

## Anirban Chakraborty

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CONTACT INFORMATION	Assistant Professor Dept. of Computational and Data Sciences Indian Institute of Science, Bangalore 560012	Office: CDS 316 Phone: +91-9073108710 Email: anirban@cds.iisc.ac.in
RESEARCH INTERESTS	Visual analytics, Data association over graphs, Data fusion and consistency, Applications of computer vision and machine learning in bio-medical image analysis, video surveillance.	
EDUCATION	<b>University of California, Riverside, CA, USA</b>	
	Ph.D., Electrical Engineering	August 2014
	<ul style="list-style-type: none"><li>• Thesis Title: <i>Exploration of Contextual Relationships for Robust Video Analysis: Applications in Camera Networks, Bio-image Analysis and Activity Forecasting.</i></li><li>• Advisor: Dr. Amit K. Roy-Chowdhury</li></ul>	
	M.S., Electrical Engineering,	December 2010
	<ul style="list-style-type: none"><li>• Specialization: <i>Intelligent Systems</i></li></ul>	
	<b>Jadavpur University, Kolkata, India</b>	
	B.E., Electrical Engineering	June 2007
RESEARCH AND WORK EXPERIENCES	<b>Assistant Professor</b>	Jun 2017 to Present
	Department of Computational and Data Sciences (CDS) Indian Institute of Science, Bangalore, India	
	<b>Researcher</b>	Dec 2016 to Present
	Research and Technology Center (RTC), India Robert Bosch Corporate Research Bangalore, India	
	<ul style="list-style-type: none"><li>• As a researcher in the computer vision group at Robert Bosch RTC India, my primary responsibilities were to explore visual analytics problems in relation to Bosch products and business units including automotive, health care, consumer electronics and IoT platforms, to provide innovative solutions and to develop prototypes that can be further translated and integrated into Bosch products/solutions.</li></ul>	
	<b>Research Fellow</b>	Nov 2015 to Dec 2016
	Rapid-Rich Object Search (ROSE) Lab School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore Supervisors: Dr. Dennis Sng, Dr. Junsong Yuan	
	<ul style="list-style-type: none"><li>• Involved in developing deployable computer vision systems for large scale multi-camera video surveillance in collaboration with industrial partners. Research and development problems include person re-identification in real-world camera networks, multi-camera object detection and tracking in crowded scenes, fast anomaly detection and activity forecasting from streaming video data etc.</li></ul>	
	<b>Post-doctoral Research Fellow</b>	Oct 2014 to Nov 2015
	Clinical Imaging Research Centre Department of Diagnostic Radiology, National University of Singapore Supervisors: Dr. David Townsend and Dr. John Totman	

- Developed automated image analysis pipeline for segmentation and estimation of trabecular bone volume fraction from MR and micro-CT images. Also established an automated pipeline to quantify adipose tissue from whole body VIBE Dixon MRI.

#### Graduate Student Researcher

Sep 2009 to Aug 2014

Department of Electrical and Computer Engineering,  
University of California, Riverside  
Supervisor: Dr. Amit K. Roy-Chowdhury

- Introduced the idea of network consistency to data association problems and proposed a rigorous mathematical framework. Showed its application in problems such as person re-identification, spatio-temporal tracking of biological cells etc.
- Developed a novel image analysis pipeline for high throughput analysis of (3D+t) confocal image stacks of plant meristems. Made fundamental contributions to all components of such a pipeline, viz. image registration, segmentation, spatio-temporal cell tracking and cell resolution 3D reconstruction.
- Investigated the effect of spatio-temporal interrelationships between objects, actions and scene in relation to the human activity recognition and forecasting problems.

#### Visiting Student Researcher

Jun 2012 to Sep 2012

Janelia Farm Research Campus,  
Howard Hughes Medical Institute  
Supervisor: Dr. Dmitri M. Chklovskii

- Worked in the ‘Fly EM’ project that aimed to reconstruct the entire *Drosophila* nervous system from EM image stacks. Developed novel techniques for improving the performance of agglomerative segmentation algorithms and contributed to the software library (GALA) containing the automated segmentation pipeline.

#### Assistant Systems Engineer - Trainee

Sep 2007 to Jul 2008

Tata Consultancy Services

- Implemented numerous database objects (in pL/SQL) for an Oracle 10g database as a part of a system-development project.

#### Undergraduate Research

Jul 2006 to Jun 2007

Jadavpur University

- Designed a system identification method to recognize different single phase converter classes using cross-correlation features of output voltage and current waveforms.

REFEREED  
JOURNAL  
PUBLICATIONS

1. **A. Chakraborty**, B. Mandal, J. Yuan, “Person Re-identification Using Multiple Egocentric Views”, *IEEE Transactions on Circuits and Systems for Video Technology* (2017) 27(3):484-498.
2. K. Mkrtchyan, **A. Chakraborty**, A. K. Roy-Chowdhury, ‘Optimal Landmark Selection for Registration of 4D Confocal Image Stacks in Arabidopsis’, *IEEE/ACM Transactions on Computational Biology and Bioinformatics* (2017) 14(2):457-467.
3. **A. Chakraborty**, A. Das, A. K. Roy-Chowdhury, “Network Consistent Data Association”, *IEEE Transactions on Pattern Analysis and Machine Intelligence* (2016) 38(9):1859-1871.
4. **A. Chakraborty**, A. K. Roy-Chowdhury, “Context Aware Spatio-temporal Cell Tracking In Densely Packed Multilayer Tissues”, *Medical Image Analysis* (2015) 19(1):149-163.

5. T. Parag, **A. Chakraborty**, S. Plaza, L. Scheffer, “A Context-Aware Delayed Agglomeration Framework for Electron Microscopy Segmentation”, *PLoS ONE* (2015) 10(5): e0125825.
6. J. Nunez-Iglesias, R. Kennedy, S. M. Plaza, **A. Chakraborty**, W. T. Katz, “Graph-based Active Learning of Agglomeration (GALA): a Python library to segment 2D and 3D neuroimages”, *Frontiers in Neuroinformatics* (2014) 8(00034).
7. **A. Chakraborty**, M. M. Perales, G. V. Reddy, A. K. Roy-Chowdhury, “Adaptive Geometric Tessellation for 3D Reconstruction of Anisotropically Developing Cells in Multilayer Tissues from Sparse Volumetric Microscopy Images”, *PLoS ONE* (2013) 8(8): e67202.
8. M. Liu\*, **A. Chakraborty\***, D. Singh, M. Gopi, R. Yadav, G.V. Reddy, A. K. Roy-Chowdhury, “Adaptive Cell Segmentation and Tracking for Volumetric Confocal Microscopy Images of A Developing Plant Meristem”, *Molecular Plant* (2011) 4(5): 922-931 (\***Jointly first authored**).

SELECTED  
CONFERENCE  
PUBLICATIONS

1. **A. Chakraborty**, B. Mandal, H. K. Galoogahi, “ Person Re-identification Using Multiple First-Person-Views on Wearable Devices”, *Winter Conference on Applications of Computer Vision (WACV)*, 2016.
2. T. Mahmud, M. Hasan, **A. Chakraborty**, A. K. Roy-Chowdhury, “ A Poisson Process Model for Activity Forecasting”, *International Conference on Image Processing (ICIP)*, 2016.
3. A. Das\*, **A. Chakraborty\***, A. K. Roy-Chowdhury, “Consistent Re-identification in a Camera Network”, *European Conference on Computer Vision (ECCV)*, 2014 (\***Jointly first-authored**).
4. **A. Chakraborty**, A. K. Roy-Chowdhury, “Context-Aware Activity Forecasting”, *Asian Conference on Computer Vision (ACCV)*, 2014.
5. **A. Chakraborty**, A. K. Roy-Chowdhury, “A Conditional Random Field Model For Tracking In Densely Packed Cell Structures”, *IEEE International Conference on Image Processing (ICIP)*, 2014.
6. K. Mkrtychyan, **A. Chakraborty**, A. K. Roy-Chowdhury, “Automated registration of live imaging stacks of Arabidopsis”, *International Symposium on Biomedical Imaging (ISBI)*, 2013.
7. **A. Chakraborty**, R. Yadav, G. V. Reddy, A. K. Roy-Chowdhury, “Cell Resolution 3D Reconstruction of Developing Multilayer Tissues from Sparsely Sampled Volumetric Microscopy Images”, *International Conference on Bioinformatics and Biomedicine (BIBM)*, 2011.
8. **A. Chakraborty**, M. Liu, K. Mkrtychyan, G. V. Reddy, A. K. Roy-Chowdhury, “Cell Volume Estimation From A Sparse Collection of Noisy Confocal Image Slices”, *Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP)*, 2010.

BOOK CHAPTERS

1. K. Mkrtychyan, **A. Chakraborty**, M. Liu, A. Roy-Chowdhury, “Automatic Image Analysis Pipeline for Studying Growth in Arabidopsis”, *Video Bioinformatics*, vol. 22, pp. 215-236, Springer International Publishing, 2015.
2. **A. Chakraborty**, R. Yadav, M. Liu, M. Tataw, K. Mkrtychyan, A.K. Roy Chowdhury, G. V. Reddy, “Computational Tools For Quantitative Analysis of Cell Growth Patterns And Morphogenesis in Actively Developing Plant Stem Cell Niches”, *Plant Signalling Networks: Methods and Protocols*, 2012.

TALKS	<p>Center for Plant Cell Biology Award Symposium, UC Riverside <span style="float: right;">Dec 2013</span>  <i>An Automated Image Analysis Pipeline for Studying Growth in Arabidopsis</i></p> <p>Center for Plant Cell Biology, UC Riverside <span style="float: right;">Jul 2011</span>  <i>An Automated Computational Framework For Cell Resolution 3D Reconstruction of SAM From Arabidopsis Live-Imaging Dataset</i></p> <p>Bioimage Informatics, Carnegie Mellon University <span style="float: right;">Sep 2010</span>  <i>Cell Volume Estimation From A Sparse Collection of Noisy Slices</i></p>
SOFTWARES	<p><b>NCDA:</b> Network-Consistent Data Association.  <i>Software for enforcing consistency when data association is done over a large graph.</i></p> <p>Spatio-temporal cell tracker.  <i>Software implementation of our context-aware tracker for finding spatio-temporal correspondences between 2D cell slices in CLSM imaged dense multilayer tissues.</i></p> <p><b>AQVT:</b> Adaptive Quadratic Voronoi Tessellation.  <i>Implementation of our adaptive quadratic tessellation along with a demo on cell resolution 3D reconstruction of a sample cluster of Arabidopsis shoot meristem cells.</i></p>
AWARDS AND ACHIEVEMENTS	<p>Dean's distinguished fellowship, UC Riverside.</p> <p>'Tech talk award' for best technical presentation in CEPCEB symposium, UC Riverside (Dec 2013).</p> <p>IEEE BIBM travel award, 2011.</p> <p>Certificate of merit for securing 35<sup>th</sup> rank among around 4,50,000 students in Higher Secondary Examination, West Bengal, India.</p>
TEACHING EXPERIENCE	<p>Teaching Assistant <span style="float: right;">Fall 2013</span>  EE 215 - Stochastic Processes  Instructor: Ertem Tuncel  Electrical Engineering, UC Riverside</p>
PROFESSIONAL SERVICE	<p>Reviewer  <i>Nature Scientific Reports, IEEE Transactions on Image Processing, IEEE/ACM Transactions on Computational Biology and Bioinformatics, Pattern Recognition Letters, Computer Vision and Image Understanding, International Conference on Computer Vision (ICCV), International Conference on Image Processing (ICIP).</i></p>
REFERENCES	<p>Available upon request.</p>