

Marcus A. Brubaker - Curriculum Vitae

CONTACT INFORMATION	Marcus A. Brubaker <i>E-mail:</i> mab@eecs.yorku.ca <i>Website:</i> http://www.eecs.yorku.ca/~mab/
EDUCATION	University of Toronto, Toronto, Ontario, Canada <ul style="list-style-type: none">• Ph.D. in Computer Science (Supervisor: David J. Fleet) 2011 Thesis Title: <i>Physical Models of Human Motion for Estimation and Scene Understanding</i>• M.Sc. in Computer Science (Supervisor: David J. Fleet) 2006 Thesis Title: <i>Physics-based Priors for Human Pose Tracking</i>• Honours B.Sc. in Computer Science with Minor in Mathematics 2004
EMPLOYMENT HISTORY	Assistant Professor at York University, Toronto. 2016- Co-Founder of Structura Biotechnology Inc. http://structura.bio 2016- Research Associate at Cadre Research Labs. http://cadreresearch.com 2011 - <ul style="list-style-type: none">• Theoretical and applied consulting in computer vision, machine learning and statistics Postdoctoral Fellow at University of Toronto, Scarborough. 2014 - 2016 <ul style="list-style-type: none">• Supervisor: David J. Fleet (University of Toronto) Postdoctoral Researcher at TTI-Chicago. http://ttic.edu 2011 - 2014 <ul style="list-style-type: none">• Supervisor: Raquel Urtasun (TTI-Chicago) Sessional Lecturer at University of Toronto, Scarborough. 2012 - 2015 <ul style="list-style-type: none">• Instructor for <i>CSCD11/CSCC11: Introduction to Machine Learning and Data Mining</i>
AFFILIATIONS	<ul style="list-style-type: none">• Assistant Professor, Department of Electrical Engineering and Computer Science, Lassonde School of Engineering, York University, Toronto, Canada. (Since 2016)• Faculty Member, Centre for Vision Research, York University, Toronto, Canada. (Since 2016)• Core Member, Vision: Science to Applications (VISTA), York University, Toronto, Canada. (Since 2016)• Member, Computer Vision Foundation. (Since 2013)• Member, IEEE. (Since 2007)
FUNDING AND AWARDS	Grants <ul style="list-style-type: none">• “<i>Firearm Forensics Black-Box Studies for Examiners and Algorithms using Measured 3D Surface Topographies</i>,” National Institute of Justice (NIJ) Applied R&D in Forensic Science for Criminal Justice Purposes, with Ryan H. Lilien, \$200,00USD, 2017.• “<i>Applied Research, Development, and Method Validation of Toolmark Imaging, Virtual Casings Comparison, and In-Lab Verification for Firearms Forensics</i>,” National Institute of Justice (NIJ) Applied R&D in Forensic Science for Criminal Justice Purposes, with Ryan H. Lilien, \$217,450USD, 2016.• “<i>Applied Research, Development and Method Validation for a Statistically Based Comparison of Tool Marks using GelSight-Based Three Dimensional Imaging and Novel Comparison Algorithms for Firearm Forensics</i>,” NIJ Applied R&D in Forensic Science for Criminal Justice Purposes, with Ryan H. Lilien, \$190,400USD, 2015.• “<i>Applied Research and Development of a Three-dimensional Topography System for Imaging and Analysis of Striated and Impressed Tool Marks for Firearm Identification using GelSight</i>,” NIJ Applied R&D in Forensic Science for Criminal Justice Purposes, with Ryan H. Lilien, \$193,000USD, 2014.• “<i>Applied Research and Development of a Three-dimensional Topography System for Firearm Identification using GelSight</i>,” NIJ Applied R&D in Forensic Science for Criminal Justice Purposes, with Ryan H. Lilien and Todd Weller, \$200,000USD, 2013.• “<i>Three-dimensional Topography System for Firearm Identification using GelSight</i>,” National Institute of Standards and Technology, Measurement Science and Engineering Research Grants Program, with Ryan H. Lilien and Todd Weller, \$174,000USD, 2013.

Scholarships and Awards

- **BioImage Computing Workshop at IEEE CVPR** **2015**
 ◇ Winner of Best Poster for [27]
- **IEEE Conference on Computer Vision and Pattern Recognition** **2013**
 ◇ Winner of Best Paper Runner-Up for [15]
- **Natural Science and Engineering Research Council** **2012 - 2014**
 ◇ Postdoctoral Fellowship, \$40,000CAD per year
- **Natural Science and Engineering Research Council** **2008 - 2010**
 ◇ Canadian Graduate Scholarship, \$35,000CAD per year
- **Ontario Graduate Scholarship** **2006 - 2007**
 ◇ \$15,000CAD per year
- **Ray Reiter Graduate Award in Computer Science** **2005 - 2006**
 ◇ \$500CAD

PUBLICATIONS

- [1] Ali Punjani, John L. Rubinstein, David J. Fleet, and Marcus A. Brubaker. cryoSPARC: algorithms for rapid unsupervised cryo-EM structure determination. *Nature Methods*, 14(3):290 – 296, 2017.
- [2] Bob Carpenter, Andrew Gelman, Matt Hoffman, Daniel Lee, Ben Goodrich, Michael Betancourt, Marcus A. Brubaker, Jiqiang Guo, Peter Li, and Allen Riddell. Stan: A Probabilistic Programming Language. *Journal of Statistical Software*, 76(1), 2017.
- [3] Wei-Chiu Ma, Shenlong Wang, Marcus A. Brubaker, Sanja Fidler, and Raquel Urtasun. Find your Way by Observing the Sun and Other Semantic Cues. In *IEEE International Conference on Robotics and Automation*, 2017.
- [4] Zhi Hao Luo, Marcus A. Brubaker, and Michael Brudno. Size and Texture-based Classification of Lung Tumors with 3D CNNs. In *IEEE Winter Conference on Applications of Computer Vision*, 2017.
- [5] Ali Punjani, Marcus A. Brubaker, and David J. Fleet. Building Proteins in a Day: Efficient 3D Molecular Structure Estimation with Electron Cryomicroscopy. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2016.
- [6] Marcus A. Brubaker, Andreas Geiger, and Raquel Urtasun. Map-based Probabilistic Visual Self-Localization. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2016.
- [7] Yali Wang, Marcus A. Brubaker, Brahim Chaib-draa, and Raquel Urtasun. Sequential Inference for Deep Gaussian Process. In *Proceedings of Nineteenth International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2016.
- [8] Marcus A. Brubaker, Ali Punjani, and David J. Fleet. Building Proteins in a Day: Efficient 3D Molecular Reconstruction. In *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition*, 2015.
- [9] Todd Weller, Marcus A. Brubaker, Pierre Duez, and Ryan Lilien. Introduction and Initial Evaluation of a Novel Three-Dimensional Imaging and Analysis System for Firearm Forensics. *Association of Firearm and Tool Mark Examiners (AFTE) Journal*, 47(4):198 – 208, 2015.
- [10] John L. Rubinstein and Marcus A. Brubaker. Alignment of cryo-EM movies of individual particles by optimization of image translations. *Journal of Structural Biology*, 192(2):188 – 195, 2015.
- [11] Jianhua Zhao, Marcus A. Brubaker, Samir Benlekber, and John L. Rubinstein. Description and comparison of algorithms for correcting anisotropic magnification in cryo-EM images. *Journal of Structural Biology*, 192(2):209 – 215, 2015.
- [12] Yanshuai Cao, Marcus A. Brubaker, David J. Fleet, and Aaron Hertzmann. Efficient Optimization for Sparse Gaussian Process Regression. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 37(12):2415 – 2427, 2015.

- [13] Yali Wang, Marcus A. Brubaker, Brahim Chaib-draa, and Raquel Urtasun. Bayesian Filtering with Online Gaussian Process Latent Variable Models. In *Proceedings of Conference on Uncertainty in Artificial Intelligence*, 2014.
- [14] Yanshuai Cao, Marcus A. Brubaker, Aaron Hertzmann, and David J. Fleet. Efficient Optimization for Sparse Gaussian Process Regression. In *Proceedings of Neural Information Processing Systems*, 2013.
- [15] Marcus A. Brubaker, Andreas Geiger, and Raquel Urtasun. Lost! Leveraging the Crowd for Probabilistic Visual Self-Localization. In *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition*, 2013.
- [16] Marcus A. Brubaker, Andreas Geiger, and Raquel Urtasun. Probabilistic Map Localization Through Visual Odometry. In *Proceedings of SUNw: Scene Understanding Workshop at IEEE Conference on Computer Vision and Pattern Recognition*, 2013.
- [17] Jianhua Zhao, Marcus A. Brubaker, and John L. Rubinstein. TMaCS: A hybrid template matching and classification system for partially-automated particle selection. *Journal of Structural Biology*, 181(3):234 – 242, 2013.
- [18] Marcus A. Brubaker, Mathieu Salzmann, and Raquel Urtasun. A Family of MCMC Methods on Implicitly Defined Manifolds. In *Proceedings of the Fifteenth International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2012.
- [19] Marcus A. Brubaker, David J. Fleet, and Aaron Hertzmann. Physics-based Person Tracking using the Anthropomorphic Walker. *International Journal of Computer Vision*, 87(1):140–155, 2010.
- [20] Navdeep Jaitly, Marcus A. Brubaker, John Rubinstein, and Ryan H. Lilien. A Bayesian Method for 3-D Macromolecular Structure Inference using Class Average Images from Single Particle Electron Microscopy. *Bioinformatics*, 26:2406–2415, 2010.
- [21] Marcus A. Brubaker, Leonid Sigal, and David J. Fleet. Video-based People Tracking. In H. Nakashima, H. Aghajan, and J.C. Augusto, editors, *Handbook on Ambient Intelligence and Smart Environments*. Springer Verlag, 2009.
- [22] Marcus A. Brubaker, Leonid Sigal, and David J. Fleet. Estimating Contact Dynamics. In *Proceedings of IEEE International Conference on Computer Vision*, 2009.
- [23] Marcus A. Brubaker and David J. Fleet. The Kneed Walker for Human Pose Tracking. In *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition*, 2008.
- [24] Marcus A. Brubaker, David J. Fleet, and Aaron Hertzmann. Physics-based person tracking using simplified lower-body dynamics. In *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition*, 2007.

CONTRIBUTIONS
WITHOUT
PROCEEDINGS

- [25] Ali Punjani, John Rubinstein, David J. Fleet, and Marcus A. Brubaker. New algorithms in cryoSPARC. In *Three Dimensional Electron Microscopy Gordon Research Conference*, June 2017.
- [26] Bob Carpenter, Matthew D. Hoffman, Marcus A. Brubaker, Daniel Lee, Michael Betancourt, Sebastian Weber, and Rob Trangucci. Algorithmic Differentiation in the Stan Math C++ Library. In *ADMB Developers Workshop*, June 2016.
- [27] Marcus A. Brubaker, Ali Punjani, and David J. Fleet. Efficient 3D Macromolecular Reconstruction with Electron Cryomicroscopy. In *BioImage Computing Workshop at IEEE Conference on Computer Vision and Pattern Recognition*, June 2015.
- [28] Ali Punjani and Marcus A. Brubaker. Microscopic Advances with Large-Scale Learning: Stochastic Optimization for Cryo-EM. In *Neural Information Processing Systems Workshop: Machine Learning in Computational Biology (MLCB)*, December 2014.
- [29] Ryan Lilien, Marcus A. Brubaker, and Todd Weller. Progress Towards a Novel 3D-Topography Imaging and Analysis System for Firearm Identification, TopMatch-GS, and Results of a Large-Scale Study. In *The Association of Firearm and Tool Mark Examiners Annual Training Seminar*, May 2014.
- [30] Ryan Lilien, Marcus A. Brubaker, and Todd Weller. Development of a 3D-Topography Imaging and Analysis System for Firearm Identification using GelSight and Feature Based Case Matching. In *The Association of Firearm and Tool Mark Examiners Annual Training Seminar*, June 2013.

- [31] Ryan Lilien, Marcus A. Brubaker, Todd Weller, and Micah Johnson. Three-Dimensional Topography System for Firearm Identification using GelSight. In *NIJ and FBI Impression and Pattern Evidence Symposium, Clearwater, Florida*, August 2012.
- [32] Marcus A. Brubaker, Ryan Lilien, Todd Weller, and Micah Johnson. Surface Topography Measurement using GelSight Elastomeric Sensor for Firearm Forensics. In *NIST Conference on Measurement Science and Standards in Forensic Firearms Analysis, Gaithersburg, Maryland*, July 2012.
- [33] Navdeep Jaitly, Marcus A. Brubaker, John Rubinstein, and Ryan Lilien. A Bayesian method for 3D reconstruction of macromolecular structure using class averages from single particle electron microscopy. In *Neural Information Processing Systems Workshop: Machine Learning in Computational Biology (MLCB)*, December 2009.
- [34] Marcus A. Brubaker, David J. Fleet, and Aaron Hertzmann. Physics-based Human Pose Tracking. In *Neural Information Processing Systems Workshop: Evaluation of Articulated Human Motion and Pose Estimation (EHuM)*, December 2006.

UNREVIEWED
CONTRIBUTIONS

- [35] Matthew Tesfaldet, Marcus A. Brubaker, and Konstantinos G. Derpanis. Two-stream convolutional networks for dynamic texture synthesis. *ArXiv e-prints*, cv.CV/1706.06982, June 2017.
- [36] Bob Carpenter, Matthew D. Hoffman, Marcus A. Brubaker, Daniel Lee, Peter Li, and Michael Betancourt. The Stan Math Library: Reverse-Mode Automatic Differentiation in C++. *ArXiv e-prints*, cs.MS/1509.07164, September 2015.
- [37] Ali Punjani and Marcus A. Brubaker. Microscopic Advances with Large-Scale Learning: Stochastic Optimization for Cryo-EM. *ArXiv e-prints*, stat.ML/1501.04656, January 2015.
- [38] Marcus A. Brubaker. *Physical Models of Human Motion for Estimation and Scene Analysis*. PhD thesis, University of Toronto, 2011.
- [39] Marcus A. Brubaker, Leonid Sigal, and David J. Fleet. Physics-based Human Motion Modelling for people tracking: A short tutorial. Tutorial at IEEE International Conference of Computer Vision, Kyoto, Japan, 2009.
- [40] Marcus A. Brubaker. Physics-based priors for human pose tracking. Master's thesis, University of Toronto, 2006.

TEACHING
AND
SUPERVISION

Students Supervised

- Yanshuai Cao (University of Toronto, with David J. Fleet and Aaron Hertzmann)
- Martin Hjelm (Toyota Technological Institute at Chicago, with Raquel Urtasun)
- Hubert Lin (University of Toronto)
- Micha Livne (University of Toronto, with David J. Fleet)
- Zhi Hao (Perry) Luo (University of Toronto/Columbia)
- Ali Punjani (University of Toronto/UC Berkeley, with David J. Fleet)
- Matthew Tesfaldet (York University, with Kosta Derpanis)
- Yali Wang (Toyota Technological Institute at Chicago, with Raquel Urtasun)
- Jianhua Zhao (University of Toronto, with John L. Rubinstein)
- Yadi Zhao (University of Toronto)

Teaching Experience

- Teaching at York University
 - ◇ EECS1710: Introduction to Programming for Digital Media (Fall 2016)
 - ◇ EECS4404/5327: Introduction to Machine Learning and Pattern Recognition (Winter 2017)
- Instructor at University of Toronto, Scarborough
 - ◇ CSCC11/D11: Machine Learning and Data Mining (2012 - 2015)
- Guest Lecturer at Toyota Technological Institute at Chicago
 - ◇ Graduate Course on Computer Vision (2013)

- Guest Lecturer at University of Toronto
 - ◇ CSC2431: Topics in Computational Biology: Computational Methods in Medicine (2014)
 - ◇ CSC2539: Topics in Computer Vision: Detection, Tracking and Analysis of People (2012)
- Teaching Assistant at University of Toronto
 - ◇ CSC320: Introduction to Visual Computing (2006 - 2010)
 - ◇ CSC2503: Foundations of Computer Vision (Graduate Course) (2007, 2010)
 - ◇ CSCD18: Computer Graphics (2004 - 2006)
 - ◇ CSC192: Computer Programming, Algorithms, Data Structures and Languages (2005)
 - ◇ CSC263: Data Structures and Analysis (2004)

SERVICE

Academic

- Associate Editor, *IET Computer Vision* (2016-)
- Program Committee: *IEEE Conference on Computer Vision and Pattern Recognition* (2009 - 2017), *IEEE International Conference on Computer Vision* (2009 - 2015), *Neural Information Processing Systems* (2011 - 2016), *European Conference on Computer Vision* (2010 - 2014), *Conference on Uncertainty in Artificial Intelligence* (2012 - 2014), *IEEE Workshop on Applications of Computer Vision* (2011), *IAPR International Conference on Pattern Recognition* (2008 - 2010, 2013)
- Reviewer: *SIGGRAPH* (2012 - 2014), *IEEE Transactions on Pattern Analysis and Machine Intelligence* (2014, 2017), *Elsevier Computer Vision and Image Understanding* (2014), *Springer International Journal of Computer Vision* (2008, 2014), *Journal of Machine Learning Research* (2012), *IEEE Transactions on Image Processing* (2011), *IEEE Transactions on Systems, Man, and Cybernetics Part A* (2011), *Eurographics* (2011), *IEEE International Conference on Robotics and Automation* (2011), *Elsevier Image and Vision Computing* (2009), *Elsevier Pattern Recognition Letters* (2005 - 2007)

Departmental and University

- Department of Computer Science, University of Toronto
 - ◇ Computer Vision Reading Group Founder and Organizer (2012 - 2016)
 - ◇ Departmental Computing Committee (2004 - 2011)
 - ◇ Graduate Student Representative, Annual Departmental Retreat (2006 - 2007)
 - ◇ M.Sc. Program Restructuring Committee (2005 - 2006)
 - ◇ Departmental Computing Transition Committee (2005 - 2006)
 - ◇ Graduate Student Representative for External Departmental Review (2005)
- University of Toronto
 - ◇ Graduate Education Council, School of Graduate Studies (2007 - 2009)
 - ◇ Committee on Student Matters, School of Graduate Studies (2008 - 2009)
 - ◇ Advisory Committee to the Provost for Appointment of Dean of Graduate Studies & Vice-Provost Graduate Education (2008 - 2009)
 - ◇ Working Group on Interdisciplinarity in Graduate Education, School of Graduate Studies (2008)
 - ◇ Committee on Program Matters, School of Graduate Studies (2007 - 2008)

PRESENTATIONS

Invited Talks

- *Algorithms for Reducing the Computational Burden of CryoEM*. Invited Semiminar at the Vollum Institute, Oregon Health and Science University, Portland, OR. December 2016.
- *Algorithms for Reducing the Computational Burden of CryoEM*. Invited Talk at Simons Electron Microscopy Workshop on Computational Methods for CryoEM, New York Structural Biology Center, New York, NY. Oct 2016.
- *Reducing the Burden of Computation for CryoEM*. Three Dimensional Electron Microscopy Gordon Research Conference, Hong Kong, China. Jun 2016.
- *Efficient 3D Molecular Structure Estimation with Electron Cryomicroscopy*. IEEE Toronto Section, Computer Chapter, Toronto, ON. Nov 2015.

- *Efficient 3D Molecular Structure Estimation with Electron Cryomicroscopy*. Invited Symposium at 12th Conference on Computer and Robot Vision, Halifax, NS. Jun 2015.
- *Lost! Leveraging the Crowd for Probabilistic Visual Self-Localization*. York University, Toronto, ON. Jan 2014.
- *Lost! Leveraging the Crowd for Probabilistic Visual Self-Localization*. IEEE Toronto Section, Computer Chapter, Toronto, ON. Sep 2013.
- *Physics in Human Motion Estimation and Scene Understanding*. University of Ontario Institute of Technology. Sep 2012.
- *Physics in Human Motion Estimation and Scene Understanding*. University of Toronto. Nov 2011.
- *Human Motion and Ground Contact from Video*. Carnegie Mellon University/Disney Research, Pittsburgh. May 2011.
- *Human Motion and Ground Contact from Video*. Bellairs Workshop on Computer Animation: GRAND Challenges, Animation and Geometry, Holetown, Barbados. Feb 2011.
- *Physics in Human Motion Estimation and Scene Understanding*. Toyota Technological Institute at Chicago. Jan 2011.
- *Physics in Human Motion Estimation and Scene Understanding*. Dartmouth College. Dec 2010.
- *Physics in Human Motion Estimation and Scene Understanding*. Boston University. Dec 2010.
- *Human Motion Estimation with Physics*. Trends in Computing, Department of Computer Science, University of Toronto, Jul 2010. (Runner up for Best Talk)
- *Estimating Contact Dynamics*. Canadian Institute for Advanced Research: Neural Computation & Adaptive Perception Summer School, Toronto, ON. Aug 2009.
- *Physics-Based Human Motion Understanding*. Rutgers University. Apr 2009.
- *Bayesian Density Estimation from Cryo-EM*. University of Toronto. Sep 2008.
- *Physics-Based Models for Human Pose Tracking*. Queens University. Apr 2008.
- *The Kneed Walker for Human Pose Tracking*. Canadian Institute for Advanced Research Workshop on Neural Computation and Adaptive Perception, Vancouver, BC. Dec 2007.
- *Physics-Based Person Tracking Using Simplified Lower-Body Dynamics*. Ecole Polytechnique Federale de Lausanne. Aug 2007.
- *Dynamical Priors for People Tracking*. Canadian Institute for Advanced Research: Neural Computation & Adaptive Perception Summer School, Toronto, ON. Aug 2006.

(Updated: June 22, 2017)