

Ayush Gupta

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Ph.D. Applicant (Fall 2024)

Education **Indian Institute of Technology (IIT) Kanpur, India** *2019 - Present*
Master of Technology, Civil Engineering
GPA: **9.6/10.0**
Bachelor of Technology, Civil Engineering
GPA: **7.7/10.0**

Research Interests

- Machine Learning for Remote Sensing & Earth Observation
- Multi-Sensor data fusion for Geodetic Applications
- Application of InSAR for monitoring Cryosphere & Crustal Deformation

Publications

- **A. Gupta**, R. Mishra and Y. Zhang, "SenGLEAN: An End-to-End Deep Learning Approach for Super-Resolution of Sentinel-2 Multi-Resolution Multispectral Images," in IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2024.3374575
- **Gupta, A.**, Devaraju, B., and Tiwari, A.: Processing Pipeline for Computing Time Series of 3D Glacier Surface Flow and Mass Balance, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-831, <https://doi.org/10.5194/egusphere-egu24-831>, 2024

Honors & Awards

- Recipient of **Class of 1968 Scholarship** in IIT Kanpur for Fall'20 semester
- MITACS Globalink Research Internship fellow at University New Brunswick, Fredericton
- Secured a rank in the top 0.5% in the JEE-Mains Examination among 1.1 million candidates

Research Projects

Monitoring Glacier flow using Geodetic Sensors *Advisor: Prof. Balaji Devraju, IIT Kanpur, India* *Spring'22 - Present*

- Explored various research methodologies concerning SAR Data, including DInSAR and Offset Tracking, for estimating glacier flow velocities
- Developed an efficient end-to-end pipeline for performing multi-temporal Pixel-Offset Tracking using Small Baseline Subset (SBAS) for Sentinel-1 data
- Systematically tracked the time series of 3D displacements for Himalayan glaciers by leveraging paired ascending and descending acquisitions, enabling comprehensive glacier monitoring
- Investigated the patterns in glacier flow for the years 2014 through 2021 for the glaciers in the Chandra Bhaga sub-basin

Super-Resolving Sentinel-2 Multispectral Images using Deep Learning *Advisor: Dr. Rakesh Mishra, University of New Brunswick, Canada* *Summer'23*

- Designed and implemented SenGLEAN model, merging SISR and pansharpener techniques
- Improved model precision by integrating attention mechanism, enhancing feature utilization
- Showcased superior performance through rigorous comparison with state-of-the-art methods
- Developed a lightweight variant LightSenGLEAN with significantly reduced parameters (81.89% reduction) while preserving accuracy and efficiency

Learn in-the-wild Texture maps for 3DMM faces *Advisor: Prof. Patrik Huber, University of York, UK* *Spring'21 - Fall'21*

- Developed a deep-learning generative model to learn in-the-wild texture maps for 3D Morphable Model (3DMM) faces using the CelebA-HQ dataset
- Implemented mesh registration to produce a dataset, enabling the creation of texture maps through the utilization of the headspace dataset texture map
- Built a texture completion pipeline to generate high-resolution complete texture maps employing GAN-based models using a very small dataset
- Implemented and experimented with different GAN-based models to learn the texture maps of 3D Morphable Faces

Industrial Research Internship	<p>Field Level Crop Loss Prediction <i>Advisor: Dr. Ashutosh Tiwari & Anil Soni, Munich RE, India</i> <i>Spring'21</i></p> <ul style="list-style-type: none"> ● Studied basics of remote sensing and effects of different bands on crop health ● Extracting Multi-Spectral satellite Optical data from the Sentinel-2, and SAR data from Sentinel-1 and prepared various agricultural indices ● Engineered an advanced algorithm for generating missing cloud cover data, utilizing a cutting-edge conditional Generative Adversarial Network (cGAN) based deep learning model ● Built a ConvLSTM-based regression model for predicting the field-level crop loss using time series of Optical and SAR data throughout the season
Professional Experience	<p>Instructional Caption and Video based Anomaly Detection <i>Siemens Technology and Services Private Limited</i> <i>Summer'22</i></p> <ul style="list-style-type: none"> ● Developed anomaly detection algorithm using video and corresponding instructional caption ● Proposed frame sampling using CNN-based model for sampling information-rich frames ● Utilized KL divergence loss on Singularity model for balancing training between text and vision encoder enhancing the learning process
Selected Course Project	<p>Ocean circulation from Altimetry and GOCE data <i>Advisor: Prof. Balaji Devraju, IIT Kanpur, India</i> <i>Spring'23</i></p> <ul style="list-style-type: none"> ● Computed Sea-Surface Height (SSH) using altimetry data and applied all the corrections ● Leveraged ITU GGC16 gravity field derived from the combination of GRACE and GOCE to compute Mean Dynamic Topography (MDT) ● Filtered MDT using anisotropic filtering for removing noise while preserving gradients ● Computed geostrophic currents and observed global currents in the region of the Indian Ocean
Teaching Experience	<p><i>Teaching Assistant, Geoinformatics</i> <i>Present</i> <i>Instructor: Prof. Bharat Lohani, IIT Kanpur, India</i></p>
Technical Skills	<p>Programming Languages: C, C++, Python, MATLAB, Javascript Softwares: QGIS, ArcGIS, GDAL, L^AT_EX ML Frameworks: Tensorflow, PyTorch, Scikit-learn, Keras Laboratory Equipment: Auto Level, Total Station, GNSS Receiver</p>
Relevant Coursework	<p>Graduate Courses</p> <ul style="list-style-type: none"> <li style="width: 50%;">● Environmental Geodesy <li style="width: 50%;">● Physical Geodesy <li style="width: 50%;">● Introduction to Machine Learning <li style="width: 50%;">● Geographical Information System <p>Other Relevant Courses</p> <ul style="list-style-type: none"> <li style="width: 50%;">● Fundamentals of Computing <li style="width: 50%;">● Data Mining and Knowledge Discovery <li style="width: 50%;">● Image Processing <li style="width: 50%;">● Linear Algebra <li style="width: 50%;">● Applied Probability and Statistics <li style="width: 50%;">● Data Structure and Algorithm
University Involvement	<p>Secretary, Programming Club, IIT Kanpur <i>Fall'20 - Spring'21</i></p> <ul style="list-style-type: none"> ● Wrote articles on various topics like Machine Learning, GANs etc ● Conducted hands-on sessions on basics of machine learning for 300+ first year students. ● Organised various hackathons for campus community <p>Secretary, Consulting Group Society, IIT Kanpur <i>Fall'20 - Spring'21</i></p> <ul style="list-style-type: none"> ● Contacted various NGOs proposing ML-based solutions for some of their problems ● Implementing the machine learning solution for those organizations.
Extra Curricular	<ul style="list-style-type: none"> ● Won 3 Gold medals at KVS Nationals Sports Meet 2018 in roller skating ● Won 1 Gold and 1 Silver medal in 1500m & 400m Athletics events at Agaz Sports Event 2019 ● Junior Executive to conduct the athletics events at Udghosh'19 (Sports Fest, IIT Kanpur) ● Volunteered to help organize women's cell's annual 5km run at IIT Kanpur