Anirudh Choudhary

RESEARCH INTERESTS
Machine Learning; Image Processing
Biomedical Data Analysis

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EDUCATION

University of Illinois at Urbana-Champaign *2020 - present*
Ph.D. in Electrical and Computer Engineering (3.86/4.0)

Georgia Institute of Technology *2018 - 2020*
Masters in Computational Science and Engineering (3.81/4.0)
Thesis: Robust Counterfactual Learning for Clinical Decision-Making using EHRs

Indian Institute of Management Calcutta, India *2011 - 2013*
Masters in Business Administration (Completed all levels of CFA and FRM)

Indian Institute of Technology Kharagpur, India *2005 - 2010*
B.Tech & M.Tech (Honors), Electrical Engineering

PUBLICATIONS

1. Pose-aware C-arm Calibration & Distortion Correction for Guidewire Tracking & Image Reconstruction
F. Heemeyer*, **A. Choudhary***, J. P. Desai *(*equal contribution)* [Paper]
International Symposium on Medical Robotics, 2020 (Oral)

2. Advancing Medical Imaging Informatics by Deep Learning-Based Domain Adaptation [Article]
A Choudhary*, L. Tong*, Y. Zhu, M. Wang *(*equal contribution)*
IMIA Yearbook of Medical Informatics, 2020

3. Learning to Evaluate Color Similarity for Histopathology Images using Triplet Networks [Paper]
A. Choudhary, H. Wu, L. Tong, M. Wang
ACM Conference on Bioinformatics, Computational Biology, and Health Informatics, 2019 (Long Oral)

4. Texture based segmentation of epithelial layer from oral histological images [Paper]
M. Krishnan, **A. Choudhary**, C. Chakraborty, A.K. Ray, R. Paul
Micron Journal (Elsevier), 2011

5. Textural characterization of histopathological images for oral sub-mucous fibrosis detection [Paper]
M. Krishnan, P. Shah, **A. Choudhary**, C. Chakraborty, R. Paul, A.K. Ray
Tissue Cell Journal (Elsevier), 2011

6. A new image processing filter for the automatic extraction of organ's internal structures [Poster]
F.P. Ferrarese, N. Moretto, D. Botturi, **A. Choudhary**, G.A. Zamboni
European Congress of Radiology, 2009

7. An entropy based multi-thresholding method for semi-automatic segmentation of liver tumors [Paper]
A. Choudhary, N. Moretto, F.P. Ferrarese, G.A. Zamboni
MICCAI Workshop, 2008

8. Learning disentangled histopathology image representation via latent similarity subspaces
A. Choudhary, H. Wu, L.Tong, M. Wang *(in preparation)*

9. Clinical Decision-Making under Uncertainty: A Bootstrapped Counterfactual Inference Approach
A. Choudhary, H. Wu, M. Wang *(in preparation)*

RESEARCH EXPERIENCE

DEPEND Group, University of Illinois at Urbana-Champaign *Fall '20 - Present*
Mentor: Prof. Ravishankar Iyer

- Modeled long term cognition decline during dementia using ODE-based pathology simulation and policy gradient-based RL; Results competitive with RNN-based supervised learning for prediction upto 6 years.
- Survival modeling for chronic liver disease (PBC) using fully parametric RNN-based approach. Leveraged time-based decay function for missing data imputation and self-attention for clinical interpretability.

Biomedical Informatics Lab, Georgia Tech *Spring '19 - Summer '20*
Mentor: Prof. May Wang

- Developed self-supervised representation learning approach using triplet networks for image retrieval and perceptual similarity evaluation of histopathology images. Studied optimal transport based deep generative models for color transfer in pathology images. *(Publications #3, #8)*
- Proposed frameworks to tackle model uncertainty and enable improved generalization for RL-based clinical policy learning on health records. Leveraged bootstrapping and adversarial learning to derive robust oral anticoagulant dosing policy. Incorporated meta learning (REPTILE) with IRL-based imitation learning to develop personalized Sepsis treatment policies using MIMIC-III data. *(Publication #9)*

Medical Robotics and Automation Lab, Georgia Tech *Fall '19 - Spring'20*
Mentor: Prof. Jaydev Desai

- Designed camera-based pose-tracking setup for X-Ray image intensifier using self-supervised point detection (Superpoint) & Siamese object tracking (SiamMask). Combined ridge detection-based segmentation with 3D image reconstruction (FISTA) for tracking guidewire during image-guided surgery. *(Publication #1)*

Biomedical Image Analysis Lab, University of Pennsylvania; *Research Intern* *Summer '09*
Mentor: Prof. Christos Davatzikos

- Developed cerebellum segmentation approach for brain MRI data using 3D Gabor features based Demons Registration & level set techniques (FAST).

Altair Robotics Laboratory, University of Verona, Italy; *Research Intern* *Summer '08*
Mentor: Prof. Paolo Fiorini

- Developed liver tumor segmentation algorithm for low-quality CT scans with 75% IOU score (4th in MICCAI's tumor segmentation challenge & incorporated into Mirosurge platform). *(Publications #6, #7)*

Courses

Advanced Computer Vision, Deep Learning, Machine Learning, Graphical Models, Random Processes, Computational Inference, Dependable AI, Reinforcement Learning, Linear Algebra, CSE Algorithms

Professional Experience

Mastercard, India; *Manager, Advanced Analytics* *Sep'17 – Jul'18*

- Developed customer segmentation models and performed card spend analysis for leading multinational retailers. Identified customer segments for a grocery retailer and amusement park using hierarchical clustering and latent mixture model. Performed campaign uplift analysis and shopping trip intent analysis using graph networks.

Loyalty Partner (AmEx subsidiary), India; *Manager, Customer Insights* *Jun'16 — Aug'17*

- Led a team of 3 to develop predictive marketing models for 50M+ customers of India's leading grocery retailer. Developed models for campaign targeting (logistic regression), behavioural segmentation (CHAID, K-Means), wallet potential estimation (XGBoost) and revenue-growth projection. Awarded "Business Excellence" and "Best Quarterly Performance" awards.

EXL Analytics, India; *Manager, Decision Analytics* *Jun'13 - Jun'16*

- Pricing & supply chain analytics for cellphone trade-in program of a Fortune-500 US insurer. Led a team of 10 consultants; Formulated pricing and bid-allocation models for primary & secondary markets achieving 30% incremental profits; Developed logistic regression & Poisson regression models for price forecasting.

Sabre Corporation, India; *Associate Software Developer* *Jul'10 – May'11*

- Full-stack developer responsible for optimization & enhancement of Travelocity's flight checkout module. Awarded "High Five" (top 5 performers in Q1'11) & "Best Technology Hack" awards.

Academic Achievements

NSF Travel Grant & Graduate Student Travel Award(Georgia Tech) - ACM BCB Conference, 2019
Finalist: Modulus, financial markets trading competition at IIM Calcutta's business summit, 2012
Masters Research Scholarship and Indian Oil Scholarship at IIT Kharagpur, 2009
Research Assistantships during internships at Univ. of Verona (2008) & Univ. of Pennsylvania (2009)
Best Outgoing Technology Award, IIT Kharagpur, 2010
Winner - National level product design competition at Entrepreneurship Summit, IIT Kharagpur, 2010
All India Rank 68 in IIT Prelims Examination & 507 in All India Engineering Entrance Examination
State Rank 5 in Regional Mathematical Olympiad, 2002
Mamraj Agarwal Scholarship in Std 10^{th}; CBSE Merit Certificate in Mathematics in Std 12^{th}
Qualified for final round of KVPY & cleared state level of National Talent Search Examination, 2001

Course Projects

Analyzing the implicit adversarial robustness of networks trained using SGD [Report] *Fall 2021*
Guidewire detection and 3D reconstruction for image-guided surgery [Report] *Spring 2020*
HIV infection simulation using mean-field ODE and antiretroviral drug-dosing using RL [Report] *Spring 2020*
Domain adaptation using spatio-temporal features for video activity recognition [Video, Slides] *Fall 2019*
Toxic comment classification using ordered neurons-based LSTM [Report] *Spring 2019*
Solving TSP using heuristic and local search algorithms [Report, Code] *Fall 2018*

Technical Skills

Programming C/C++, Python, PyTorch (library)
Softwares & Tools R, MATLAB, LATEX, Hadoop, Apache Spark, Hive