Shivesh Chaudhary

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EDUCATION

Georgia Institute of Technology, Atlanta, USA
Graduate Research Assistant, Chemical Engineering, Jan 2016 - current
CGPA: 3.54/4.0

Indian Institute of Technology (IIT), Kanpur, India
Master of Technology, Chemical Engineering, July 2008 - May 2013
CGPA: 10.0/10.0 (Rank 1/12)

Indian Institute of Technology (IIT), Kanpur, India
Bachelor of Technology, Chemical Engineering, July 2008 - May 2013
CGPA: 8.6/10.0 (Rank 5/53)

RESEARCH EXPERIENCE

Graduate Research Assistant Jan 2016 - current
Computer vision tools for high-throughput processing of *C. elegans* whole-brain calcium recording datasets
Advisor: Prof. Hang Lu, Georgia Institute of Technology

- **CRF_Cell_ID** - a Conditional Random Fields based structured prediction method for automatic annotation of biological names of neurons in dense fluorescent neuron activity recordings. [paper], [code]
- **Deep_Denoising** - a deep learning based image denoiser that can extract high quality neuron activity signal from noisy videos enabling longer timescale, faster, and benign imaging conditions. [code coming soon], [slides]
- **JR_CRF_Track** - a cell tracking method for automatically tracking nuclei in non-rigid brain. The method combined Joint Point-Cloud Registration with Conditional Random Fields based labelling to improve correspondence estimation and registration across multiple point-clouds simultaneously. [paper]
- **WB_CellSeg** - a cell segmentation framework combining MaskRCNN instance segmentation with optimal transport based clustering for fast and accurate segmentation of dense nuclei in fluorescent images. [code coming soon], [poster]
- **CellTrack_Opt** - a framework to compare cell tracking methods in fluorescent images across 6 accuracy metrics using real or synthetic data. Provides baseline implementation for 21 methods (7 registration based and 14 graph-matching based) across 3 different track linking strategies. [poster]
- **Microfluidics** - Developed and used microfluidic devices to collect fluorescent microscopy data. Applied precise chemosensory and mechanosensory stimulation using microfluidics to determine how sensory stimulus is encoded in *C. elegans* brain. Correlated behavioral data to whole-brain neuron activity data.

Skills - Python, MATLAB, TensorFlow, Github, Machine Learning, Deep Learning, Cluster Computing, Pandas, Scikit-Learn, Jupyter, Probabilistic Graphical Models, Image Processing, Signal Processing, Convex Optimization, Confocal Microscopy, Microfluidics automation, Transgenics, *C. elegans* neurobiology and genetics, behavior recording, PCR, Cell Segmentation, Cell Tracking, Image denoising, Image registration

Masters Thesis May 2012 - June 2013
Comprehensive modelling of water permeation across proton exchange membrane fuel

cells as well as effects of inclusion of electro-osmotic pump
Advisor: Prof P. K. Bhattacharya, IIT Kanpur

- Developed a comprehensive 2-D, two phase, non-isothermal and transient model of PEM fuel cells using COMSOL Multiphysics and modelled two approaches of water uptake by membrane which account for Schroeder's Paradox. [paper]

Skills - MATLAB, COMSOL Multiphysics, Numerical methods and simulation, Fluid Mechanics, Mass Transfer, Heat transfer, Catalysis

JOURNAL PUBLICATIONS

1. Hyun Jee Lee, **Chaudhary S**, Lu H. Automated annotation of cell identities in multi-cell functional imaging videos." *in preparation*
2. **Chaudhary S**, Lu H. Deep learning combined with optimal transport based framework for fast 3D cell segmentation in whole-brain image stacks." *in preparation*
3. **Chaudhary S**, Lu H. Deep learning based image restoration enhances functional and whole-brain imaging." *in submission*
4. **Chaudhary S**, Lee SA, Li Y, Patel DS, Lu H. Graphical-model framework for automated annotation of cell identities in dense cellular images. Elife. 2021;10: e60321. doi:10.7554/eLife.60321
5. **Chaudhary S**, Lu H. Point-set registration framework with Conditional Random Fields for automatic tracking of neurons in *C. elegans* whole-brain videos. Workshop on Worm's Neural Information Processing (WNIP), 31st Conference on Neural Information Processing Systems (NIPS 2017)
6. **Chaudhary S**, Sachan VK, Bhattacharya PK. Two dimensional modelling of water uptake in proton exchange membrane fuel cell. Int J Hydrogen Energy. 2014;39: 17802–17818

CONFERENCE PRESENTATION

Talks

1. Deep learning tools for dense fluorescent microscopic images and *C. elegans* whole-brain imaging. - 2021 AICHE, Boston, MA, USA
2. An objective method screening approach for optimizing cell tracking and identity annotation in dense fluorescent images. - 2021 AICHE, Boston, MA, USA
3. Graphical model framework for automated annotation of cell identities in dense cellular images - 2021 AICHE, Boston, MA, USA.
4. Deep learning based signal restoration enables high speed and long-term fluorescent imaging in microfluidics - 2021 microTAS, Palm Springs, CA, USA.
5. Deep learning based signal restoration enhances functional and whole-brain imaging - July 2021 Georgia Tech-Emory worm club, GA, USA.
6. A strategy for neuron identification in whole-brain videos. - 2019 MLSE ChemE and BME tracks, Georgia Tech, GA, USA.
7. A strategy for neuron identification in whole-brain videos. - July 2019 Georgia Tech-Emory worm club, GA, USA.
8. Automated tools for fast processing to investigate global brain dynamics. - 2018 Zeigler Seminar, Georgia Tech, GA, USA. [**Award Talk**]
9. Improving the interpretability of *C. elegans* whole-brain functional recordings. - 4th Year Symposium, Georgia Tech, GA, USA.

10. Comprehensive modelling of water permeation across proton exchange membrane fuel cells as well as effects of inclusion of electro-osmotic pump" in 37th Annual Review Meeting, Vikram Sarabhai Space Center, Kerala, India, Nov 2013.

Posters

1. Whole-brain cell annotation framework combined with on-chip stimulation reveals stimulus encoding in brain. - 2021 microTAS, Palm Springs, CA, USA.
2. Deep learning toolbox for *C. elegans* whole-brain imaging. - 2021 International *C. elegans* Conference, Virtual.
3. A strategy for neuron identification in *C. elegans* whole-brain videos. - 2019 International *C. elegans* Conference, UCLA, CA, USA.
4. A strategy for neuron identification in *C. elegans* whole-brain videos. - 2019 GRC on Modulation of Neural Circuits and Behavior, Les Diablerets, CH.
5. Improving the interpretability of *C. elegans* whole-brain dynamics. - 2019 Southeast Center for Mathematics and Biology Symposium, Georgia Tech, GA, USA.
6. Improving the interpretability of *C. elegans* whole-brain dynamics. - 2019 Emory Biophysics workshop, Emory University, GA, USA.
7. Automatic neuron identity determination in *C. elegans* whole-brain videos. - MLSE 2018, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA.
8. Fast and automatic processing of *C. elegans* whole-brain videos with probabilistic graphical models. - CRIDC 2018, Georgia Tech, GA, USA.
9. Point-set registration framework with Conditional Random Fields for automatic tracking of neurons in *C. elegans* whole-brain videos. - NIPS Workshop on Worm's Neural Information Processing 2017, Long Beach, CA, USA. [**Poster and Short Paper**]
10. Automatic cell identification, tracking and annotation in whole brain functional recording videos of [*C. elegans*]. - Emerging Tools for Acquisition and Interpretation of Whole-Brain Functional Data 2017, Janelia Research Farms, Virgina, USA.

RELEVANT COURSEWORK

- Information Processing Models in Neural Systems, Biomedical Optics, Convex Optimization, Probabilistic Graphical Models

AWARDS AND DISTINCTIONS

- NSF Student Award, MLSE 2019 - Machine Learning in BME track.
- 2018 **Zeigler Award** for the Best Research Proposal, Chemical and Biomolecular Engineering Department, Georgia Tech.
- 2018 Petit Scholarship Mentor - selected to mentor an undergrad student for a year to conduct biomedical research. Georgia Tech.
- SGA Conference Travel Fund. 2017, 2018, 2019. Georgia Tech.
- MEXT Scholarship 2014, awarded by Japan Government to pursue higher studies in University of Tokyo (Declined)
- All India Rank 13/11000, Graduate Aptitude Test for Engineering (GATE 2012) Chemical Engineering
- National Talent Search Examination (NTSE) Scholarship, NCERT, 2006
- All India Rank 91, National Science Talent Search Examination (NSTSE), 2006

TEACHING ASSISTANT

- CHBE2130, Thermodynamics, Spring 2019, Georgia Tech
- CHBE3200, Transport Phenomena 1, Summer 2018, Georgia Tech
- CHBE3200, Transport Phenomena 1, Summer 2017, Georgia Tech
- CHE453, Chemical Engineering Design, Spring 2013, IIT Kanpur
- CHE674, Introduction to Nanoscience and Nanotechnology, Fall 2012, IIT Kanpur

PROFESSIONAL SERVICE

Undergraduates Mentored

- Yueyi Li, Mentored 2017 - 2019, Petit Scholar
- Rebecca K Xiao, Mentored 2019
- Stutee Acharya, Mentored 2019

Peer reviewing for journals

- Lab On Chip, Food and Function

Volunteer

- Microfluidics demonstration with Lu Lab at 2019 Science Night - Morningside Elementary School, Atlanta, Georgia, USA

WORK EXPERIENCE

Senior Consultant, EXL Service July 2013 - December 2015

Project - Helped one of the largest US based health insurance provider to improve their First Call Resolution Rate

- Used strategies such as text-mining to identify and link most common reasons for calling back of customers and suggested methods to handle such reasons
- Performed site-wise analysis of call handling to identify under-performing and over-performing sites
- Developed a SAS based framework to gauge the performance of sites on timely basis.

Project - Identified individual and institutional non-compliant users misusing the services of a global health information provider

- Formulated several mathematical strategies to identify individual as well as institutional non-compliant users
- Developed a SAS based framework to identify non-compliant users on timely basis

Skills - SAS, ExcelVBA, SQL, Tableau, Dashboards, Data analysis, Predictive Modelling, Statistial analysis