Shreshth Saini

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Education

MSE+PhD in Electrical and Computer Engineering (AI)
The University of Texas at Austin *2022 – 2024*
Supervisor: **Prof. Alan C Bovik**

B. Tech. in Electrical Engineering
Indian Institute of Technology Jodhpur, India *2016 – 2020*
Supervisor: **Dr. Anil K Tiwari**

Research Interests

Computer Vision (CV), Video Engineering, Deep Learning (DL), Machine Learning (ML), Image/Video Processing, Vision models, VR/XR.

Employment and Research Appointments

Graduate Research Assistant **Austin,Texas**
YouTube/Laboratory for Image and Video Engineering, UT Austin *Aug. 2022 – Present*
Supervisor: **Prof. Alan C Bovik**
- Working with **YouTube** to develop novel and scalable algorithms in the field of video engineering.
- Developing Inverse/Tone-Mapping algorithms for **High dynamic range(HDR)** contents upto **12 bits**.
- Create the largest HDR-SDR dataset for short-form videos.
- Non-Linear expansion of extremes of sub-level luminance.
- Scalable vision models for short content.

Research Engineer/Machine Learning Engineer **Singapore**
BioMind *Feb. 2022 – June 2022*
- Developed scalable SOTA **multi-modal deep learning models** for accurate segmentation and classification of **25+** tumor/non-tumor classes.(**Products**)
- Exploited TFRecords for **memory-intense 4D datasets** and proposed novel **multi-task model** for tumor predictions.

Research Engineer-AI **Pune, India**
Arkray, Inc. *Aug. 2020 – Dec. 2021*
- Developed efficient and SOTA AI solutions for highly **noisy 2D and 3D input modalities**.
- Designed and implemented the iterative and **continuous learning pipeline** for AI models to improve labeling.
- Proposed **semi-supervised deep learning model** to learn from a large chunk of the private unlabelled dataset.
- Deployed models for products, namely urine sediment analyzer and automated bodyfluid analysis.(**Aution EYE**)

Research Assistant **Singapore**
National University of Singapore *May 2019 – July 2019*
Supervisor: **Dr. Mengling 'Mornin' Feng**
- Developed novel **deep learning architecture** for large-scale public health datasets.
- Published SOTA results with low cost for skin lesion analysis.
- Helped in organising **NUS-MIT Datathon**, also participated and **won imaging track**.

Undergraduate Researcher **Jodhpur, India**
Image Processing and Computer Vision Lab, IIT Jodhpur *Aug. 2018 – Aug. 2020*
Supervisor: **Dr. Anil Kumar Tiwari**
- Worked on developing machine learning methods aimed for AI-based diagnosis and treatment support.
- Developed novel deep learning models for retinal vessel, skin lesion -segmentation, and diagnosis of left-atrium in 3D GE-MRIs.

Research Intern **Mandi, India**
The Multimedia Analytics, Networks and Systems Lab, IIT Mandi *May 2018 – July 2018*
Supervisor: **Dr. Aditya Nigam**
- Initiated my research work in the field of Biometrics, CV, and ML. Worked on NR-IQA and robust iris segmentation.
- Volunteered in conducting and teaching CNN in international workshop on applied deep learning(**IWADL**).

Publications

Conferences:

1. **M2SLAe-Net:Multi-Scale Multi-Level Attention Embedded Network for Retinal Vessel Segmentation**
   S. Saini, G. Agrawal.
   The IEEE International Symposium on Biomedical Imaging **(IEEE ISBI), 2021** Acropolis-France
2. **(M)SLAe-Net:Multi-Scale Multi-Level Attention Embedded Network for Retinal Vessel Segmentation**[Paper]
   S. Saini, G. Agrawal.
   9th IEEE International Conference On Healthcare Informatics **(IEEE ICHI), 2021**
   (full Oral Presentation) Victoria, British Columbia, Canada
3. **B-SegNet Branched SegMentor Network for Skin Leison Segmentation**[Paper]
   S Saini, YS Jeon, M Feng.
   Association for Computing Machinery Conference on Health, Inference, and Learning **(ACM CHIL), 2021**
   (full Oral Presentation)
4. **Detector-SegMentor Network for Skin Lesion Localization and Segmentation**[Paper]
   S Saini, D Gupta, AK Tiwari.
   National Conference on Computer Vision, Pattern Recognition, Image Processing, & Graphics **(NCVPRIPG), 2019**
   (full Oral Presentation), twin of ICVGIP

Journals:

1. **PixISegNet:pixel-level iris segmentation network using convolutional encoder–decoder with stacked hourglass bottleneck**[Paper]
   RR Jha[1], G Jaswal[1], D Gupta[2], **S Saini**[2], A Nigam.
   The Institution of Engineering and Technology **(IET Biometrics, 2019)**

Book Chapters:

1. **Iris Segmentation in the Wild using Encoder-Decoder based Deep Learning Techniques**[Paper]
   S Saini, D Gupta, RR Jha, G Jaswal, A Nigam.
   AI and Deep Learning in Biometric Security: Trends, Potential and Challenge
   CRC Press (Taylor & Francis Group), 2020

Selected Talks and Achievements

- Awarded Cockrell Engineering (UT Austin) Graduate Fellowship for exceptional academic record, **2022-2027**
- Received Merit-Cum-Means Scholarship from IIT Jodhpur to cover undergraduate expenses, **2017-2019**
- Won medical imaging track at **NUS-MIT datathon**, led a team of 10 data scientists and clinicians, **2019**
- Established undergraduate research group **(LAMBDA)**, group publishes in international conferences, **2018**
- Letter of Appreciation from District Collector (Sirohi) for Academic Excellence, **2013**
- Oral presentation at **IEEE-ICHI, 2021**
- Oral and Poster presentation at **ACM-CHIL, 2021**
- Poster presentation at **IEEE-ISBI, 2021**
- Poster presentation at **NCVPRIPG, 2019**
- Skin Lesion Analysis, **NUS-Singapore, 2019**

Selected Coursework

Computer Science & Electrical
- Machine Learning
- Artificial Intelligence
- Advanced Computer Vision
- Information Theory and Coding
- Digital Image Processing
- Computational Imaging
- Digital Video
- Vision Systems

Mathematics
- Probability, Statistics, and Random Processes
- Linear Algebra and Calculus
- Complex Analysis and Differential Equations
- Adv. Probability and Stochastic Processes
- Statistical Methods I

Others
- Principles of Management
- Professional Ethics
- Basic of Leadership
- IP Management and Exploitation
- Technology Management

Technical Skills

- **Programming Languages:** Python, MATLAB, C++, Git, Bash, SQL, Tex
- **Packages:** Tensorflow, Pytorch, Scikit-Learn, OpenCV, Docker

Position of Responsibilities

Student Leader **Jodhpur, India**
LAMBDA, IIT Jodhpur *Aug. 2018 – Aug. 2020*
- Formally established and led undergraduate search group of 30+ students
"*Learning Approaches For Medical Big Data (LAMBDA)*"

Overall Student Head **Jodhpur, India**
Entrepreneurship Cell, IIT Jodhpur *May 2018 – May 2019*
- Led, Managed and Promoted entrepreneurial activities in and around the institute.
- Organised IdeaSpark, which witnessed participation from pan-India and established entrepreneurs as guests.

Assistant Head **Jodhpur, India**
Counselling Services, IIT Jodhpur *May 2018 – May 2019*
- Organized events and workshops for maintaining positive atmosphere in college and mentored student guides.
- I was given the responsibility to guide freshmen in their personal, professional and academic life.

Vice Captain **Jodhpur, India**
Astronomy Club, IIT Jodhpur *May 2017 – May 2018*
- Organised and supervised the events for astronomy enthusiast within the institute.

References

- Up to 4 references available on request

Additional Projects

Generative/Vision Models

Diffusion models for low level vision tasks **Austin, U.S.A**
Supervisor: **Dr. Zhangyang "Atlas" Wang**, *UT Austin* *Jan. 2023 – Apr. 2023*
- Studied the effect of diffusion time steps, fine-tuning steps, and amount of data in transfer learning and zero-shot for novel diffusion models for super-resolution tasks.
- We compared fine-tuning and zero-shot(Null-Space Model) for animeface and celebHQ datasets.
- We concluded factors such as diffusion fine-tuning for initial (0-500) time steps for 10,000 iterations, and 4000 samples are enough to get good results on Out of distribution (OOD) dataset. .

Vision Transformers for Video Frame Interpolation (FlawLessFrames) **Austin, U.S.A**
Supervisor: **Prof. Alan C Bovik**, *UT Austin* *Jan. 2023 – Apr. 2023*
- Proposed novel vision Transformer architecture for Video Frame Interpolation without the need for Optical Flows.
- Optical flow is an extra step, which is computationally expensive.
- We exploit self-attention to put it across frames and force the model to learn object motions implicitly.
- We get comparable results on the DAVIS dataset.

Biometrics

Robust Iris Segmentation for Biometric systems[Paper] **Mandi, India**
Supervisor: **Dr. Aditya Nigam**, *IIT Mandi* *May 2018–Nov 2018*
- Proposed a new segmentation network for challenging case of non ideal iris whilst capturing the image.
- Network consisted of Convolutional Neural Network based Encoder-Decoder with stacked Hourglass bottleneck.
- Achieved state of the art results (jaccard index of 0.92) on publicly available datasets of iris.

No Reference Biometric Image Quality Assessment **Mandi, India**
Supervisor: **Dr. Aditya Nigam**, *IIT Mandi* *May 2018 – July 2018*
- Explored deep neural networks for hand based (palm, finger, and knuckle) biometric image quality assessment.
- Network pipeline consisted of two parts: (i) Image-Re-constructor and (ii) The Quality Score Regressor.
- The proposed Network on outperformed the practical classical methods.

General

Multipath Super Resolution Network with Novel loss **Jodhpur, India**
Supervisor: **Dr. Rajendra Nagar**, *IIT Jodhpur* *Jan. 2020 – June 2020*
- Developed a multipath deep neural network for aggreation of global and fine local features for super resolution.
- Incorporated sub-pixel shuffling along with the novel weighted pixel-perceptual loss for sharp image reconstruction.
- Model was trained in end-to-end manner from scratch on T91 and evaluated on BSDS100, Set14, and Set5.