Ripon Kumar Saha

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Education

- **Arizona State University** — Arizona, US
  PhD in Computer Engineering (Computer Vision) — *January 2021 - Present*
  - **Relevant Courses**: Physics-Based Computer Vision, Machine Vision & Pattern Recognition, Algorithms, Random Signal Theory
- **Gwangju Institute of Science and Technology** — Gwangju, South Korea
  Master of Science in Biomedical Science & Engineering — *August 2018 - December 2020*
  - **Relevant Courses**: Computer Vision, Deep Learning, Advanced Deep Learning, Biomedical Optics
  - **Award**: Recipient of the South Korean Government Scholarship
- **Jessore University of Science and Technology (JUST)** — Jessore, Bangladesh
  Bachelor of Science in Computer Science & Engineering — *February 2012 - December 2017*

Technical Skills

- **Programming Languages**: Python, MATLAB, C, C++, Java, SQL, Bash, JavaScript
- **Frameworks & Libraries**: PyTorch, TensorFlow, Keras, Fast.AI, Pandas, NumPy, Scikit, NLTK, OpenCV, Flask, J2EE
- **Machine Learning & AI**: CNN, FCN, RNN, LSTM, Diffusion Models, GAN, Transformers
- **Data Visualization and Analysis**: Tableau, Microsoft PowerBI, Seaborn, Origin-Pro, GraphPad
- **High-Performance Computing**: Batch Scripting, GPU Clusters, Python Multi-Processing, Dask, Cython
- **Version Control and DevOps**: Git, Docker, MySQL

Experience

- **Kitware Inc.** — Minneapolis, MN
  Summer Internship — *May 2024 - Aug 2024*
  - **Deep Learning and Computer Vision Methods**: Applied deep learning and computer vision methods for object detection, event/activity recognition, and video/image search, calculating uncertainty in object recognition and detection in long-range video footage.
  - **Data Utilization**: Utilized data from ground, handheld, aerial, or satellite cameras, advancing real-time segmentation, enhancing multiple degraded videos, optimizing performance, and emphasizing object feature preservation.
- **Imaging Lyceum Lab, Arizona State University** — Tempe, AZ
  Research Assistant — *January 2021 - Present*
  - **Dynamic Scene Restoration**: Designed a physics-based deep learning model for dynamic scene restoration affected by atmospheric turbulence with Ultra-Zoom or astrophotography camera, presenting findings to colleagues and students.
  - **Research Contributions**: Contributed to research on computational imaging and photography, computer vision, and visual/perceptual experience with a focus on challenges posed by atmospheric turbulence in Ultra-Zoom and astrophotography cameras.
- **Alphacore Inc.** — Tempe, AZ
  Doctorate Student Collaborator — *March 2021 - August 2023*
  - **Field Experiments**: Managed onsite field setup with telescopes, drones, cameras, weather stations, & scintillometers.
  - **Atmospheric Turbulence Model**: Built a deep learning model for Atmospheric Turbulence estimation for varying focus distances, light intensity, platform motion, and camera shake while analyzing extensive multidimensional data from various sensors.
- **Lightsense Technology Inc.** — Tucson, AZ
  Summer Intern — *June 2022 - August 2022*
  - **AI Model Development**: Developed an AI model for Covid-19 classification using spectral data and ML techniques.
  - **Spectral Unmixing Solutions**: Developed spectral unmixing solutions for bacteria samples, analyzing viruses in saliva and buffer solutions using the PARAFAC algorithm and various preprocessing techniques.
- **NeuroPhotonics Lab, Gwangju Institute of Science and Technology** — Gwangju, South Korea
  Research Assistant - Machine Learning and Computer Vision — *August 2018 - December 2020*
  - **Deep Learning Architecture**: Designed a multimodal deep learning architecture for Meibomian Gland analysis with GAN in PyTorch, Resnet50, and encoder-decoder based network for segmentation and qualitative analysis.
  - **Automated Assessment**: Enabled automated assessment of infrared images of tear film, detecting and segmenting out the eye gland area, removing the specular reflection, and releasing a dataset of 1,600 infrared images with annotated MASK for public use.

Projects

- **Multimodal approach for atmospheric image degradation (2024)**: Developed a multimodal system integrating image quality metrics with meteorological data using a Kolmogorov Arnold Network (KAN) to predict atmospheric image degradation, surpassing previous state-of-the-art methods in accuracy and generalizability.
- **AI Chat Assistant for Oral History Documentation (2022)**: Developed an AI platform for U.S. refugee oral histories using LLMs, integrating Transformer and T5 models for intent recognition and responses. Utilized Whisper and Google TTS for voice interactions.
- **Real-Time Atmospheric Turbulence Video Simulator (2022)**: Developed a high-speed simulator in Python for real-time applications, simulating 3 sets of simplex noise for realistic movement and coherent video, producing 4k/8k resolution atmospheric turbulence.
- **Turbulence-Resistant Object Segmentation (2021)**: Built a Region Growing algorithm for object segmentation in turbulent videos, minimizing degradation in long-range observation systems. Refined with a two-stage process using optical flow and RAFT, validated with real-world data.
- **Blood Glucose Prediction via CV (2020)**: Designed an architecture to analyze images of custom contact lenses in various color spaces, leveraging spectroscopy for measurements, achieving 85% accuracy in blood glucose prediction.
- **Denoising Low Light Images with DL (2019)**: Introduced deep learning-based low-light image enhancement, designed a U-Net architecture in PyTorch, trained with short exposure dark images and 67GB long exposure images on RTX 2080Ti.
- **3D Point Cloud and Mesh from Motion (2018)**: Analyzed images from different viewpoints, estimating the fundamental matrix and camera poses in 3D space, providing 3D point cloud information, converting to 3D Mesh using MeshLab.
- **Focus-Stacked Imaging (2018)**: Aligned images based on SIFT, determining depth from focus measure, combining focus points to produce an all in-focus image, broadening depth of field, and reducing blur.
- **Diffraction Microscopy Setup (2017)**: Built an optical setup with two cameras, a beam splitter, laser beam, and various lens elements, collaborating to develop Confocal, Abbe diffraction, and Light-sheet microscopes.

Publications

- **Turb-Seg-Res: A Segment-then-Restore Pipeline for Dynamic Videos with Atmospheric Turbulence**: Saha, Ripon Kumar, Qin D, e J, Li N, and Jayasuriya S, **CVPR 2024**
- **Unsupervised Region-Growing Network for Object Segmentation in Atmospheric Turbulence**: Qin D, Saha, Ripon Kumar, Jayasuriya S, Ye J, and Li N, **ECCV 2024**
- **Automated Quantification of Meibomian Gland Dropout in Infrared Meibography using Deep Learning**: Saha, Ripon Kumar, Chowdhury AM, Na KS, Hwang GD, Hwang H, and Chung E, **Ocular Surface 2022**
- **Turbulence Strength C2n Estimation from Video using Physics-based Deep Learning**: Saha, Ripon Kumar, Esen S, Jihoo K, Joseph S, and Suren J, **Optics Express 2022**
- **Electrocorticography-Based Motor Imagery Movements Classification using LSTM based on Deep Learning Approach**: Rashid M, Islam M, Sulaiman N, Bari BS, Saha, Ripon Kumar, Hasan MJ, **SN Applied Science 2020**
- **MetaVIn: Meteorological and Visual Integration for Atmospheric Image Degradation Estimation**: Saha, Ripon Kumar, Mccloskey S, Jayasuriya S, **submitted to WACV 2025**

Honors, Awards, and Additional Information

- **1st Place Winner**: BuildwithAI Hackathon (4,000 participants, 70 countries) 2020
- **Recipient of the "Most Active Online Attendee" Award**: European Conference on Computer Vision 2020
- **Reviewer**: Reviewer for WACV, IEEE Access, Journal of Optics Express, and Applied Optics
- **Volunteering**: Co-Organizer, cholopaltai.org (2018); Programming Instructor, Jessore University (2014 - 2015)