – Created an interactive 3D physics based sculpting system for an imersive virtual reality stereoscopic display.

LEHMAN BROTHERS INC.

New York, NY

Summer Associate

- **Summer 1996:** Implemented trading strategy for the equity derivatives trading desk. Rotated through equity derivatives trading, fixed income derivatives trading, proprietary equities trading, etc.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Department of Computer Science

Cambridge, MA

Recitation Instructor

- **Fall '96 – Spring '97: Discrete Math** – Taught three recitations per week to three classes each of 30 students.
- **Spring 1996: Algorithms** – Taught two recitations per week to two classes each of 40 students.
- **Spring 1993: Probabilistic System Analysis** – Taught one recitation per week to a class of 40 students.

Research Projects

- **1995: Learning Robot Motor Tasks** – Developed and implemented a *reinforcement learning* algorithm that learns to control a robot manipulator to perform specified tasks.

Publications**Book in Preparation:**

“A Multilinear (Tensor) Algebraic Framework for Computer Vision and Graphics and Machine Learning.” Springer, London

In Preparation:

“Unstructured and Semi-Supervised Multilinear Tensor Factorization”, M.A.O. Vasilescu, and Xiao (Steven) Zeng

“Compositional Hierarchical TensorFaces”, E. Kim, Bo-Kun Wang, Qi Qu, Tonislav Ivanov, M.A.O.Vasilescu

“Hierarchical Computation of the Compositional Tensor Factorization”, M.A.O. Vasilescu and Xiao Zeng

In Review:

“Representing Cause-and-Effect with Generalized Block Tensor Factorization”, M.A.O. Vasilescu and E. Kim

Published:

“Compositional Hierarchical Tensor Factorization: Representing Hierarchical Intrinsic and Extrinsic Causal Factors”, M.A.O. Vasilescu, E. Kim, *25TH ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD2019) Workshop on Tensor Methods for Emerging Data Science Challenges*, August 5, 2019.

“Face Tracking with Multilinear (Tensor) Active Appearance Models”, W. Si, K. Yamaguchi, M.A.O. Vasilescu, June 2013.

“Multilinear Projection for Face Recognition via Canonical Decomposition”, M.A.O. Vasilescu, *IEEE International Face and Gesture Conf. (FG'11)*, 476-483, 2011.

“Multilinear Projection for Face Recognition via Rank-1 Analysis”, M.A.O. Vasilescu, *CVPR, IEEE Computer Society and IEEE Biometrics Council Workshop on Biometrics*, June 18, 2010.

“Head pose estimation using multilinear subspace analysis for robot human awareness”, T. Ivanov, L. Mathies, M.A.O. Vasilescu, *ICCV, 2nd IEEE International Workshop on Subspace Methods*, September, 2009.

“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.

Research Grants Awarded

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)

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”

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

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

Awards

MIT’s Technology Review 2003 Top 100 Young Innovator, September 24, 2003.

Veuve Clicquot Ponsardin La Grande Dame 2003 Woman of Distinction, October 8 2003, Diageo, Canada

University of Toronto: University of Toronto Open Fellowship, 1997–2000

MIT: Undergraduate scholarships worth over \$30,000

MIT-ACM Undergraduate Computer Science Conference Award Winning Paper, 1989

- **Title:** “A NeWS-Based Window Object for Graph Interfaces”
- **Selection criteria:** quality research done by MIT undergraduates.
- **Sponsors:** MIT EECS, ACM and Microsoft.

Patents

“Method, system, storage medium, and data structure for Compositional Hierarchical Tensor Factorization”, US Patent Application No. 62/857,795 filed June 5, 2019.

“Multilinear (Tensor) Independent Component Analysis,” US Patent Application No. 7,693,299 B2 filed January 13, 2004.

“TensorTextures”, US Patent Application No. 60/490,131 filed July 25, 2003.

“Multilinear Image Analysis and Recognition”, US Patent Application No. 60/383,300 filed March 23, 2002.

“Human Motion Signatures”, US Patent Application No. 60/337,912 filed December 6, 2001.

Licenses

Created and licensed interactive deformable models prototype software to be included in “Shapes” software package marketed by **XOX, Inc.**, Minneapolis, MN, 1995. Technology based on MS dissertation.

**Scientific
Leadership****PANEL/TUTORIAL/SPECIAL SESSION CHAIR**

2019 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
 2018 Thesis Fast Forward Co-Chair, SIGGRAPH with Eftychios Sifakis
 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 :

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

AAAI 2020 - declined Siggraph 2016 - Unified Jury
 International Conference on Computer Vision (ICCV 2009, 2007)
 Computer Vision and Pattern Recognition (2009 - declined, 2008, 2007)

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)

**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,

- Step Fund, 2007–2008
- Kokoche Inc, 2012–
- Regulars, LLC

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 2020, 2019, 2016, 2011, 2007, 2006, 2005, 2001, 1998)
 International Conference on Machine Learning (ICML 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

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

- 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

- 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”.
- 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”.

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- 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".

Memberships Member, Institute for Electrical and Electronics Engineers (IEEE)
Member of the Society for Women Engineers.

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.
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Guest Lectures	<p>University of California – Department of Computer and Electrical Engineering Los Angeles, CA</p> <ul style="list-style-type: none"> ● “Tensors for Digital Image Processing”, Digital Image Processing, ECE 211A, Instructor: Fabien Scalzo, University of California, Los Angeles, March 1, 2018. <p>STONY BROOK UNIVERSITY – Department of Computer Science Stony Brook, NY</p> <ul style="list-style-type: none"> ● “Computational Photography”, Computer Vision, CSE327, Instructor: D. Samaras, Stony Brook University, April 30, 2009. ● “Discrete Linear Systems”, Instructor: Radu Grosu, Stony Brook University, February 20, 2009. ● “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision, Instructor: Prof. D. Samaras, Stony Brook University, Department of Computer Science: November 1, 2007. ● “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision, Instructor: Prof. D. Samaras, Stony Brook University, Department of Computer Science: October 25, 2006, <p>MASSACHUSETTS INSTITUTE OF TECHNOLOGY – Media Arts and Sciences Cambridge, MA</p> <ul style="list-style-type: none"> ● “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Pattern Recognition and Analysis MAS622J, Instructor: Prof. R. Picard, Massachusetts Institute of Technology, Media Arts and Sciences, November 20, 2006. <p>NEW YORK UNIVERSITY – Department of Computer Science New York, NY</p> <ul style="list-style-type: none"> ● “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 3, 2005. ● “Deformable Models: Mass-Spring Systems”, Visual Modeling G22.3033-005, Instructor: Prof. D. Terzopoulos, New York University, Computer Science Department, February 12, 19, 2003. ● “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision G22.2271-001, Instructor: Prof. D. Geiger, New York University, Computer Science Department, December, 2002. ● “Deformable Models: Mass-Spring Systems”, Visual Modeling G22.3033-005, Instructor: Prof. D. Terzopoulos, New York University, Computer Science Department, March 12, 19, 2002. ● “Face Recognition: EigenFaces, FisherFaces, TensorFaces”, Computer Vision G22.2271-001, Instructor: Prof. D. Geiger, New York University, Computer Science Department, May 8, 2002.
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Students

MASTER OF SCIENCE

University of California, Los Angeles

December 2017 - : Xiao (Steven) Zheng

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 2017

2005-2006: Felix O. Santiago; Dissertation: "Human Motion Synthesis", February 2016

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"

INDEPENDENT STUDIES

Courant Institute, New York University

Svetlana Stenchikova, 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"