Anirudh Choudhary

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Research Interests

Machine Learning
Image Processing
Biomedical Data Analysis

Education

University of Illinois at Urbana-Champaign, USA — *2020 - present*
PhD in Electrical and Computer Engineering

Georgia Institute of Technology, USA — *2018 - 2020*
Masters in Computational Science and Engineering

Indian Institute of Management Calcutta, India — *2011 - 2013*
Masters in Business Administration (Top 20%)

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

Publications (*equal contribution)

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

F. Heemeyer*, **A. Choudhary***, J. P. Desai,"Pose-aware C-Arm Calibration & Image Distortion Correction for Guidewire Tracking & Image Reconstruction", IEEE Symposium on Medical Robotics, 2020 [Paper]

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

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

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

F.P. Ferrarese, N. Moretto, D. Botturi, **A. Choudhary**, G.A. Zamboni, "A new image processing filter for the automatic extraction of organs' internal structures: Application to liver tumors", ECR 2009 [Poster]

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

Review Articles

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

Research Experience

Biomedical Informatics Lab, Georgia Tech; *Graduate Researcher* — *Spring '19 - Summer '20*

- Evaluated optimal transport based deep generative models for color transfer in pathology images; Developed self-supervised representation learning framework for evaluating color-based perceptual similarity
- Proposed distributionally robust offline policy estimators for treatment policy learning on health records
- Implemented offline meta-inverse reinforcement learning for imitating clinician's sepsis treatment policies

Medical Robotics and Automation Lab, Georgia Tech; *Graduate Researcher* — *Fall '19 - Spring'20*

- Developed camera-based CARM pose-tracking using self-supervised point detection & siamese tracking
- Implemented 2D-segmentation & 3D reconstruction for tracking guidewires in X-ray image guided surgery

Centre for Spatial Planning, Georgia Tech; *Research Assistant* — *Fall '18 - Spring '19*

- Formulated large-scale highway infrastructure optimization using parallel Genetic Algorithm in OpenCL

B.Tech & M.Tech Thesis, IIT Kharagpur — *Fall '08 - Spring '10*

- Cancer detection in oral pathology images using spatial & wavelet based texture features (91% accuracy)

Biomedical Image Analysis Lab, University of Pennsylvania; *Research Intern* — *Summer '09*

- Cerebellum segmentation in MRI images using 3D Gabor features based Demons registration & level sets

Altair Robotics Laboratory, University of Verona, Italy; *Research Intern* — *Summer '08*

- Developed an automated liver tumor detection algorithm for abdominal CT scans (75% ROI overlap)
- Work incorporated into Mirosurge robotic platform; Stood 4th in MICCAI's tumor segmentation challenge

Courses

Computer Vision, Graphical Models, Deep Learning, Machine Learning, Dependable AI, Artificial Intelligence, Numerical Linear Algebra, CSE Algorithms, Modeling & Simulation, Computational Inference

Professional Experience

Mastercard Advisors, India; *Senior Analyst, Advanced Analytics* *Sep'17 – Jul'18*

- Developed unsupervised segmentation models for customer shopping behaviour analysis for leading multinational retailers, amusement parks and ride-hailing firm
- Implemented finite mixture model-based clustering, graph network-based trip visualization and campaign uplift models using 1TB+ card transactions. Extensively worked with PySpark, Hadoop and Hive.

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

- Led a team of 3 for spend analytics & customer acquisition modelling for India's leading grocery retailer
- Modeled campaign propensity & customer wallet potential using logistic regression & gradient-boosting
- Business Excellence Award (2017) and Quarter Performance Award (Q4 2016)

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

- Pricing & supply chain analytics for leading US insurer operating T-Mobile's phone trade-in program
- Led a team of 10 consultants; Formulated pricing and bidding allocation models for primary/secondary markets achieving 30% incremental profits; Developed generalized linear models for mobile price forecasting
- Worked as Chief of Staff to Head of Insurance Operations Management (2013-15) - Supported CXOs in financial analysis, capacity optimization, merger planning & strategy formulation ($250M portfolio)

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

- Full-stack developer responsible for optimization & enhancement of Travelocityś flight checkout module
- High performance award (top 5 performers in Q1'11); Best technology award at Sabre Hack Day

Academic Achievements

NSF Travel Grant & Graduate Student Travel Award(Georgia Tech) - ACM BCB Conference, 2019
Runners-up: Procter & Gamble's marketing strategy case-study competition, IIM Calcutta, 2013
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

Programming

C, Python, R, MATLAB; PySpark, PyTorch, Tensorflow

Course Projects

Simulation of within-host dynamics in HIV patients, *Modeling & Simulation* *Spring 2020*

- Modeled the viral dynamics of HIV infection using ODE simulation and developed reinforcement learning-based optimal antiretroviral drug-dosing strategy [Report]

Domain Adaptation for Action Recognition in Videos, *ML with Limited Supervision* *Fall 2019*

- Developed adversarial domain alignment approach using spatio-temporal CNN for temporal domain adaptation on sports videos (UCF and HMDB). Evaluated attention and optical-flow based feature pooling, two stream action recognition network and graph temporal network. [Video] [Slides]

Evaluating Tree Structure based RNN, *ICLR Reproducibility Challenge* *Spring 2019*

- Evaluated Ordered Neurons based LSTM (ON-LSTM) and AWD LSTM frameworks on toxic comments classification and incorporated ON-LSTM in ULMFiT framework for transfer learning. [Report]

Traveling Salesman Problem Solver; *CSE Algorithms* *Fall 2018*

- Evaluated Branch & Bound, MST Approximation & Local Search based approaches for solving TSPLIB instances and implemented List based Simulated Annealing achieving 0-3% relative error. [Report] [Code]