ARCHAN RAY

github: archanray ⋄ website: people.cs.umass.edu/∼ray
(413) · 992 · 9222 ⋄ ray@cs.umass.edu, talk2archan@gmail.com
New York, NY 11372

RESEARCH INTEREST

Randomized Algorithms, Kernel Methods, Statistical Analysis, Machine Learning.

EDUCATION

University of Massachusetts, Amherst *September 2016* - present
Ph.D. in Computer Science, *advised by* Professor Cameron Musco
GPA: 3.717/4.0

Indian Statistical Institute, Kolkata *July 2015*
M.Tech. in Computer Science, *advised by* Professor Dipti Prasad Mukherjee
Thesis: Estimation of image features representing facial emotions for emotion synthesis
Percentage: 74.25%

Jalpaiguri Government Engineering College, West Bengal *June 2013*
B.Tech. in Computer Science and Engineering
GPA: 8.5/10.0

RESEARCH EXPERIENCE

University of Massachusetts August 2019 - *present*
Graduate Research Assistant *Amherst, MA*

· Approximate matrix properties and applications to real world datasets.
· *Area of Study*: Randomized Algorithms, Kernel Methods.

Amazon Web Services May 2020 - August 2020
Applied Research Intern *New York, NY*

· Develop an algorithm to perform pseudo semi-supervised learning for short texts.
· The challenges involve: a) leveraging the giant body of supervised architectures with unlabelled data, b) identifying confident pseudo labelled samples.
· *Area of Study*: Unsupervised Learning, Natural Language Processing.

University of Massachusetts May 2017 - May 2019
Graduate Research Assistant *Amherst, MA*

· Develop an algorithm to detect and recognize texts in historical maps. Compare with relevant baselines.
· Create a database of annotated historical maps (technical publication listed).
· *Area of Study*: Convolutional Neural Networks, Computer Vision and Word Spotting.

Amazon Web Services June 2019 - August 2019
Applied Research Intern *New York, NY*

· We develop an algorithm for visual question answering using transformer architecture.
· The challenges involve: a) object detection, and b) multimodal attention.
· *Area of Study*: Computer Vision, Natural Language Processing.

Indian Statistical Institute August 2015 - August 2016
Visiting Research Scholar *Kolkata, India*

· We developed an algorithm for detection and recognition of objects from planogram images.
· *Area of Study*: Computer Vision, Graph Theory.

TCS Innovation Labs May 2014 - July 2014
Research Intern *Gurgaon, India*

· A new computation framework was developed and the interpretations are done on the basis of statistical differences between populations of normal and abnormal classes of face images.
· *Area of Study*: Computer Vision, Support Vector Machines, Markov Models, Topology and Modern Analysis, Active Shape Modeling.

RRSC-E (Indian Space Research Organization) June 2012 - August 2012
Research Intern *Kolkata, India*

· Develop an algorithm to identify distinct signals (spectral unmixing of endmembers) in a hyperspectral image.
· *Area of Study*: Game Theory, Digital Signal Processing, PCA & KPCA, Image Processing.

PROFESSIONAL EXPERIENCE

University of Massachusetts
Graduate Teaching Assistant *Amherst, MA*

· Representing, Storing, and Retrieving Information (CS145), *Spring '21*, with William T. Verts
· Algorithms for Data Science (CS514), *Spring '20*, with Cameron Musco.
· Graduate Computer Vision (CS670), *Fall '19*, with Subhransu Maji.
· Graduate Machine Learning (CS589), *Spring '19*, with Justin Domke.
· Graduate Machine Learning (CS589), *Spring '17*, with Benjamin Marlin.
· Introduction to Algorithms (CS311), *Fall '16*, with Andrew McGregor and Akshay Krishnamurthy.

PUBLICATIONS

Bhattacharjee R., Dexter G., Drineas P., Musco, C., & **Ray, A.** (2022, May) "Sublinear Time Eigenvalue Approximation via Random Sampling". *arXiv preprint arXiv:2109.07647*.

Ray, A., Monath, N., McCallum, A., & Musco, C. (2021 December) "Sublinear Time Approximation of Text Similarity Matrices". to appear in *AAAI Conference on Artificial Intelligence (AAAI) 2022*.

Ray, A., Chowdhury, A. R., Fung, Y., Weinman, J., & Learned-Miller, E. (2019, December). "Tight Coupling of Character, Word, and Place Recognition for End-to-End Text Recognition in Maps". *Technical Report, College of Information and Computer Sciences, University of Massachusetts, Amherst, MA*

Ray, A., Chen, Z., Gafford, B., Gifford, N., Jai Kumar, J., Lamsal, A., Niehus-Staab, L., Weinman, J., & Learned-Miller, E. (2018, October). "Historical Map Annotations for Text Detection and Recognition". *Technical Report, Grinnell College, Grinnell, IA 50112*.

Ray, A., Kumar, N., Shaw, A., & Mukherjee, D. P. (2018, September). "U-PC: Unsupervised Planogram Compliance". *In European Conference on Computer Vision (pp. 598-613). Springer, Cham.*

PATENTS

Pranoy, H., Rao, S.Y., Ramakrishnan, R., Shaw, A.K., **Ray, A.**, Kumar, N. and Mukherjee, D.P., Tata Consultancy Services Ltd, 2020. System and method for object recognition based estimation of planogram compliance. U.S. Patent 10,748,030.

HONORS AND ACHIEVEMENTS

AAAI-22 Student Scholarship, 36th AAAI Conference on Artificial Intelligence *January 2022*
Best Dissertation in M.Tech. Computer Science, Indian Statistical Institute, Kolkata *July 2015*

RELEVANT COURSEWORKS

University of Massachusetts, Amherst: Deep Learning (A), Computer Vision (A), Machine Learning (A), Research Methods in Empirical CS (A), Automated Knowledge Based Construction (A), Advanced Algorithms (B+), Software Analysis and Evaluation (A-), Advanced Database Systems (B+).

Indian Statistical Institute, Kolkata: Artificial Neural Networks, Computer Vision, Computer Graphics, Advanced Pattern Recognition, Advanced Digital Signal Processing, Abstract Algebra.

Jalpaiguri Government Engineering College: Digital Image Processing, Artificial Intelligence, Mathematics, Advanced Algorithms

ACADEMIC ACTIVITIES

IEEE Transactions on Image Processing. Reviewer

NeurIPS 2019 Workshop Sets & Partitions. Reviewer

Indian Conference on Computer Vision, Graphics and Image Processing. Reviewer

OTHER RESEARCH AND CLASS PROJECTS

Efficient distributed routing in quantum networks October 2019 - December 2019
Advisor: Dr. Kaushik Chakraborty *QuTech, TU Delft*

- We present an efficient algorithm for routing in quantum networks.
- We improve upon the state of the art by using link prediction for dynamic routing of incoming datastreams.
- *Area of Study*: Quantum Networks and Link Prediction.

Online nearest neighbor clustering using levarage score sampling October 2019 - December 2019
Course advisor: Prof. Cameron Musco and Prof. Andrew McCallum *UMass Amherst*

- We present an efficient and online nearest neighbor search.
- A kernel function is used as a distance measure for two points in the cluster. The use of leverage scores allows for a faster implementation.
- *Area of Study*: Kernel Methods and Natural Language Processing.

Invariant methods and graph equivalence (IMAGE) February 2017 - May 2017
Course advisor: Prof. Yuriy Brun *UMass Amherst*

- Inspect invariant methods with a view to identify code similarity using graph equivalence.
- Use graph kernels as a similarity measurement to quantify the similarities between code pieces.
- *Area of Study*: Kernel Methods, Software Analysis and Graph Kernels.

Recommendation from citation databases April 2017 - May 2017
Course advisor: Prof. Alexandra Meliou *UMass Amherst*

- Investigate recommendations in the context of bibliographic networks. Design a recommendation framework that uses only the graph topology to estimate valid recommendations given a query node in the graph.
- Our experiments on Stanford citation networks and CiteULike datasets promises that the combination of our method and topic modeling result in competent recommender models.
- *Area of Study*: Statistical Learning, Graph Database and Recommender Framework.

Generating Harder CAPTCHAs using GAN September 2016 - December 2016
Course advisor: Prof. Sridhar Mahadevan *UMass Amherst*

- We propose the use of GANs to generate harder CAPTCHAs taking into account the intrinsic properties of the breaker CNNS.
- Our experiments showed a significant decrease in the recognition accuracy of the CNNs.
- *Area of Study*: Deep Learning, Generative Models and Adversarial Networks.

Canonicalizing Neural Networks September 2016 - December 2016
Advisor: Prof. Erik Learned Miller *UMass Amherst*

- Study the convergence of a fixed neural network to its many optima.
- Transform the trained network keeping its functional behaviour consistent and studied the existence of "equivalence classes" for a neural network.
- *Area of Study*: Neural Networks, and Functional Analysis

Sammon's Mapping Using a Revised Distance Strategy September 2014 - August 2015
Advisor: Dr. Swagatam Das *ISI Kolkata*

- Investigate Sammon's mapping using Bregman's divergence. Propose a different distance strategy to attain the reduction from non-linear dimension.
- *Area of Study*: Functional Analysis, and Measure Theory.

Estimation of Image Features for Emotion Synthesis ***(best dissertation)*** February 2014 - July 2015
Advisor: Prof. Dipti Prasad Mukherjee *ISI Kolkata*

- Develop a method to estimate emotion-specific features on human face which characterizes an emotion class.
- Develop an algorithm to estimate the change a person's image from no emotion to a given emotion using these features.
- SNR of the synthesized images showed improvements as compared to state-of-the-art methods.
- *Area of Study*: Support Vector Machines, Statistical Inference, Computer Vision, Differential Geometry.

Frame Based Audio Signal Processing using DSK6713 August 2014 - October 2014
Advisor: Dr. Sarbani Palit *ISI Kolkata*

- Investigate and develop an algorithm to remove noise and jitters while amplifying signals.
- *Area of Study*: Convolution Theorem, Micro-controllers and Microprocessor, DSK Toolkit.

Thread Library Implementation in Pintos April 2014 - May 2014
Course advisor: Prof. Mandar Mitra *ISI Kolkata*

- Strengthen the thread library that supports the operating system. Implement an advanced scheduler.
- We removed busy waiting of the timer function.We further improved the timer interrupt service and added priority scheduling support for threads, including priority inversion and priority donation.
- *Area of Study*: Multilevel Feedback Queue Scheduling, Optimization Barriers, Priority Scheduling.

Minimum Enclosing Circle of a Set of Points and Two Mobile Points November 2013 - February 2014
Advisor: Dr. Sandip Das *ISI Kolkata*

- Study variations in the center and radius of the minimum enclosing circle (MEC) of a given set of points and two mobile points moving along straight lines.
- The basis of the changes is the farthest point Voronoi of the given set of points.
- *Area of Study*: Voronoi Diagram, Kinetic Data Structure, Co-Ordinate Geometry.

Facial Recognition using Fiducial Points and Graph Matching Aug 2012 - May 2013
Advisor: Prof. Animesh Hazra *Jalpaiguri Govt. Engg. College*

- Develop an algorithm to extract the facial features of the given image to help identify peoples faces from an already available database with increased efficiency and optimal time complexity.
- *Area of Study*: Image Processing, Graph Theory.