

# Abeer Banerjee

@ abeer.ceeri20a@acsir.res.in |  LinkedIn |  Website |  India

## ABOUT

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I am currently a third-year Integrated Ph.D. scholar at CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani, India. My academic pursuits revolve around the exploration of learning-based image reconstruction methods for computational imaging, under the supervision of Dr. Sanjay Singh. Beyond my scholarly endeavors, I find great fascination in the fields of philosophy and photography.

## EDUCATION

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<b>Academy of Scientific and Innovative Research (AcSIR)</b> <i>Integrated Dual-Degree Ph.D.; CGPA: 9.13/10</i> <i>Topic: Computational Imaging; Advisor: Dr. Sanjay Singh</i> <i>Master's Thesis: Generative Colorization of Grayscale Images [Report]</i>	Pilani, India 2020 – Present
<b>Institute of Radio Physics and Electronics (IRPE), University of Calcutta</b> <i>B.Tech in Electronics and Communications Engineering; CGPA: 8.64/10</i> <i>Advisor: Dr. Ashik Paul, Professor, IRPE, University of Calcutta</i> <i>Thesis: Portable multi-constellation satellite navigation module [Synopsis]</i>	Kolkata, India 2016 – 2020

## RESEARCH EXPERIENCE

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<b>Senior Research Fellow</b> <i>Advanced Information Technologies Group, CSIR-CEERI</i> <ul style="list-style-type: none"><li>Solving inverse-problems in computational imaging using deep-learning techniques. The current research focus is on robust learning-based image reconstruction in the low-data regime.</li><li>Imaging and image processing with neuromorphic vision sensors for tasks like fall-detection, eye-gaze estimation, etc.</li><li>Other research activities include mentoring junior lab members in the area of deep learning for image processing.</li></ul>	Sep 2022 – Present
<b>Junior Research Fellow</b> <i>Intelligent Systems Group, CSIR-CEERI</i> <ul style="list-style-type: none"><li>Worked on deep learning methods for image processing. The research focus was on the restoration of historical images using state-of-the-art generative adversarial networks.</li><li>Worked on defect detection of power-line infrastructure using aerial images. Performed few-shot defect detection of power-line components with ensembled convolutional neural networks using only about 20 to 25 images.</li><li>Involved in deep-learning-based face anti-spoofing in uncontrolled environments that could be employed in high-security scenarios for robust facial recognition.</li></ul>	Sep 2020 - Sep 2022
<b>Research Intern</b> <i>DRDO-Instruments Research and Development Establishment</i> <ul style="list-style-type: none"><li>Worked on infrared image processing techniques for military applications under the supervision of Dr. Himanshu Singh, Scientist F, Vision Instrumentation Lab.</li><li>Performed edge-preserved smoothing of infrared thermal images using various classical image filtering algorithms.</li></ul>	Jun 2018 - Aug 2018

## PEER-REVIEWED PUBLICATIONS

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**Abeer Banerjee**, Himanshu Kumar, Sumeet Saurav, and Sanjay Singh, Reconstructing Synthetic Lensless Images in the Low-Data Regime, In *34th British Machine Vision Conference*. BMVC Proceedings. **BMVC 2023** CORE rank A (Accepted).

**Abeer Banerjee**, Sumeet Saurav, and Sanjay Singh, Physics-informed Deep-Deblurring: Under-parameterized vs. Over-parameterized, In *30th International Conference on Image Processing*. IEEE Proceedings. **IEEE-ICIP 2023** CORE rank B. [\[Link\]](#)

**Abeer Banerjee**, Himanshu Kumar, Sumeet Saurav, and Sanjay Singh, Lensless Image Reconstruction with Untrained Neural Network, In *37th International Conference on Image and Vision Computing New Zealand (pp. 430-441)*. Cham: Springer Nature Switzerland. **IVCNZ 2022 CORE rank C**. [Link]

Himanshu Kumar\*, **Abeer Banerjee\***, Sumeet Saurav, and Sanjay Singh, ParaColorizer: Realistic Image Colorization using Parallel Generative Networks. \*Equal Contribution. The Visual Computer Journal, Springer 2023, SCI Impact Factor: 3.5 (Accepted). [Link]

**Abeer Banerjee**, Shyam Sunder Prasad, Naval Mehta, Himanshu Kumar, Sumeet Saurav, and Sanjay Singh, *Gaze Detection using Encoded Retinomorphic Events*, Gaze Detection Using Encoded Retinomorphic Events. In *14th International Conference on Intelligent Human Computer Interaction (pp. 442-453)*. Cham: Springer Nature Switzerland. **IHCI 2022**. [Link]

Soumyajit Karmakar, **Abeer Banerjee**, Prashant Sadashiv Gidde, Sumeet Saurav, and Sanjay Singh, Convolutional Ensembling-based Few-Shot Defect Detection Technique, In *Proceedings of the Thirteenth Indian Conference on Computer Vision, Graphics and Image Processing (pp. 1-7)*. **ICVGIP 2022**. [Link]

Shyam Sunder Prasad, Naval Mehta, **Abeer Banerjee**, Sumeet Saurav, and Sanjay Singh, JS-SpoofNet: A Jointly Supervised Parallel Branched Neural Network for Spoof Detection. Neurocomputing Journal, Elsevier 2023, SCI Impact Factor: 6.0 (Accepted). [Link]

Shyam Sunder Prasad, Naval Mehta, **Abeer Banerjee**, Himanshu Kumar, Sumeet Saurav, and Sanjay Singh, Real-Time Privacy-Preserving Fall Detection using Dynamic Vision Sensors, In *IEEE 19th India Council International Conference (pp. 1-6)*. **IEEE-INDICON 2022**. [Link]

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## COPYRIGHTS

**Abeer Banerjee**, Himanshu Kumar, Sumeet Saurav, and Sanjay Singh, AI-enabled Software Module for Realistic Colorization of Grayscale Images, Copyright Registered, CR Diary/Application No. 15782/2023-CO/SW, Date of Filing: 08/06/2023, Registration No. SW-17058/2023, Date of Registration: 08/08/2023.

Shyam Sunder Prasad, Naval Kishore Mehta, **Abeer Banerjee**, Sumeet Saurav, Ravi Saini, and Sanjay Singh, AI-based Software Package for Real-time Face Anti-spoofing Detection in Unconstrained Natural Environment, Copyright Registered, CR Diary/Application No. 15783/2023-CO/SW, Date of Filing: 08/06/2023, Registration No. SW-16929/2023, Date of Registration: 20/07/2023.

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## RELEVANT RESEARCH PROJECTS

**Lensless Image Reconstruction with AI (ongoing)** | Funded by CSIR-CEERI and CSIR-HRDG

- As an integral part of my PhD research work, I work on the reconstruction of lensless images using various AI-based methods. I focus on reconstruction in the low-data regime which is particularly tricky for deep-learning networks because they typically require high amounts of data for training.
- The resulting research on [Physics-informed Deep Deblurring] and [Low-shot Lensless Imaging] has been published at ranked international conferences like BMVC, ICIP, and IVCNZ.

**Retinomorphic Vision with AI** | Funded by CSIR-CEERI

- We estimated human saccadic eye motion using data from retinomorphic sensors. The resulting research paper was selected as an oral presentation at the peer-reviewed International Conference on Intelligent Human-Computer Interaction, in 2022.
- We detected human falling actions using retinomorphic sensors and were able to achieve real-time performance at the edge-device using a lightweight 3D-CNN framework. The resulting research paper was presented at the India Council International Conference, in 2022.

**Historical Image Restoration with AI** | Funded by CSIR-CEERI

- For most of the historical images being grayscale, the task was to colorize them while restoring their quality. This ill-posed inverse problem was solved using parallel generative adversarial networks. The resulting research paper has been published in The Visual Computer Journal, Springer.

**Arduino-based Flight Controller** | Funded by TEQUIP-III

- Instead of using commercially available Flight controllers like APM 2.8, the complete PID logic was implemented on Arduino UNO. We participated at the Quadrone@Cognizance-2018, IIT Roorkee with our custom-made quadcopter.

## Man-Operated Car Having AI (MOCHA)

- This project earned us the first runner-up position at the Science and Tech. Exhibition cum Competition, STEX 2018, organized by IEEE Photonics Society Kolkata Chapter.
- We built a DTMF-controlled all-terrain toy car with a rocker-bogie mechanism having an off-the-shelf camera unit to capture images. The images were then processed by ResNet to obtain generalized predictions.

## SKILLS

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**Programming:** Python, MATLAB, L<sup>A</sup>T<sub>E</sub>X

**Libraries:** PyTorch (preferred), Tensorflow, OpenCV

**Languages:** English (TOEFL 2020: 96/120), Bengali (Native), Hindi (Limited)

## RELEVANT COURSEWORK

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**Integrated Ph.D. Coursework:** Research Methodology; Research Publications and Ethics, Advanced Engineering Mathematics; Signal Processing and Machine Learning; Image Processing and Computer Vision; Real-Time Autonomous Systems; Modelling and Simulation

**Bachelor's Coursework:** Engineering Mathematics; Physics; Signals and Systems; Control Theory and Systems; Digital Signal Processing; Data Structures and Algorithms; Microprocessors and Microcontrollers; Mobile and Satellite Communications

## AWARDS & ACHIEVEMENTS

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**SRF-GATE 2022:** A three-member expert assessment committee recommended the upgradation of my fellowship status to Senior Research Fellow (GATE), given my performance and publications during my tenure as a junior research fellow.

**JRF-GATE 2020:** Junior Research Fellowship (GATE) is awarded to selected students in the Integrated Dual Degree Ph.D. program who have qualified Graduate Aptitude Test in Engineering (GATE) and are recommended by the selection committee duly approved by the Director of their respective host institute.

**Certificate of Excellence by DRDO 2018:** Awarded by DRDO-Instruments Research and Development Establishment, under the supervision of Dr. Himanshu Singh, Scientist, for my performance during my tenure as a research intern.

**Felicitation for Academic Excellence 2016:** Awarded by Hem-Sheela Model School, Durgapur, West Bengal, India, for scoring **94.0%** in the Senior Secondary Examination (AISSCE-CBSE).

**Felicitation for Academic Excellence 2014:** Awarded by Pranavananda Vidya Mandir, Durgapur, West Bengal, India, for scoring **90.4%** in the Secondary Examination (CISCE-ICSE).