Megh Shukla, M.Tech.

Computer Vision Research Engineer

Research Interests: Uncertainty Estimation, Active Learning, Human Pose Estimation, X-Shot Learning

work.meghshukla@gmail.com GitHub: meghshukla LinkedIn: megh-shukla

AWARDS

Mercedes-Benz Innovation Award 2021 | *Mercedes-Benz R&D India* 2021

- High Quality Patent Application, ***annual award*** for **top-5%** inventions at Mercedes-Benz R&D India

Institute Silver Medal 2019 | *IIT Bombay* 2019

- Master of Technology class of 2019: Secured **Department Rank 1, Institute Rank 3**
- Advanced Performer (AP), IIT Bombay (Awarded for exceptional performance in credit courses):
  - Introduction to Machine Learning EE 769: **Top 3 out of 178** were awarded AP
  - Advanced Satellite Image Processing GNR 602: **First AP since 2014**
- Graduate Aptitude Test in Engineering (GATE): **Top 1.5%** candidates in Electronics and Communication Engineering

RESEARCH

1. Bayesian Uncertainty and Expected Gradient Length - Regression: Two Sides Of The Same Coin? Theory

Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (*WACV*) 2022 (arXiv)

Author(s): *Megh Shukla*

2. A Mathematical Analysis of Learning Loss for Active Learning in Regression Theory

Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (*CVPRW*) 2021 (CVF Open Access)

Author(s): *Megh Shukla*, Shuaib Ahmed

3. Reducing Annotation Costs For Human Pose Estimation: A Bayesian Network Approach Applied

Patent filed: "Method and System For Annotating One Or More Images Of A User", Daimler AG, India *Patent* Office 2020

Inventor(s): *Megh Shukla*, Shuaib Ahmed

4. LEt-SNE: A Hybrid Approach to Data Embedding and Visualization of Hyperspectral Imagery Applied

Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (*ICASSP*) 2020 (IEEE Xplore)

Author(s): *Megh Shukla*, Biplab Banerjee, KM Buddhiraju

EDUCATION

Indian Institute Of Technology Bombay | CPI: 9.98 2019

Master of Technology in Geoinformatics Engineering (Satellite Imagery)

TA: Principles (GNR607) / Advanced (GNR602) Satellite Image Processing (GNR607), Machine Learning for Remote Sensing (GNR652)

Thesis: LEt-SNE: A Hybrid Approach to Data Embedding and Visualization of Satellite Imagery GitHub/IEEE

University Of Mumbai | CPI: 9.00 2017

Bachelor of Engineering in Electronics and Telecommunication Engineering

Thesis: Resonance Frequency Estimation for Microstrip Antennas Using Artificial Neural Networks GitHub/Springer

EXPERIENCE

Mercedes-Benz R&D India | *Computer Vision Research Engineer, MBUX Interior Assistant* 2019-Present

- Module owner: Active Learning for **Human Pose Estimation**; responsible for devising and executing end-to-end R&D cycle
- Active Learning intelligently selects images for annotation, annotation costs/model deployment time reduced by **30-50%**
- Performed feasibility study; analyzed, implemented and optimized existing research for **active and incremental learning** pipeline
- Designed algorithms to improve: a) Overall performance [1] b) Pre-empting failures [2] c) Explainability [3] in active learning

(a) *EGL++* [1] uses t-SNE to quantify the dissimilarity between an unlabelled sample and previous labels in its neighborhood

(b) *LearningLoss++* [2] provides a theoretical background for Learning Loss, highlighting the ability to pre-empt failure cases

(c) *Bayesian Nets* [3] maximize the likelihood over poses seen by the model, and acts as a visual prior for heatmap predictions

HARMAN India, a Samsung Company | *Research Intern, HARMAN X* May '18 - Jul' 18

- Explored *Capsule Networks* and Whitebox/Blackbox techniques for **Adversarial Learning** applications in Autonomous Driving
- Experimented with Reconstruction and Dithering using *TensorFlow* to prevent white box attacks on the model
- Parallelized the serial implementation of gradient computation in *cleverhans*: Jacobian augmentation function
- Devised PCA augmentations to increase similarity between Substitute and Oracle (blackbox) outputs from **92% to 95%**

GITHUB

GPU Acceleration Using CUDA-Python | **Advanced Satellite Image Processing (GNR602)** Apr '18

- GPU implementation of Maximum Likelihood and Relaxation Labelling for image pixel-wise classification and smoothing
- Defined **CUDA** kernels for thread-level control in Python using **Numba** library, with *Qt* based GUI packaged in an executable file
- Performance improvement due to GPU computations: *CPU* (Intel i5-8250U): ***~2:30 mins CPU+GPU*** (NVIDIA MX150) : ***~5 seconds***

Cross-Platform Application For Dynamic Entity Navigation | **Geographic Information Systems (GNR605)** Nov '17

- Designed a prototype app for routing between moving entities (eg: food carts) and campus pedestrians
- Used Qt Framework to make a cross platform app (Android/iOS), OpenStreetMap used for map rendering
- App provides Geocoding/Reverse Geocoding features with navigation, planned usage limited to IIT Bombay area

COURSEWORK

Computer Vision: Introduction to Machine Learning (EE 769), Neural Networks (ETE 703), Advanced Machine Learning (CS 726 - Audit), Principles (GNR 607) / Advanced (GNR 602) Satellite Image Processing, Image and Video Processing (ETC 701), Applied Mathematics - (I, II, II, III, IV), Random Signal Analysis (ETC 503), Data Analysis for Geospatial Applications (GNR 653), Geospatial Predictive Modelling (GNR 627), Signals and Systems (ETC 405), Discrete Time Signal Processing (ETC 602), Speech Processing (ETE 801), Structured Programming Approach (FEC 205), Object Oriented Programming (ETSL 304)

Information theory has been covered throughout courses related to communication engineering