

# LASITH ADHIKARI

3075, Park Ave, Apt 2, Merced, CA 95348, USA

Email: [ladhikari@ucmerced.edu](mailto:ladhikari@ucmerced.edu)

Phone: (209) 218-6821/ (209) 233-2903

LinkedIn/GitHub : lasiadhi

Web : <http://graduatestudent.ucmerced.edu/ladhikari/>

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## PROFILE

- 5 years of experience in optimization and computational imaging with more than 15 IEEE publications
- Pioneered 7 novel sparsity-promoting algorithms with applications to medical imaging and signal processing
- Possess strong analytical and problem solving skills and highly experienced in Matlab, Python, C++, and SQL
- A dynamic, hardworking and talented individual with good leadership and communication skills

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## EDUCATION

2012 - 2017	<b>Ph.D. in Applied Mathematics,</b> University of California, Merced, USA Dissertation: <b>Nonconvex Sparse Recovery Methods</b> Many real world applications such as astronomy, night vision, and medical imaging do not follow Gaussian noise statistics. However, they follow Poisson distribution. Accurate recovery of sparse signals from Poisson noise corrupted measurements is notoriously difficult due to the nonuniform nature of the noise. I developed and implemented 7 novel sparsity-promoting algorithms to solve inverse problems using nonconvex regularization techniques that led to more accurate and high strength reconstructions with the applications to medical imaging and signal processing. I published my research finding in more than 15 IEEE peer-reviewed papers.	GPA: 3.93
2006 - 2010	<b>B.Sc. (Special) in Mathematics,</b> University of Sri Jayewardenepura (USJ), Sri Lanka	GPA: 3.50
2005 - 2008	<b>B.Sc. (Hons) in Information Technology,</b> Sri Lanka Institute of Information Technology (SLIIT), Sri Lanka	GPA: 3.68
1996 - 2004	Ananda College, Colombo 10, Sri Lanka	

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## SKILLS

Programming:	Proficient in: <b>Python</b> (Pandas, NumPy, Scikit-Learn, SciPy, Matplotlib), <b>Matlab</b> , <b>C++</b> , Familiar with: C#.net., C, R, SPSS, Minitab, Java
Database:	Proficient in: <b>MySQL</b> . Familiar with: Oracle 10g, Microsoft Access
Software:	MS office, Latex, Photoshop, Lightroom, Illustrator

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## PROFESSIONAL EXPERIENCE

2017 - Present	<b>School of Natural Sciences Dean's Distinguished Scholar</b> at Applied Mathematics, UC Merced. Completing the dissertation and mentoring junior graduates on medical imaging.
2014 - 2016	<b>Graduate Student Researcher and Graduate Student Opportunity Fellow, UC Merced.</b> Researched on sparse recovery methods for the applications to medical imaging and signal/image processing. Implemented and published 7 novel optimization algorithms.
2016 Summer	<b>Industrial Mathematical and Statistical Modeling Workshop</b> at Statistical and Applied Mathematical Sciences Institute (SAMSI), NCSU, NC. Worked on a bathymetry estimation group project under the guidance of US Army Corps of Engineers.
2012 - 2015	<b>Teaching Assistant, UC Merced.</b> Taught Calculus 1, Probability and Statistics, Mathematical Methods for Optimization, Introduction to Linear Algebra & Differential Equations, Numerical Analysis I.

2011 - 2012	<b>Computer Technology Instructor</b> , Department of Mathematics, USJ, Sri Lanka. Taught: Computer programming (C++). Visiting lecturer to conduct mathematics lab session, Faculty of Medical Sciences, USJ, Sri Lanka.
2010 - 2011	<b>Instructor</b> , Department of Mathematics, USJ, Sri Lanka. Taught: Calculus I/II, Numerical Methods I/II, Abstract Algebra, Optimization 1, Applicable Mathematics
2009	<b>Internship</b> at Ansell Lanka (Pvt) Ltd., Sri Lanka: Performed a defect analysis to improve the quality of the glove manufacturing process. Identified major defects of gloves. Proposed corrective decisions to the management to improve the process quality.

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## PROJECT EXPERIENCE

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- **Implemented a nonconvex Poisson intensity recovery method using Matlab**
  - Enhanced sparsity and structure in the solution through p-norm ( $p < 1$ ) regularization
  - Demonstrated the proposed method eliminates the spurious artifacts found in LASSO-type method
- **Implemented a nonconvex total variation (TV) algorithm for non sparse images in Matlab**
  - Employed a weighted TV approach to bypass the nonconvexity
  - Reconstructed quality images from photon-limited observations compared to existing TV methods
- **Implemented a sparsity promoting algorithm using the Shannon entropy in Matlab**
  - Pioneered the nonconvex Shannon entropy regularization technique for accurate Poisson recovery
  - Improved computational efficiency by 4-times compared to the p-norm and LASSO-type methods
- **Designed and implemented nonconvex method to solve time-dependent tomography problems**
  - Implemented novel stage-based methods in Matlab to solve time-dependent bioluminescence tomography and fluorescence lifetime imaging problems
  - By exploiting the structure of the projection matrix, designed a scalable algorithm using forward and backward substitution techniques.
  - Validated the effectiveness of the inverse algorithm on large scale 2D imaging experiments.
- **Implemented a limited-memory trust-region method for sparse optimization in Matlab**
  - Innovated a novel transformation technique through a smooth approximation for the optimization problem
  - Optimized the nonconvex cost function using the trust-region method through BFGS Hessian approximation
  - Eliminated spurious artifacts with 200% computational time improvement compared to the state-of-the-art LASSO solvers
- **Recovered near shore bathymetry from surface wave properties**
  - Applied the linearized wave theory to estimate bathymetry near Duck, North Carolina from given measurements of surface wave properties collected by the U.S. Army
  - Developed a Matlab code to solve nonlinear inverse problem using the Tikhonov regularization
  - Utilized the Markov Chain Monte Carlo method to obtain a Bayesian estimation of bathymetry from posterior samples
- **Discrete image reconstruction using parallel beam geometry (Computed Tomography (CT))**
  - A course project at UC Berkeley: Developed a C++ software to reconstruct cross-sectional CT images
  - Implemented the filtered back-projection using OpenCV and FFTW packages
  - Experienced in SVN revision control system
- **Implemented an innovative apartment complex surveillance system**
  - An undergraduate capstone project at SLIIT: Developed a wireless hardware and software system to ensure the security of an apartment complex using C#.net and Oracle 9i
  - Designed user-friendly system interfaces of the monitoring application using Krypton Toolkit and used Ozeki NG SMS gateway to communicate with a GSM modem
  - Employed cost-effective wireless XBee transceivers to communicate data from/to sensor nodes
- **Implemented a face recognition system using Eigenfaces and Fisherfaces using C#.net and Matlab**
  - An undergraduate individual project at USJ: Developed and implemented feature-based and appearance-based faced recognition system using machine learning approaches
  - Projected digital images onto a "face space" using the principal component or/and linear discriminant tools
  - Recognized faces with 80% and 90% accuracy rates for feature-based and appearance based methods

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## AWARDS AND HONORS

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2017 January	SIAM Student <b>Travel Award</b> for SIAM Conference on Optimization
2016 November	<b>Dean's Distinguished Scholars Fellowship</b> 2017, UC Merced
2016 November	Open Data Science Conference (ODSC) West <b>Scholarship</b>
2016 October	Student <b>Travel Fellowship</b> , National Science Foundation, USA
2016 Summer	Summer <b>Research Fellowship</b> , Applied Mathematics, UC Merced
2016 April	<b>Artist of the Year</b> (Photography) – 2nd Place, Bobcat Art Show, UC Merced
2015 - 2016	<b>Graduate Student Opportunity Program Fellowship</b> , UC Merced
2015 - 2017	Research <b>Travel Fellowship</b> , Applied Mathematics, UC Merced
2011 December	<b>Fulbright Opportunity Grant Scholarship</b> , US - Sri Lanka Fulbright Commission
2005 - 2009	<b>Five scholarships</b> in recognition of superior academic performance during B.Sc. in IT
2001	Grade 11 <b>Electronics Subject Prize</b> , Ananda College

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## MISCELLANEOUS EXPERIENCE

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- **Communication:** Gave more than 20 presentations to disseminate research findings all around the world: Washington D.C., Monterey, Merced, Phoenix, Tokyo, Shanghai, Quebec City, Nice, Pittsburgh, New Orleans.
  - **Group Studies:** Participating and leading the Statistical Learning Group at Applied Math, UC Merced.
  - **Leadership:** Mentored participants in sparse optimization/medical imaging for the Research Experience for Undergraduates (REU) ARCHIMEDES program at UC Merced, Summer, 2014 and 2016. Led Bathymetry Group at the modeling workshop at NCSU.
  - **Collaboration:** Collaborate with leading scientist on cutting edge research techniques: Prof. Arnold Kim, Prof. Changqing Li, Prof. Jennifer Erway, Prof. Robert Plemmons, Prof. Suzanne Sindi, and Dr. Fei Wen.
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## CERTIFICATION

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- Neural Networks for Machine Learning by University of Toronto on Coursera. Certificate earned on 2017.
  - PC Hardware, Department of Computer Science & Engineering, University of Moratuwa, Sri Lanka, 2004.
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## PEER-REVIEWED PUBLICATIONS

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1. **L. Adhikari** and R. Marcia, *Nonconvex relaxation for Poisson intensity reconstruction*, Proceedings of the 2015 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2015.
2. **L. Adhikari** and R. Marcia, *p-th power total variation regularization in photon-limited imaging via iterative reweighting*, Proceedings of 2015 European Signal Processing Conference (EUSIPCO), 2015.
3. **L. Adhikari**, D. Zhu, C. Li, and R. Marcia, *Nonconvex reconstruction for low-dimensional fluorescence molecular tomographic Poisson observations*, Proceedings of the 2015 IEEE International Conference on Image Processing (ICIP), 2015.
4. A. Orkusyan, **L. Adhikari**, J. Valenzuela, and R. Marcia, *Analysis of p-norm regularized subproblem minimization for sparse photon-limited image recovery*, Proceedings of 2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2016.
5. M. Banuelos, R. Almanza, **L. Adhikari**, S. Sindi, and R. Marcia, *Sparse signal recovery methods for variant detection in next-generation sequencing data*, Proceedings of 2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2016.
6. **L. Adhikari**, A. Kim and R. Marcia, *Sparse reconstruction for fluorescence lifetime imaging microscopy with Poisson noise*, Proceedings of the IEEE Global Conf. on Signal and Information Processing (GlobalSIP), 2016.

7. **L. Adhikari**, A. Kim and R. Marcia, *Nonconvex sparse Poisson intensity reconstruction for time-dependent bioluminescence tomography*, Proceedings of the 2016 International Symposium on Information Theory and Its Applications (ISITA), 2016.
8. M. Banuelos, R. Almanza, **L. Adhikari**, R. Marcia and S. Sindi, *Sparse genomic structural variant detection: exploiting parent-child relatedness for signal recovery*, Proceedings of the 2016 IEEE Workshop on Statistical Signal Processing (SSP), 2016.
9. **L. Adhikari** and R. Marcia, *Bounded sparse photon-limited image recovery*, Proceedings of 2016 IEEE International Conference on Image Processing (ICIP), 2016.
10. M. Banuelos, R. Almanza, **L. Adhikari**, R. Marcia, and S. Sindi, *Constrained variant detection with SPaRC: Sparsity, Parental Relatedness, and Coverage*, Proceedings of International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2016.
11. **L. Adhikari**, J. B. Erway, R. Marcia and R. J. Plemmons, *Trust-region methods for nonconvex sparse recovery optimization*, Proceedings of the 2016 Inter. Symposium on Info. Theory and Its Apps (ISITA), 2016.
12. M. Banuelos, **L. Adhikari**, A. Fujikawa, J. Sahagun, K.Sanderson, M. Spence, R. Almanza, S. Sindi, and R. Marcia, *Nonconvex regularization for sparse genomic variant signal detection*, Accepted to 2017 IEEE International Symposium on Medical Measurements and Applications (MeMeA), 2017.
13. M. Banuelos, **L. Adhikari**, A. Fujikawa, J. Sahagun, K.Sanderson, M. Spence, R. Almanza, S. Sindi, and R. Marcia, *Sparse diploid spatial biosignal recovery for genomic variation detection*, Accepted to 2017 IEEE International Symposium on Medical Measurements and Applications (MeMeA), 2017.
14. **L. Adhikari** and R. Marcia, *Non-convex sparse optimization for photon-limited imaging*, Proceedings of M.Sc./Ph.D. Forum in the 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2017.
15. M. Banuelos, R. Almanza, **L. Adhikari**, S. Sindi, and R. Marcia, *Biomedical signal recovery: Genomic variant detection in family lineages*, Accepted to 2017 IEEE 5th Portuguese Meeting on Bioengineering, 2017.
16. F. Wen, **L. Adhikari**, P. Liu, R. Marcia and W. Yu, *Recovery and demixing of sparse signals using nonconvex regularization*, Submitted, 2017.
17. **L. Adhikari**, J. Erway, S. Lockhart, and R. Marcia, *Limited memory trust-region methods for sparse relaxation*, Submitted, 2017.
18. **L. Adhikari** and R. Marcia, *Non-convex Shannon entropy for photon-limited imaging*, Submitted, 2017.

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## REFERENCES

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- Dr. Roummel F. Marcia <rmarcia@ucmerced.edu>, Applied Mathematics, UC Merced, Merced, CA 95343.
- Dr. Arnold D. Kim <adkim@ucmerced.edu>, Applied Mathematics, UC Merced, Merced, CA 95343.
- Dr. Lea Jenkins <lea@clemson.edu>, Dept. of Mathematical Sciences, Clemson University, SC 29634.
- Dr. Changqing Li <cli32@ucmerced.edu>, School of Engineering, UC Merced, Merced, CA 95343.