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 Interpretable 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, LaTeX, ROS, AutoCAD
Service	Reviewer for ICCV 2023
	Workflow chair at AAAI 2024