

# VIRAJ SHAH

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## INTEREST AREAS

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Computer Vision, GANs and Generative Models, Inverse Problems in Imaging, Deep Learning, Signal Processing

## EDUCATION

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Jan. '20 - May '24 (expected)	<b>University of Illinois at Urbana-Champaign (UIUC)</b> <i>Ph.D., Electrical Engineering</i> , CGPA: 4.00/4.00
2016 - 2019	<b>Iowa State University</b> <i>M.S. (thesis), Electrical Engineering</i> , CGPA: 3.89/4.00
2012 - 2016	<b>Indian Institute of Technology (IIT), Roorkee</b> <i>B.Tech., Electrical Engineering</i> , CGPA: 8.97/10

## ACADEMIC HONORS

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- Recipient of **James M. Henderson Fellowship** (for 2020-21) at ECE Department, UIUC. [[News](#)]
- Received **2<sup>nd</sup>** prize in **Open Data Challenge 2019** organized by Materials Research Society. [[News](#)]
- Recipient of prestigious **Departmental Fellowship** from ECpE department, Iowa State University.
- Ranked in **top 5%** among 144 students in undergraduate class, EE Department, IIT Roorkee.

## RESEARCH INTERNSHIPS

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**Applied Science Intern at Amazon, Seattle** Summer and Fall, 2021  
*Advisor:* Dr. Aleix Martinez

- Developed novel algorithm for **GAN Inversion** by leveraging insights from signal processing literature to solve image manipulation tasks on complex scenes. Manuscript is under review at a top-tier conference venue.

**Research Intern in AI group at Siemens Healthineers, Princeton** Summer, 2019  
*Advisor:* Dr. Mariappan Nadar

- Analyzed **adversarial robustness** of deep learning-based inverse recovery models used in MRI.
- Implemented state-of-the-art attacks and defenses for the **U-Net-based image reconstruction model**. Resulting model shows **improvements in robustness** against adversarial attacks, implemented in **PyTorch**.

## RESEARCH EXPERIENCE

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[...] refers to **publications** section

**Research Assistant at Computer Vision and Robotics Lab, UIUC** Spring, 2020 - May, 2021

- Worked on developing **novel deep learning architectures** that leverage frequency domain representations of images, implemented in **TensorFlow and Keras**.

**Research Assistant at DICE Lab, Iowa State University** Fall, 2016 - Fall, 2019  
*Advisor:* Dr. Chinmay Hegde

- *GANs for solving imaging problems:* Developed algorithms with provable guarantees that employ **generative priors** to solve imaging inverse problems such as compressive sensing [2, 3, 4], implemented in TensorFlow.
- *Physics-aware generative models:* Developed **GANs** that explicitly enforce known physical invariances in the training process to synthesize physics-compliant representations [5, 6, 7, 8].
- *High Dynamic Range(HDR) photography using modulo imaging:* Designed (provable) algorithms with sub-Nyquist sample complexity for a HDR reconstruction from modulo and quantized modulo observations [9, 10, 11].
- *Modeling multidimensional risk in drivers with Diabetes:* Performed **big data analysis** using **Pandas and R** to predict driver glycemic state and associated risk using real-time measurements of driver physiology [12, 13].

## SELECTED PUBLICATIONS & PREPRINTS

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1. A paper on Image Manipulation using GANs, *under review* at a top-tier conference.
2. **V. Shah**, R. Hyder, M. Asif, and C. Hegde, Provably Convergent Algorithms for Solving Inverse Problems Using Generative Models, *under review*. (preprint [arXiv:2105.06371](#))
3. **V. Shah** and C. Hegde, Solving Linear Inverse Problems using GAN Priors: an Algorithm with Provable Guarantees, *International Conference on Acoustics, Speech, and Signal Processing - ICASSP, 2018*. (preprint [arXiv:1802.08406](#))
4. R. Hyder, **V. Shah**, C. Hegde, and M. Asif, Alternating Phase Projected Gradient Descent with Generative Priors for Solving Compressive Phase Retrieval, *International Conference on Acoustics, Speech, and Signal Processing - ICASSP, 2019*. (preprint [arXiv:1903.02707](#))
5. **V. Shah**<sup>1</sup>, A. Joshi<sup>1</sup>, S. Ghosal, B. Pokuri, S. Sarkar, B. Ganapathysubramanian, and C. Hegde, Encoding Invariances in Deep Generative Models. (preprint [arXiv:1906.01626](#))  
<sup>1</sup> Equal contribution.
6. A. Joshi<sup>1</sup>, **V. Shah**<sup>1</sup>, S. Ghosal, B. Pokuri, S. Sarkar, B. Ganapathysubramanian, and C. Hegde, Generative Models for Solving Nonlinear Partial Differential Equations, *NeurIPS 2019 Workshop on Machine Learning and the Physical Sciences*. ([preprint](#))  
<sup>1</sup> Equal contribution.
7. A. Joshi, M. Cho, **V. Shah**, B. Pokuri, S. Sarkar, B. Ganapathysubramanian, C. Hegde, InvNet: Encoding Geometric and Statistical Invariances in Deep Generative Models, *AAAI 2020 Conference on Artificial Intelligence*.
8. R. Singh<sup>1</sup>, **V. Shah**<sup>1</sup>, B. Pokuri, S. Sarkar, B. Ganapathysubramanian, and C. Hegde, Physics-aware Deep Generative Models for Creating Synthetic Microstructures, *NeurIPS 2018 Workshop on Machine Learning for Molecules and Materials*. (preprint [arXiv:1811.09669](#))  
<sup>1</sup> Equal contribution.
9. **V. Shah** and C. Hegde, Sparse Signal Recovery from Modulo Observations, *EURASIP Journal on Advances in Signal Processing, 2020*. ([article](#))
10. **V. Shah** and C. Hegde, Signal Reconstruction from Modulo Observations, *Global Conference on Signal and Information Processing - GlobalSIP, 2019* (preprint [arXiv:1812.00557](#))
11. **V. Shah**, M. Soltani, and C. Hegde, Reconstruction from Periodic Nonlinearities, with Applications to HDR Imaging, *Asilomar Conference on Signals, Systems, and Computers, 2017*. (preprint [arXiv:1710.00109](#))
12. **V. Shah**, J. Merickel, P. Charkraborty, A. Sharma, C. Hegde,..., M. Rizzo, Quantifying driver speed behavior from real-time physiology in type 1 diabetes, *International Symposium on Future Active Safety Technology, 2019*.
13. P. Charkraborty, J. Merickel, **V. Shah**, A. Sharma, C. Hegde,..., M. Rizzo, Quantifying Vehicle Control from Physiology in Type 1 Diabetes, *Journal for Traffic Injury Prevention, Association for the Advancement of Automotive Medicine (AAAM), 2019*.

## TECHNICAL SKILLS

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<b>Programming</b>	Python, Matlab, R, C++
<b>Deep Learning packages</b>	PyTorch, TensorFlow, Keras, Scikit-Learn, OpenCV, Pandas
<b>Web and design aids</b>	HTML, css, js, InkScape, Photoshop, L <sup>A</sup> T <sub>E</sub> X

## LEADERSHIP & SERVICE

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- **Outreach Coordinator**, [Data Science Reading Group](#), & [Summer Reading Group](#), Iowa State University.
- **Frontend Designer & Web-developer**, [Information Management Group \(IMG\)](#), IIT Roorkee.
- **Coordinator**, IEEE IIT Roorkee Students Chapter & [IEEE Special Interest Group](#).
- **Mentor**, IEEE Mentorship Program, IEEE IIT Roorkee Students Chapter.
- **Reviewer**, IEEE Transactions on Signal Processing (TSP).
- **Reviewer**, EURASIP Signal Processing.