Anush Sankaran, PhD
IBM Research AI

CONTACT INFORMATION

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RESEARCH INTERESTS

Deep Learning, Data for AI, Democratization of AI, Unsupervised Feature Learning, Image Analysis, Biometrics.

INDUSTRIAL EXPERIENCE

Advisory Researcher, IBM Research AI, India (November, 2015 - Present)

- Bottom up forming a research growth strategy in *Data for AI*. Stressing on the importance of data in AI lifecycle, the aim of this project is to solve the problems in the world of data and prepare the data to be AI ready.
- Leading technical efforts in IBM Deep Learning IDE. It's a visual programming IDE, where you could design a deep learning model using an intuitive drag-and-drop framework. Now a part of Neural Network Modeller in Watson Studio (`https://datascience.ibm.com/`).
- Exploring problems in the domain of machine learning for creativity (`https://ml4creativity.mybluemix.net/`): The goal is to create creative assistants to help augment human experts in various creative fields.
- Lead researcher for project iSight, which aims in creating a cognitive automated system to extract the error context for SAP system screenshots and to supply a structured resolution procedure, mined from previous instances of data.

TEACHING EXPERIENCE

Visiting Faculty

- Grad level course on *Visual Recognition* at IIIT Bangalore, Jan-Apr 2019. Co-instructor with Prof. Dinesh Babu Jayagopi

ACADEMIC QUALIFICATION

Doctor of Philosophy (July 2010 - August 2017) **9.56/10**

Indraprastha Institute of Information Technology-Delhi, New Delhi, India

- Dissertation Topic: "Learning Representations for Fingerprint Variants"
- Advisors: Dr. Mayank Vatsa and Dr. Richa Singh
- Graduate courses:

Advanced PR and ML	Machine Learning
Image Analysis	Computer Vision
Pattern Recognition	Information Retrieval
Probability and Statistics	Advanced Biometrics
Technical Writing	Probabilistic Graphical Models (Audit)

Bachelor of Engineering (Computer Science Engineering) (2006 - 2010) **9.45/10**

Coimbatore Institute of Technology, Coimbatore, Tamilnadu, India

Higher Secondary (2005 - 2006) **94.75%**

Bharathiya Vidya Bhavan, Coimbatore, Tamilnadu, India

RESEARCH EXPERIENCE (OUTSIDE PUBLICATIONS)

IBM Research AI, India

AI Model Catalog **April 2018 - February 2019**

For a given task, "Which AI (ML or DL) model to start off with?" is a common question that most practitioners ask. To aid their cause, we built a menu card (catalog) of the public existing AI

models. The catalog is populated in a semi-automated manner using content from github and PDF of research papers. Additionally, we implemented model recommendation algorithm to suggest a rank list of models for a given new dataset and also predict the accuracy performance of each model on the new dataset in a trainless manner.

Neural Network Modeller **June 2017 - April 2018**
A visual programming IDE to design a DL model in a drag-and-drop fashion and automatically generate execution ready code in multiple libraries. Technically lead the team in both the research and product agenda of this project. Implemented product ready code for Neural Network Modeller as a part of Watson Studio, which was released in IBM flagship conference, Think 2018.

Cognitive Support Automation **Jan 2016 - Aug 2017**
Most of the IT support systems contain screenshot images to add meta information to the corresponding ticket. This project, *iSight*, automatically extracts the error messages and context from a screenshot image and provides error resolution from a knowledge base in real-time.

Lane Department of CSE, West Virginia University **Jun 2014 - Oct 2014**
With: Prof. Afzel Noore
Eye Gaze Analysis for Latent Fingerprint matching
Fingerprints obtained from forensic crime scenes are often compared manually by experts making it a laborious task. The aim of this research is to understand how human analyze noise data through eye gaze analysis and translate this knowledge to develop better automated fingerprint identification systems.

The Hong Kong Polytechnic University **Jun 2011- Aug 2011**
With: Dr. Ajay Kumar
Feature level fusion of fingerprints More often in a biometric authentication application, we have the liberty to capture more than one fingerprint from the individual. This research aims in the fusion of information obtained from multiple fingerprint at both data and feature level, to provide a more confident authentication.

Indraprastha Institute of Information Technology-Delhi, India
Smooth learning of Deep Networks **Dec 2014 - Jul 2015**
Deep networks along with its successful performance in multiple domains, poses lots of learning challenges such as learning large number of parameters, reduced performance when only limited training data is available. Addressing these challenges, improves the learning capacity and provides flexibility to address deep learning in many new challenges.

Reinforcement based task adaptation framework **Aug 2013 - Jan 2014**
We propose a reward based learning mechanism that learns a classification or regression task completely from unlabeled data. The learnt hypothesis can be used as a supplement to improve the performance of a supervised or semi-supervised classifier.

Tom without a Jerry **Jan 2011 - Feb 2011**
This project involves creating a Windows based stand alone application for controlling the mouse pointer, using only hand movements detected as gestures by a web-camera.

Publications

Total Citations: 291; **h-index:** 10; (as per Google Scholar, as of 1st May, 2019)
Journals

1. A. Malhotra, **A. Sankaran**, M. Vatsa, R. Singh, K. B. Morris, and A. Noore, Understanding Latent Fingerprint Examination process during ACE-V procedure using Eye-Gaze Analysis, *Forensic Science International*, Elsevier, 2018 (under review). **Impact Factor: 2.271**
2. **A. Sankaran**, A. Malhotra, M. Vatsa, and R. Singh, Fingerphoto Authentication using Deep

Scattering Networks, *IEEE Transaction on Information Forensics and Security*, 2018 (under review). **Impact Factor: 4.332**

3. S. Agrawal, **A. Sankaran**, A. Laha, S. Ahmed CG, D. Shrivastava, K. Sankaranarayanan, What is Deemed Computationally Creative?, *IBM Journal On Research and Development, Special Issue on Computational Creativity*, vol. 63, no. 1, pp. 3:1-3:12, Jan.-Feb. 2019.
4. **A. Sankaran**, A. Majumdar, M. Vatsa, and R. Singh, Group Sparse Autoencoder, *Image and Vision Computing, Special Issue on Regularization Techniques for High-Dimensional Data Analysis*, Elsevier, vol. 60, pp. 64-74, 2017. **Impact Factor: 2.671**
5. **A. Sankaran**, A. Jain, T. Vashisth, M. Vatsa, and R. Singh, Adaptive latent fingerprint segmentation using feature selection and random decision forest classification, *Information Fusion*, Elsevier, vol. 34, pp. 1-15, 2017. **Impact Factor: 5.667**
6. **A. Sankaran**, G. Goswami, M. Vatsa, R. Singh, and A. Majumdar, Class Sparsity Signature based Restricted Boltzmann Machines, *Pattern Recognition, Special Issue on Deep Image Video*, Elsevier, vol. 61, pp. 674-685, 2017. **Impact Factor: 4.582**
7. **A. Sankaran**, M. Vatsa, R. Singh, Multisensor Optical and Latent Fingerprint Database, *IEEE Access*, vol. 3, pp. 653 - 665, 2015. **Impact Factor: 3.244**
8. **A. Sankaran**, M. Vatsa, R. Singh, Latent Fingerprint Matching: A Survey, *IEEE Access*, vol. 2, pp. 982-1004, 2014. (*Appeared as one of the top-10 highly viewed publication of 2014*). **Impact Factor: 3.244**

Book Chapters

1. **A. Sankaran**, A. Malhotra, M. Vatsa, and R. Singh, Learning Representations for Uncontrolled Fingerprint Recognition, *Deep Learning in Biometrics*, CRC Press, 2018.
2. A. Malhotra, **A. Sankaran**, A. Mittal, M. Vatsa, and R. Singh, Fingerphoto Authentication using Smartphone Camera captured under Varying Environmental Conditions, *Human Recognition in Outdoor Unconstrained Environments: Using Computer Vision, Pattern Recognition and Machine Learning Methods for Biometrics*, Elsevier, 2016. Editors: Maria De Marsico, Michele Nappi and Hugo Proenca.

Patents

1. Multi-Modal Construction of Deep Learning Networks, US Patent Application 15/491,162
2. **10 patents** are under submission with USPTO.
3. **5 patents** have cleared internal IBM review process and in the process of submission.

Peer Reviewed Conference Articles*

1. A. Prabhu, R. Dasgupta, **A. Sankaran**, S. Tamilselvam, S. Mani, "You might also like this model": Data Driven Approach for Recommending Deep Learning Models for Unknown Datasets, 2019 (In submission).
2. S. Tamilselvam, N. Panwar, S. Khare, R. Aralikatte, S. Mani, **A. Sankaran**, A Visual Programming Paradigm for Abstract Deep Learning Model Development, 2019 (In submission).
3. R. Sinha, **A. Sankaran**, M. Vatsa, R. Singh, AuthorGAN: GAN authoring made easy, *IEEE Information Visualization (InfoVis)* 2019 (In submission).
4. S. Mani, **A. Sankaran**, R. Aralikatte, DeepTriage: Exploring the Effectiveness of Deep Learning for Bug Triaging, *ACM India Joint International Conference on Data Science and Management of Data (CoDS-COMAD)*, 2019.
5. N. Gantayat, G. Sridhara, **A. Sankaran**, S. Dechu, S. Mani, and G. Dasgupta, Towards Creating Business Process Models from Images, *In International Conference on Service-Oriented Computing (ICSOC)*, 2018.

6. R. Aralikatte, N. Gantayat, N. Panwar, **A. Sankaran**, S. Mani. Sanskrit Sandhi Splitting using seq2(seq)2, *In Empirical Methods in Natural Language Processing (EMNLP)*, 2018.
7. **A. Sankaran**, M. Vatsa, R. Singh, Intuition Learning, *Joint IJCAI/ECAI/AAMAS/ICML Workshop on Domain Adaptation for Visual Understanding (DAVU)*, 2018.
8. S. Suri, **A. Sankaran**, M. Vatsa, R. Singh, On Matching Faces with Alterations due to Plastic Surgery and Disguise, *International Conference on Biometrics: Theory, Applications and Systems (BTAS)*, 2018.
9. V. Munigala, A. Mishra, S. G. Tamilselvam, S. Khare, R. Dasgupta, and **A. Sankaran**, PersuaAIDE ! An Adaptive Persuasive Text Generation System for Fashion Domain, *Cognitive Computing Track, TheWebConf (WWW)*, 2018
10. A. Sethi, **A. Sankaran**, N. Panwar, S. Khare, and S. Mani, DLPaper2Code: Auto-generation of Code from Deep Learning Research Papers, *Association for the Advancement of Artificial Intelligence (AAAI)*, 2018
11. S. Mani, N. Gantayat, R. Aralikatte, M. Gupta, S. Dechu, **A. Sankaran**, S. Khare, B. Mitchell, H. Subramanian, and H. Venkatarangan, Hi, How can I help you?: Automating enterprise IT support help desks, *Innovative Applications of Artificial Intelligence (IAAI)*, 2018.
12. **A. Sankaran**, N. Panwar, S. Khare, S. Mani, A. Sethi, R. Aralikatte, and N. Gantayat, Democratization of Deep Learning using DARVIZ, *AAAI - Demo Track*, 2018.
13. S. Mani, N. Gantayat, R. Aralikatte, M. Gupta, S. Dechu, **A. Sankaran**, S. Khare, B. Mitchell, H. Subramanian, and H. Venkatarangan, Agent Assist: Automating enterprise IT support help desks, *AAAI - Demo Track*, 2018.
14. **A. Sankaran**, R. Aralikatte, S. Mani, S. Khare, N. Panwar, and N. Gantayat, DARVIZ: deep abstract representation, visualization, and verification of deep learning models, *International Conference on Software Engineering: New Ideas and Emerging Results Track*, 2017.
15. A. Taneja, A. Tayal, A. Malhotra, **A. Sankaran**, M. Vatsa, and R. Singh, Fingerphoto Spoofing in Mobile Devices: A Preliminary Study, *International Conference on Biometrics: Theory, Applications and Systems*, 2016.
16. **A. Sankaran**, A. Malhotra, A. Mittal, M. Vatsa, and R. Singh, On Smartphone Camera based Fingerphoto Authentication, *International Conference on Biometrics: Theory, Applications and Systems*, 2015.
17. **A. Sankaran**, A. Agarwal, R. Keshari, S. Ghosh, A. Sharma, M. Vatsa, and R. Singh, Latent Fingerprint from Multiple Surfaces: Database and Quality Analysis, *International Conference on Biometrics: Theory, Applications and Systems*, 2015.
18. **A. Sankaran**, P. Pandey, M. Vatsa, R. Singh, On Latent Fingerprint Minutiae Extraction using Stacked Denoising Sparse AutoEncoders, In Proceedings of *International Joint Conference on Biometrics*, 2014 (**Best Poster Award**).
19. **A. Sankaran**, M. Vatsa, R. Singh, Automated Clarity and Quality Assessment for Latent Fingerprints: A Preliminary Study, In Proceedings of *International Conference on Biometrics: Theory, Applications and Systems*, 2013 (**Best Poster Award**).
20. **A. Sankaran**, M. Vatsa, R. Singh, Hierarchical Fusion for Matching Simultaneous Latent Fingerprint, In Proceedings of *International Conference on Biometrics: Theory, Applications and Systems*, 2012.
21. **A. Sankaran**, T.I. Dhamecha, M. Vatsa, R. Singh, On Matching Latent to Latent Fingerprints, In Proceedings of *International Joint Conference on Biometrics*, 2011.
22. T.I. Dhamecha, **A. Sankaran**, R. Singh, M. Vatsa, Is Gender Classification Across Ethnicity Feasible using Discriminant Functions?, In Proceedings of *International Joint Conference on Biometrics*, 2011.

* In biometrics research area, International Joint Conference on Biometrics (IJCB), Internation Conference on Biometrics (ICB), Biometrics: Theory, Applications, and Systems (BTAS) are considered highly prestigious venues.

Technical Reports

1. Naveen Panwar, Shreya Khare, Neelamadhav Gantayat, Rahul Aralikatte, Senthil Mani, and **Anush Sankaran**, mAnI: Movie Amalgamation using Neural Imitation, arXiv preprint, arXiv: 1708.04923, 2017.
2. Vitobha Munigala, Srikanth Tamilselvam, and **Anush Sankaran**, "Let me convince you to buy my product...": A Case Study of an Automated Persuasive System for Fashion Products, arXiv preprint, arXiv:1709.08366, 2017.
3. T. Narendra, **A. Sankaran**, D. Vijaykeerthy, S. Mani, Explaining Deep Learning Models using Causal Inference, arXiv preprint arXiv:1811.04376, 2018.

Honors and Awards

- IBM Research recognition award for serving as a global technical co-lead for *Creative Assistants* in the **Global Technical Outreach AI Leadership** program, 2017.
- Received five times **Manager's choice award** for extensive contribution to the project and team, since 2016.
- Selected for Doctoral Consortium at **BTAS 2015**.
- Received first place in the highly competitive IDRBT Doctoral Colloquium, **December 2013**.
- Overseas Research Fellowship for visiting West Virginia University, USA during **May - Oct '14**.
- Received commendation letter for outstanding TA duty in Probability and Statistics course during Winter '14 Semester
- TCS (Tata Consultancy Services) Research Fellowship for **August, 2010 - July 2015**.
- Best paper (poster presentation) award at IEEE IAPR International Joint Conference on Biometrics, **October 2014**
- Best paper (poster presentation) award at IEEE Sixth International Conference on Biometrics: Theory, Applications, and Systems (BTAS), **August 2013**
- "TCS Best Student Project Award" for my undergraduate thesis "Multi-resolution Image Query Using Haar transformation And Image Tagging", **2009-2010**.

Academic Experience

Teaching Assistant

Course (Instructor)	Semester	Duties
Probability and Statistics (Dr. Richa Singh)*	Winter '14 (Head TA)	Conducting tutorials, office hours, designing and grading exam papers and homework assignments
Machine Learning (Dr. Mayank Vatsa)	Winter '12 and '13	Office hours, designing and grading exam papers and homework assignment
Data Structures (Dr. Vikram Goyal)	Winter '11	Office hours, homework assignment, and lab tutorials
Probability and Statistics (Dr. Richa Singh)	Monsoon '10	Office hours, designing and grading exam papers and homework assignment

Other teaching activities: Taught selected topics such as Reinforcement Learning (RL), Hidden Markov Models (HMM), Autoencoders, Fingerprint technology, Principal Component Analysis (PCA), Probability distributions in Machine Learning, Pattern Recognition, and Probability & Statistics

* **Director commendation letter** for best TA of the year.

Student Mentoring

Student Name	Type	Project Name	Duration
Industry Summer Interns			
Raunak Sinha (IIIT-D)	Bachelor's	Sequential Generative Adversarial Nets	May '18 - Aug '18
Ameya Prabhu (IIIT-H)	Master's	Efficient Neural Architecture Search	May '18 - Aug '18
Akshay Sethi (IIIT-D)	Bachelor's	DLPaper2Code (AAAI '18)	May '17 - Jul '17
Shavak Agarwal (BITS Pilani)	Bachelor's	Generating Creative Advertisements (IBM Research Journal)	May '17 - Jul '17
Master's Student			
Abhishek Mitra	Thesis	Quality Estimation of Fingerphoto Images	Sep '16 - May '17
Undergraduate Student			
Saksham Suri	BTP	Intuition Learning	Sep '17 - current
Aakriti Tayal	IP	Spoofing smartphone fingerphoto recognition (BTAS-16)	Jan '16 - May '16
Archit Taneja	IP		Jan '16 - May '16
Aakarsh Malhotra	BTP	Smartphone fingerphoto recognition (Book chapter, BTAS-15)	Aug '14 - May '15
Apoorva Mittal	BTP		Aug '14 - May '15
Prateekshit Pandey	IP	Minutiae extraction using sparse autoencoder (IJCB-14)	Jan '14 - Aug '15
Tarun Vashisth	BTP	Latent fingerprint segmentation (Information Fusion, Journal)	Aug '12 - May '13
Aayush Jain	BTP		Aug '12 - May '13
Kavita Asiwal (NIT Surathkal)	IP	Fingerprint ridge flow detection	May '12 - July '12
Shashwat Goel	CP	Cricket match score predictor	Jan '11 - May '11

BTP: B.Tech. Project; IP: Independent Project; CP: Course Project

Professional Activities

- **Primary organizer** – "Machine Learning for Creativity" workshop in 23rd SIGKDD Conference on Knowledge Discovery and Data Mining, 2017 (KDD 2017)
- **Member** – ACM, IEEE, IEEE Signal Processing Society
- **Reviewer for**
  - Neural Information Processing Systems (NIPS), 2018
  - Association for the Advancement of Artificial Intelligence (AAAI), 2019
  - International Conference on Learning Representations (ICLR), 2019
  - Computer Vision and Pattern Recognition (CVPR), 2019
  - IEEE Transactions on Information, Forensics and Security (IEEE TIFS)
  - IEEE Transactions on Image Processing (IEEE TIP)
  - IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE PAMI)
  - Pattern Recognition, Elsevier
  - Information Fusion, Elsevier
  - EURASIP Journal on Image and Video Processing
  - Computer Vision and Image Understanding
  - IEEE International Conference on Image Processing
- **Student volunteer** – BTAS 2015, IJCB 2014, ICB 2012.

Talks and Presentations	• The Journey from Shallow to Deep Learning at NCVPRIPG, IIT Mandi, 2017 • "Watson Made Simple with Tanmay Bhakshi", 4th episode, Deep Learning using DARVIZ through IBM Facebook Live, Aug 2017. • Co-organized "Machine Learning for Creativity" workshop at SIGKDD 2017, Halifax, Canada, Aug 2017. • Deep Learning using DARVIZ, Summer School in Deep Learning, IIIT Hyderabad, July 2017. • What the fun is Deep Learning?, IEEE-IISc Deep learning Summit, IISC, June 2017. • Deep Learning Made Easy using DARVIZ, Winter School on Machine Learning in Biometrics, Feb 2017.
Referees	Available on request.