

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- Research Associate at Cadre Research Labs. http://cadresearch.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>
FUNDING AND AWARDS	Grants <ul style="list-style-type: none">• “<i>Applied Research, Development, and Method Validation of Toolmark Imaging, Virtual Casing 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 <ul style="list-style-type: none">• BioImage Computing Workshop at IEEE CVPR 2015<ul style="list-style-type: none">◇ Winner of Best Poster for [22]• IEEE Conference on Computer Vision and Pattern Recognition 2013<ul style="list-style-type: none">◇ Winner of Best Paper Runner-Up for [11]• Natural Science and Engineering Research Council 2012 - 2014<ul style="list-style-type: none">◇ 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] Marcus A. Brubaker, Andreas Geiger, and Raquel Urtasun. Map-based Probabilistic Visual Self-Localization. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2016.
- [2] 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.
- [3] 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.
- [4] 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.
- [5] 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 (to appear)*, 2016.
- [6] 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.
- [7] Jianhua Zhao, Marcus A. Brubaker, Samir Benlekbir, 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.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.
- [15] 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.

- [16] 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.
- [17] 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.
- [18] Marcus A. Brubaker, Leonid Sigal, and David J. Fleet. Estimating Contact Dynamics. In *Proceedings of IEEE International Conference on Computer Vision*, 2009.
- [19] 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.
- [20] 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

- [21] 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.
- [22] 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.
- [23] 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.
- [24] 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.
- [25] 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.
- [26] 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.
- [27] 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.
- [28] 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.
- [29] 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

- [30] 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.
- [31] 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.
- [32] Marcus A. Brubaker. *Physical Models of Human Motion for Estimation and Scene Analysis*. PhD thesis, University of Toronto, 2011.

- [33] 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.
- [34] 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)
- 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

- 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

- Program Committee: *IEEE Conference on Computer Vision and Pattern Recognition* (2009 - 2016), *IEEE International Conference on Computer Vision* (2009 - 2015), *Neural Information Processing Systems* (2011 - 2015), *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), *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), *Springer International Journal of Computer Vision* (2008, 2014), *Elsevier Pattern Recognition Letters* (2005 - 2007)

Departmental and University

- Department of Computer Science, University of Toronto
 - ◇ Computer Vision Reading Group Founder and Organizer (2012 -)
 - ◇ 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

- *Reducing the Burden of Computation for CryoEM*. Three Dimensional Electron Microscopy Gordon Research Conference, Hong Kong, China. June 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.

OTHER
EMPLOYMENT

Software Engineer (Alldata LLC, Peoria, IL)

1998 - 2002

Asst Network Admin (Washington Community High School, Washington, IL)

1998

(Updated: July 4, 2016)