Suvadip Mukherjee

Postdoctoral scientist,
Bioimage Analysis Unit
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Professional Profile

I am a research professional trained in multidimensional data analytics, with an emphasis on image analytics for biological and biomedical applications. Presently, I am a researcher at the Bioimage Analysis Laboratory at Institut Pasteur, Paris led by Prof. Jean-Christophe Olivo-Marin. Previously, I was employed as a Lead Scientist in the Artificial Intelligence Image Analytics (AIIA) group at GE Global Research, Bangalore, where I led a team of data scientists for developing image analytics and machine learning solutions for different ultrasound imaging applications. My broad research interests include image and data analytics, computer vision, and machine/deep learning. Specific interests include image segmentation, statistical pattern analysis, bio-image informatics, and deep learning for medical image processing.

Skills & Abilities

More than ten years of experience in image analysis, computer vision, machine learning, deep learning both in academia and research industry. Experienced in developing novel technologies, publishing peer-reviewed research articles and mentoring graduate students. Led a team of scientists to conceptualize, develop and deploy the first AI enabled solution for GE Healthcare [More details]. Presently working on statistical pattern analysis problems and deep learning applications in bioimage informatics and computer vision.

Experience

Research Associate — Institut Pasteur, Paris, France   *Nov. 2018 — present*
Responsible for designing and implementing solutions for bio-image informatics using applied computer vision and machine learning

Lead Scientist — General Electric Global Research, Bangalore, India   *2015 — 2018*
Designed image processing and machine learning algorithms for medical imaging problems in computed tomography (CT), ultra- sound, and digital microscopy. Presently leading a team of scientists and engineers for AI projects in ultrasound image analytics for obstetrics and gynecological applications.

Research Assistant — University of Virginia, Charlottesville, USA   *2011 — 2015*
Designed image analytics and computer vision algorithms with an emphasis on biomedical and biological applications. Recipient of the prestigious Charles E. Brown scholarship for academic excellence during the third year of the PhD program

Engineer — Siemens Ltd., India   *2008 — 2009*
Involved in providing industrial automation solutions for steel industries in India.

Education

Doctor of Philosophy (Electrical Engineering)
2011-2015

Advisor: Dr. Scott T. Acton
Virginia Image and Video Analysis Lab
Charles L. Brown Department of Electrical and Computer Engineering
University of Virginia, Charlottesville, VA, USA

M.S. (Computer Science)
2009-2011

Advisor: Dr. Bhabatosh Chanda
Electronics and Communication Sciences Department
Indian Statistical Institute, Kolkata, India

B.S. (Electrical Engineering)
2004-2008

Department of Electrical Engineering
Jadavpur University, Kolkata, India

Programming skills

o Programming Languages: *Python, C/C++, Matlab, Java*
o Scientific platforms: *OpenCV, ITK, PyTorch, Keras, ICY*

Awards and Honors

o Spotlight Award for developing the first AI based application for 3D fetal ultrasound
General Electric Company, 2018

o Nomination for GE Crotonville's *Early Career Leadership* training
General Electric Company, 2018

o Charles L. Brown Graduate scholarship for academic excellence
University of Virgina, 2012

o TCS innovation award for best M.S. dissertation
Indian Statistical Institute, 2011

o Gold medal for scholarship in M.S. curriculum
Indian Statistical Institute, 2011

Invited talks

o "New frontiers in bio-image informatics", Indian Statistical Institute, Kolkata, October 2019.
o "Artificial intelligence in biomedical imaging", PES Institute of Technology, Bangalore, India, 2018
o "Chasing the neurome: Segmentation and comparison of neurons" in *European Signal Processing Conference* (EUSIPCO), 2013, Marrakech, Morocco

Patent applications

1. <u>Mukherjee, Suvadip</u>, Lagache, Thibault, and Olivo-Marin, Jean-Christophe. "Method for detecting spatial coupling", US Patent Application, filed June, 2020.
2. <u>Mukherjee, Suvadip</u>, Gogna, Annupriya, V. Rahul, and Anzengruber, Stephan. "System and method for determining condition of fetal nervous system", US Patent Application, published, October, 2020.
3. <u>Mukherjee, Suvadip</u>, Roshni Bhagalia, and Xiaojie Huang. "Automated segmentation using deep learned priors." U.S. Patent.
4. Perrey, Christian Fritz, <u>Suvadip Mukherjee</u>, Nitin Singhal, and Rakesh Mullick. "Methods and systems for ultrasound imaging." U.S. Patent Application 15/258,099, filed February 15, 2018.
5. Singhal, Nitin, <u>Mukherjee, Suvadip</u>, and Krishnan, Kajoli. "System and method for measuring one or more entities in a reproductive organ", Indian Patent Application, published 11/05/2018.

Publications [Journals]

1. S. Mukherjee, T. Lagache, and J-C. Olivo-Marin, "Evaluating the Stability of Spatial Keypoints via Cluster Core Correspondence Index", *IEEE Transactions on Image Processing (accepted, in press)*
2. S. Mukherjee, C. Gonzalez, L. Danglot, T. Lagache, and J.-C. Olivo-Marin, "Generalizing the Statistical Analysis of Objects' Spatial Coupling in Bioimaging", *IEEE Signal Processing Letters*, vol. 27, pp. 1085-1089, 2020, doi: 10.1109/LSP.2020.3003821.
3. S. Mukherjee, B. Condron and S.T. Acton, "Tubularity Flow Field A Technique For Automatic Neuron Segmentation," *IEEE Transactions on Image Processing*, vol.24, no.1, pp.374,389, Jan. 2015
4. S. Mukherjee and S.T. Acton, "Region Based Segmentation in Presence of Intensity Inhomogeneity Using Legendre Polynomials," *IEEE Signal Processing Letters*, vol.22, no.3, pp.298,302, March 2015
5. R. Sarkar, S. Mukherjee and S.T. Acton, "Dictionary Learning Level Set," *IEEE Signal Processing Letters*, vol.22, no.11, pp.2034,2038, Nov. 2015
6. Slepian, Zoe, et al. "Visual attraction in Drosophila larvae develops during a critical period and is modulated by crowding conditions." *Journal of Comparative Physiology A* 201.10 (2015): 1019-1027.
7. S. Mukherjee, T. Lagache., J. Olivo-Marin, "Generalized Statistical Object Distance Analysis", *in preparation*, to be submitted to *IEEE Transactions on PAMI*
8. S. Mukherjee, R. Sarkar, E. Labruyere, "Deep multi-task learning with unsupervised domain adaption for fluorescent microscopy", *in preparation*, to be submitted to *IEEE Transactions on Medical Imaging*

Publications [Peer reviewed conferences]

1. S. Mukherjee, R. Sarkar, E. Labruyere and J.-C. Olivo-Marin, "A Min-Max Based Hyperparameter Estimation for Domain-Adapted Segmentation of Amoeboid Cells" *submitted* to *IEEE ISBI, 2021*
2. S. Mukherjee, S. Jain, L. Danglot, and J.-C. Olivo-Marin "Morphological Reconstruction of Detached Dendritic Spines via Geodesic Path Prediction", *submitted* to *IEEE ISBI 2021*.
3. S. Kubler, S. Mukherjee, T. Lagache, and J. Olivo-Marin, "A Robust and Versatile Framework To Compare Spike Detection Methods in Calcium Imaging of Neuronal Activity" *submitted* to *IEEE ISBI 2021*.
4. R. Sarkar, S.Mukherjee, E. Labruyere, and J.-C. Olivo-Marin. "Learning to Segment Clustered Amoeboid Cells from Brightfield Microscopy via Multi-Task Learning with Adaptive Weight Selection", *ICPR 2020 (accepted)*
5. S. Mukherjee, X. Huang, and R. R. Bhagalia. "Lung nodule segmentation using deep learned prior based graph cut." *IEEE ISBI* 2017
6. Singhal, Nitin, Suvadip Mukherjee, and Christian Perrey. "Automated assessment of endometrium from transvaginal ultrasound using Deep Learned Snake." *IEEE ISBI* 2017
7. S. Mukherjee and S.T. Acton, "Oriented filters for vessel contrast enhancement with local directional evidence." *IEEE ISBI*, 2015.
8. M. Consylman, S. Mukherjee, D.P. Mukherjee, B. Condron and Scott T. Acton, "Social behavior analysis of Drosophila larvae via motion activity recognition", *IEEE SSIAI* 2014.
9. S. Mukherjee et al. "Neuron segmentation with level sets", *ACSSC* 2013:1078-1082
10. R. Sarkar, S. Mukherjee and S. T. Acton, "Shape descriptors based on compressed sensing with application to neuron matching", *ACSSC* 2013: 970-974
11. S. Mukherjee and S. T. Acton, "Vector field convolution medialness applied to neuron tracing," *IEEE ICIP* 2013: 665-669
12. S. Mukherjee, B. Condron and S. T. Acton, "Chasing the neurome: Segmentation and comparison of neurons," *EUSIPCO* 2013: 1-4
13. S. Mukherjee et al., "Tree2Tree2: Neuron tracing in 3D," *IEEE ISBI* 2013: 448-451
14. S. Mukherjee et al. "A geometric-statistical approach toward neuron matching", *IEEE ISBI* 2012: 772-775.
15. S. Mukherjee and B. Chanda. "A Robust Human Iris Verification Using a Novel Combination of Features." *NCVPRIPG*, 2011.
16. S. Mukherjee, et al. "Tracking sunflower circumnutation using affine parametric active contours." *IEEE SSIAI*, 2014.

Mentoring activities and outreach

o **[05/2019-08/2019]** Volunteered as a tutor for the Amgen Scholar Mentorship Program at Institut Pasteur. Tutored Ms. Catalina Gonzalez (Amgen scholar from Colombia, currently pursuing graduate degree from Sorbonne University), to develop a Java-based plugin in ICY to estimate molecular colocalization in microscopy. This work was published in IEEE Signal Processing Letter.

- o **[01/2019-04/2019]** Tutored Mr. Sammit Jain (from India, graduate student at BITS Goa) during his internship to develop an algorithm for dendritic spine analysis from two photon microscopy. This work was published in IEEE ISBI.
- o **[2018-]** Regularly involved in mentoring domestic and international graduate students (from China, Algeria, and France) for the M.S. thesis project. Worked with the mentees to define research problems, brainstorm technical innovation, and assist with preparing technical manuscripts.
- o **[2017-18]** Co-organized a four-week course on "Introduction to AI and deep learning" for non-computational engineers at General Electric. This course was developed to enable non-experts in the field to gain working expertise in AI and machine learning.

Professional activities

- o **Member of technical committee**, Indian Conference on Vision, Graphics, and Image Processing, 2016, Mandi, India
- o **Invited session chair,** 9th International Conference on Advances in Pattern Recognition (ICAPR), 2017, Bangalore, India
- o **Reviewer of technical articles** for *IEEE Transactions on Image Processing, IEEE Transactions on Medical Imaging, IEEE Signal Processing Letters, IEEE Transactions on Circuits, Systems and Video, Nature Computational Science, Medical Image Analysis, IEEE International Conference on Image Processing (ICIP), IEEE International Symposium on Biomedical Imaging (ISBI)*

References

Dr. Scott T. Acton
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USA
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Dr. Jean-Christophe Olivo-Marin
Professor and Head
BioImage Analysis Unit,
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Dr. Dipti Prasad Mukherjee
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