

# Omar DeGuchy

Applied Mathematics  
School of Natural Sciences  
University of California, Merced  
5200 N. Lake Road  
Merced, CA 95343

Phone: +1 626 991 6017  
Email: odeguchy@ucmerced.edu  
<http://graduatestudents.ucmerced.edu/odeguchy/>

---

## RESEARCH INTERESTS

Large-Scale Numerical Optimization, Deep Learning, Numerical Signal Processing

## EDUCATION

- Expected Graduation: May 2020 University of California, Merced  
Ph.D in Applied Mathematics  
Advisor: Dr. Roummel F Marcia  
GPA: 3.787
- 2015 California Polytechnic University Pomona  
Masters of Science in Applied Mathematics  
Thesis: About Solutions of the Linear Complementarity Problem  
Advisor: Dr. Hubertus von Bremen
- 2006 California State University Long Beach  
Bachelors of Science in Business Management with an emphasis in Finance, Real Estate and Law

## SKILLS

- Programming: Proficient in: MATLAB, Bash, Python (NumPy, SciPy), Tensorflow, PyTorch  
Familiar with: R, HTML5
- Software: LaTeX, Vim text editor, MS office, Photoshop
- Languages: Native English speaker; conversational Spanish speaker with knowledge in French

## PROFESSIONAL EXPERIENCE

- August 2018 - Present: Graduate student assistant - The Math Center at UC Merced
  - Responsibilities include assisting students with current assignments and facilitating workshops designed to promote student success in mathematics.
- May 2018 - August 2018: Intern - Autonomy Technology Research (ATR) Center Summer Program
  - Collaborated with an Air Force Research Lab (AFRL) mentor as well as other students to solve challenging Air Force problems in sensing and autonomy technologies. Research topics included deep learning/machine learning, Generative Adversarial Networks (GANs), synthetic data generation, image formation and feature extraction.
- August 2015 - May 2018: Teaching Assistant - University of California, Merced
  - Duties include preparing short lectures to supplement material presented by the instructor of record, facilitating student participation in problem solving sessions and developing student assessment materials.

- September 2014 - June 2015: Student Assistant - California Polytecnic University, Pomona
  - Responsibilities include grading assignments and providing feedback to students enrolled in statistics, linear algebra and numerical analysis.
- July 2014 - August 2014 : Teaching Asisstant - 2014 CSU Alliance for PUMP Summer Program
  - Facilitated problem sessions. Clarified topics given during lecture. Graded assignments and provided feedback for students. Topics included real analysis and abstract linear algebra.

## PROFESSIONAL DEVELOPMENT AND OUTREACH

- August 2018 - Present: Grad Excel Program - Graduate student mentor for first year graduate students
- August 2018 - December 2018: Undergraduate research mentor
- August 2017 - Graduate student mentor - 2017 Descartes Scholar Program
- August 2017 - Graduate student assistant - 2017 Descartes Teacher Scholar Workshop

## PROJECT EXPERIENCE

- November 2017 - Learned Photon Limited Imaging: Reconstruction of Poisson Realizations using Artificial Neural Networks
  - Deep learning methods are implemented in Tensorflow to recover structured signals often arising in compressed sensing. Instead of relying on previous optimization algorithms, stacked denoising autoencoders and convolutional neural network architectures are used to reconstruct compressed signals imposed with Poisson noise. The proposed architectures are trained using the MNIST dataset and image classification is used to quantify the characteristics of each method.
- November 2016 - A Study of the Quadratic Penalty Method for Constrained Optimization
  - A series of analytic problems about the theory of the quadratic penalty method were solved. The method was implemented using MATLAB in conjunction with the steepest descent method and the Newton conjugate gradient method. The methods were tested on a variety of problems and the results were analyzed.

## PEER-REVIEWED PUBLICATIONS

- O.DeGuchy, A. Ho and R. Marcia, *Image disambiguation with deep neural networks*, Submitted, 2019.
- O. DeGuchy, R. Marcia, *Asynchronous parallel pattern search methods for parameter tuning in sparse signal reconstruction*, Submitted, 2019.
- O. DeGuchy, F. Santiago, M. Banuelos, and R. Marcia, *Deep neural networks for low-resolution photon-limited imaging*, Accepted, 2019.
- B. Lewis, O. DeGuchy, J. Sebastian and J. Kaminski, *Realistic SAR data augmentation using machine learning techniques*, Algorithms for Synthetic Aperture Radar Imagery XXVI, SPIE Defense + Commercial Sensing, 2019.
- J. Rafati, O. DeGuchy and R. Marcia, *Trust-region minimization algorithm for training responses (TRMinATR): The rise of machine learning techniques*, EUSIPCO, 2018.
- O. DeGuchy, L. Adhikari, A. Kim and R. Marcia, *Photon-limited fluorescence lifetime imaging microscopy signal recovery with known bounds*, IEEE CAMSAP, 2017.
- L. Adhikari, O. DeGuchy, J. Erway, S. Lockhart, and R. Marcia, *Limited-memory trust-region methods for sparse relaxation*, Wavelets and Sparsity XVII, SPIE Optical Engineering + Applications, 2017.

- L. Adhikari, R. Baikejiang, O.DeGuchy and R. Marcia, *Non-convex Shannon entropy for photon-limited imaging*, Wavelets and Sparsity XVII, SPIE Optical Engineering + Applications, 2017.
- O.DeGuchy, J.Erway, and R. Marcia, *Compact Representation of the Full Broyden Class of Quasi-Newton Updates*, Numerical Linear Algebra with Applications, 2017.

## AWARDS

- August 2018 - Best presentation at the 2018 Air Force Research Labs ATR Center Summer Internship Meeting
- August 2018 - Best documentation at the 2018 Air Force Research Labs ATR Center Summer Internship Meeting
- June 2018 - Tapia 2018 Scholarship to attend the 2018 ACM Richard Tapia Celebration of Diversity in Computing Conference
- March 2018 - Outstanding Poster Presentation Award at Latinx in the Mathematical Sciences Conference 2018 hosted by IPAM
- August 2017 - SACNAS Student Travel Award for SACNAS 2017
- Summer 2017 - UC Merced Applied Mathematics Summer Research Fellowship
- April 2017 - UC Merced Applied Mathematics Travel Fellowship

## SELECTED CONFERENCE PRESENTATIONS

- *Deep neural networks for compressed image reconstruction*, 2018 ACM Richard Tapia Celebration of Diversity in Computing Conference, Orlando, FL, September 20, 2018. Poster.
- *Trust-region minimization algorithm for training responses (TRMinATR): The rise of machine learning techniques*, The 26th European Signal Processing Conference (EUSIPCO 2018), Rome, Italy, September 06, 2018. Poster.
- *Deep Neural Networks for Low-resolution Photon-limited Imaging*, 2018 SIAM Annual Meeting (AN18), Portland, OR, July 10, 2018. Talk.
- *Photon-limited fluorescence lifetime imaging microscopy signal recovery with known bounds*, Latinx in the Mathematical Sciences Conference 2018 hosted by IPAM, Los Angeles, CA, March 8, 2018. Poster.
- *Non-convex Shannon Entropy for Photon-limited Imaging*, MAA General Contributed Paper Session on Applied Mathematics, II, Joint Mathematics Meeting, San Diego, CA, January 10, 2018. Talk.
- *Compact Representation of the Full Broyden Class of Quasi-Newton Updates*, SACNAS 2017, Salt Lake City, UT, October 20, 2017. Talk.
- *Limited-memory Trust-region Methods for Sparse Relaxation*, Wavelets and Sparsity XVII, SPIE Optical Engineering + Applications, San Diego, CA, August 6, 2017. Talk.
- *Non-convex Shannon Entropy for Photon-limited Imaging*, Wavelets and Sparsity XVII, SPIE Optical Engineering + Applications, San Diego, CA, August 6, 2017. Talk.
- *Non-convex Sparse Poisson Intensity Reconstruction for Time-Dependent Tomography*, 2017 SIAM Conference On Optimization, Vancouver, British Columbia, Canada, May 22 2017. Talk.
- *Compact Representation of the Full Broyden Class of Quasi-Newton Updates*, 2017 SIAM Conference On Optimization, Vancouver, British Columbia, Canada, May 22 2017. Poster.
- *Compact Representation of the Full Broyden Class of Quasi-Newton Updates*, National Labs Day at UC Merced, Merced, CA, October 21, 2016. Poster.

## **AFFILIATIONS**

- 2019 - Present: Founding member of Deep Learning Group at UC Merced
- 2018 - Present: Member of IEEE
- 2018 - Present: UC Merced Student Chapter Vice President
- 2017 - Present: Member of SPIE: International Society for Optics and Photonics
- 2017 - Present: Member of SACNAS
- 2015 - Present: Member of the Optimization Research Group at UC Merced
- 2013 - Present: Member of SIAM - UC Merced Student Chapter Vice President