Vishal Pani

PERSONAL INFORMATION

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DoB & Nationality	:	31.08.1998 | Indian

EDUCATION

Master in Computer Science — CGPA – 5.48/6 (Until 2nd semester)
École polytechnique fédérale de Lausanne (EPFL) — **Sep 2021 - Present**

Bachelor of Technology (Honors) in Information Technology
Indian Institute of Information Technology (IIIT), Allahabad, India — CGPA - 9.44/10 — **Jul 2017 - Jun 2021**

Senior Secondary School (CBSE, AISSCE)
Anandalaya Gujarat, India — 93.2% — **Mar 2016 - Mar 2017**

RESEARCH INTERESTS: Computer Vision, Rendering, Computer Graphics, Geometry Processing.

RELEVANT COURSES: Advanced Computer Graphics, Geometric Computing, Machine Learning, Graphics and Visual Computing.

PUBLICATIONS:

TrichTrack: Multi-Object Tracking of Small-Scale Trichogramma Wasps. — **Nov 2021**
In Proceedings of the 17th IEEE Int'l Conf on Advanced Video and Signal-based Surveillance, AVSS 2021

TECHNICAL SKILLS

Languages: [Python, C/C++] *(proficient)*, [Java, JavaScript, Go] *(good)*, [MATLAB] *(basic)*.
Rendering: [Mitsuba3] *(good)*, [OpenGL] *(basic)*.
Data Processing & ML Libraries: [NumPy, Pandas, PyTorch] *(proficient)*, [scikit-learn, fastai, Keras] *(good)*.
Others: [Google Colab, Jupyter Notebook] *(proficient)*, [MS Office, LaTeX] *(good)*, [Google Cloud, Unity] *(basic)*.

WORK/RESEARCH EXPERIENCE

Research Assistant, Realistic Graphics Lab (RGL), EPFL, Switzerland — **July 2022 – Present**
Goniophotometer Calibration & Verification of Differentiable Rendering Algorithms
Supervisor: Dr. Wenzel Jakob

- Calibrated the camera on a goniophotometer in order to match real-world captures with Mitsuba renders.
- Optimized for the pixel reprojection error by improving the camera model and using image-level transformations.
- Resultant pipeline reduced the pixel reprojection error from an initial average of ~10 pixels to ~1 pixel.
- Currently integrating the pipeline to reproduce results of Differentiable Rendering algorithms from real-world captures.

Research Intern (Bachelors Thesis), Inria STARS team, Sophia Antipolis, France — **Jan 2021 – July 2021**
Multi-Object Tracking of Small-Scale Trichogramma Wasps (In collaboration with Institut Sophia Agrobiotech)
Supervisor: Dr. Francois Bremond

Researched Multi-Object Tracking and Re-ID methods to study interactions between Trichogramma wasps over a long horizon.

- Developed a robust two-stage online tracker to handle the erratic movements of generic small-scale objects, in our case, Trichogramma wasps. The tracker is also extendable to any scenario where objects may enter or exit the scene.
- Designed a weakly supervised sampling technique for training the ReID model, due to the unavailability of ground truth (GT) tracking annotations.
- By overcoming the problems posed by erratic movement and sparse features, the tracking pipeline outperforms SOTA insect and animal tracking softwares on MOT metrics, specifically, MOTA, Identity (ID) switches, and fragmentations.

Research Intern (Summer Internship), Institute of Photogrammetry, University of Stuttgart, Germany — **May 2020 – Dec 2020**
On the Association of Textured Meshes and Imagery for Multi-Modal Semantic Segmentation
Supervisor: apl. Prof. Dr.-Ing. Norbert Haala

Developed ray casting and semantic segmentation (SS) modules to project 3D textured city meshes to 2D imagery for SS.

- Programmed a parallelized ray casting module to transfer the data (labels, depth, etc.) in the meshes to the image using NumPy and trimesh libraries of python; parallelization offers over 10x speed-up over the sequential implementation.
- Maintained pixel-to-face id mapping to ensure back-projections of predictions to the meshes.
- Integrated a PyTorch-based semantic segmentation module containing a suite of models, weighted loss functions, optimizers, and learning rate schedulers.
- Analyzed and compared performance of entire pipeline based on overall accuracy, mIoU, and f1 score.

Research Intern (Summer Internship), ECSU, Indian Statistical Institute (ISI), Kolkata **May 2019 – July 2019**
Stabilization Techniques for the Training of GANs
Supervisor: Dr. Nikhil R. Pal
Investigated generative models and stabilized the training procedure of LS-GANs.

- Conducted a thorough literature survey on generative models, specifically auto-encoders and GANs.
- Stabilized the error oscillation of discriminator of a LS-GAN by adding a damping term to its loss function.
- Improved the structural integrity of the output of a GAN by implementing a "pre-training" scheme.
- Both the experiments showed qualitatively better or competitive results to base models.

SEMESTER/COURSE PROJECTS

Nori – CS-440, Advanced Computer Graphics *(Individual)* **Feb 2022 – Jun 2022**
Implemented Rendering algorithms on top of a barebones renderer in C++.

- Coded 5 assignments on topics ranging from implementing an Octree for accelerating ray tracing to a full-blown path tracer with next event estimation and multiple importance sampling.
- Extend Nori with advanced features (Homogenous Participating Media, Environment Map Lighting, etc.) for the final project.

Mandatory Semester Project, Geometric Computing Lab, EPFL **Feb 2022 – Jun 2022**
On the Similarities between Latent Space and Feature Space Geometry of Generative Models
Supervisor: Dr. Mark Pauly, Quentin Becker

- Developed a quantitative metric (LCM) that measures the correlation of the geometries of the latent and feature space of generative models.
- LCM is model-agnostic and can detect anisotropy in the latent space of the generative model.
- Implemented optimization methods for finding shorter curves in the latent space (needed to calculate LCM) which beat previous methods.

6th and 7th Semester Project, Centre of Intelligent Robotics, IIIT Allahabad **Jan 2020 – Dec 2020**
SLAM for Extreme Weather/Lighting Conditions *(Team of 3)*
Supervisor: Dr. Rahul Kala
Researched and improved SLAM for extreme weather/lighting conditions for single domain and multi-domain settings

- Engineered a novel 2 branched ResNet-based model on PyTorch to get similarity measure between cross-domain images.
- Entire pipeline contains a novel binning method, local sequence matching and global place relocalization methods coupled with visual odometry to extract continuous pose from discrete places.
- Results beat state-of-the-art visual odometry and place recognition libraries.
- Extended the work to a multi-domain setting by implementing a N-branch ResNet based model integrated with a ReID model to produce static embeddings; local matching and global relocalization handled by particle filters.

INDEPENDENT PROJECTS

Learn.ai *(Team size: 4)* **Feb 2020**

- Developed a WebApp to construct neural networks by dragging and dropping layers..
- Implemented a module to automatically generate Tensorflow.js code by parsing front-end data.
- Selected in the top 10 projects at Hack36, a national-level hackathon organized by NIT Allahabad.

ACADEMIC AWARDS AND ACHIEVEMENTS

- Runner up in Advanced Computer Graphics (CS-440) Rendering Competition, render praised for its technical and artistic quality, Jun 2022.
- Won the "top scorer" prize in OpenCode'18, a month-long open-source event organized at IIIT Allahabad, Feb 2018.
- Ranked in top 0.5 percent among 12,00,000 examinees, Joint Entrance Examination Mains, Jun 2017.
- Amul Vidya Shree Award for outstanding academic performance in CBSE AISSE Examination, 2015.
- Received the prestigious Aruna Lal Scholarship, Physics Research Lab, Gujarat for a period of 2 years, Feb 2016.
- Ranked 6th in state of Gujarat National Talent Search Examination (Stage 1), 2015.

EXTRA-CURRICULAR ACTIVITIES

- Lead Organizer of Hack in the North – the most selective student hackathon in India: raised a total sponsorship of about Rs 670,000 (~8,250 USD) for the event; sponsors included tech giants like Atlassian, Elastic, GitHub, etc.
- Coordinator of the Artificial Intelligence Wing, GeekHaven (2019), the technical club of IIIT Allahabad
- Silver Medalist, Inter-IIIT Football/Soccer tournament, Feb 2019.
- Participated in CBSE National Football/Soccer Championship, Anandalaya, Anand, Jun 2013 – Dec 2014.
- Received "best cadet" and "best shooter" award in Combined Annual Training Camp, National Cadet Corp (NCC), 2014

LANGUAGES: English (Advanced – CEFR Level C1 – TOEFL), Hindi (Proficient - Level C1), Odia (Mother tongue).
HOBBIES: Reading novels (generally epic fantasy and hard sci-fi), Enjoying Video Games, Playing Football/Soccer, Fencing.