Tooba Imtiaz

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Education

Fall 2021 - Present — **PhD Candidate,** Electrical Engineering, *Northeastern University*, Boston | **Advisor:** Prof. Jennifer Dy

2018 - 2020 — **Masters,** Electrical Engineering, (**GPA**: 3.87/4.3) *Korea Advanced Institute of Science and Technology (KAIST)*, S. Korea | **Advisor:** Prof. In-So Kweon

2014 - 2018 — **Bachelors,** Electrical Engineering, (**GPA**: 3.93/4.0, **Rank:** 5^{th}/156) *National University of Sciences and Technology (NUST)*, Pakistan | **Advisor:** Prof. Faisal Shafait

Work Experience

Sep 2021 – Present — **Research Assistant** | Machine Learning Lab @ SPIRAL, *Northeastern University, Boston*

- Developed an optimization-based sparse adversarial attack on images and evaluated its interpretability. (Pre-print under review.)
- Implemented Nerf-based 3D scene reconstruction from phone camera videos to facilitate at-home patient health monitoring.

Spring 2023 — **Teaching Assistant** | EECE7397 Advanced Machine Learning, Northeastern University

Sep 2020 - Aug 2021 — **External Consultant for ML and AI** | Endress+Hauser, *Maulburg, Germany*

Proposed ML and CV-based solutions for process automation and optimization. Led two projects, both deployed to production:
- **Deep learning for unsupervised 3D classification:** used Autoencoders, Capsule architectures, and Implicit Neural Networks.
- **Forecasting on time series:** utilized DNNs and Temporal Transformers to predict compound concentrations in liquids using sensors measuring base physical quantities. Achieved $\sim 96\%$ accuracy w.r.t. specialized physical sensors.

Sep 2018 - Aug 2020 — **Research Assistant** | Robotics and Computer Vision Lab, *KAIST, South Korea*

- **Bosch-RCV Project:** Performed camera calibration, data collection, and vehicle trajectory estimation. Designed an occlusion-robust vehicle re-identification method using GANs for seamless tracking across a multi-camera surrounding awareness system.
- **Universal Adversarial Perturbations:** Developed novel adversarial attack algorithms. Published at CVPR, AAAI, and ACCV '20.

Sep 2015 - May 2018 — **Research Intern** | TUKL-NUST R&D Centre, *NUST, Pakistan*

- Proposed table detection and parsing in document images using ML and CV (LSTMs, text classification, clustering algorithms).
- Implemented LSTMs for handwritten address recognition to sort postal mail.

Publications

SAIF: Sparse Adversarial and Imperceptible Attack Framework | **Under review**
T. Imtiaz, M. Kohler, J. Miller, Z. Wang, M. Sznaier, O. Camps, J. Dy
Devised a sparse adversarial attack using Frank-Wolfe, achieving SOTA results under tight sparsity and magnitude constraints on ImageNet & CIFAR10.

Volumetric propagation network: Stereo-lidar fusion for long-range depth estimation | **IEEE RA-L 2021**
J. Choe, K. Joo, **T. Imtiaz**, I.S. Kweon
Proposed a geometry-aware stereo-LiDAR fusion network for long-range depth estimation. I contributed to the network design and experiments.

Understanding Adversarial Examples from the Mutual Influence of Images and Perturbations | **CVPR 2020**
C. Zhang*, P. Benz*, **T. Imtiaz**, I.S. Kweon
Analyzed logits of clean images against additive perturbations and proposed a novel adversarial attack. I developed the loss objective and experiments.

CD-UAP: Class Discriminative Universal Adversarial Perturbation | **AAAI 2020**
C. Zhang*, P. Benz*, **T. Imtiaz**, I.S. Kweon
Proposed a novel UAP attack, causing a DNN to misclassify only a select group of classes. I contributed to the sampling strategy and experiments.

Double targeted universal adversarial perturbations | **ACCV 2020**
P. Benz*, C. Zhang*, **T. Imtiaz**, I.S. Kweon
Proposed a 'bidirectional' targeted UAP attack, such that classification labels are switched across a pair of classes. I designed the ablative experiments.

Scholarships and Awards

2022 — ICML '22 volunteer award
2020 — Qualcomm Innovation Fellowship Award, South Korea (among the 20 awardees)
2014-2018 — NUST Merit Scholarship (Awarded to top-3 GPA holders of cohort)
2017 — Global UGRAD Exchange Program, US Dept of State ($\sim 7.6\%$ selection rate)

Skills and Service

Python — PyTorch, Tensorflow, Keras, Numpy, scikit-learn, Matplotlib
C / C++ / Java — Object-oriented programming, Data structures, frontend and backend dev
Misc. — MATLAB (Image and signal processing, Geometry and ML Toolbox, Simulink), Unix, gcc, Git, SQL, LaTeX, ROS, AutoCAD
Service — Reviewer for CVPR 2024, ICCV 2023, NeurIPS 2023 (New in ML Workshop)
Workflow chair at AAAI 2024