Uday Kamal

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Education

Present – Jan 2021 | **Georgia Institute of Technology, Ph.D. in ECE, Atlanta, GA**
- Advisor : Dr. Saibal Mukhopadhyay
- Research in Efficient Spatiotemporal Processing for Event-based Perception

Apr 2019 – Feb 2015 | **Bangladesh University of Engineering and Technology, B.Sc. in EEE, Bangladesh**
- Advisor : Dr. Kamrul Hasan
- Research in Robust Object Detection under Challenging Weather Condition

Research Experience

Present – Jan 2022 | **Memory Augmented Representation Learning for Event-based Perception**
- Advisor : Dr. Saibal Mukhopadhyay
- Proposed a novel memory-augmented event-based spatiotemporal representation learning framework.
- Applied set-based self-attention to learn higher-order interactions among the events.
- Proposed method achieves higher efficiency with performance similar to the frame-based method.
- A manuscript is under review in ICLR2023

Event-based Perception | Memory-augmented Learning | Self-Attention | Spatiotemporal Representation

May 2022 – Jan 2022 | **Learning Quadrupedal Locomotion Policies from Real-World Videos**
- Advisors : Dr. Sehoon Ha, Dr. Jie Tan
- Combined 3D pose estimation and imitation learning to learn to mimic animal motion from a video.
- Applied temporal consistency aware motion refinement to improve the estimated pose to be retargeted in the learning gym (PyBullet).
- Experiments indicate the possibility of learning control policies from these retargeted motions [Report].

Deep Reinforcement Learning | Imitation Learning | 3D Pose Estimation | Legged Robot Control

Present – Aug 2021 | **Quantization Aware Differentiable Neural Architecture Search (NAS)**
- Advisor : Dr. Alexey Tumanov
- Developed a differentiable NAS method that combines the architecture and bit-precision search space.
- Integrated weight-shared bit precision and partial-channel to reduce the search space.
- Initial experiments on CIFAR10 show promising results with discovered architecture being an order of magnitude efficient compared to the baselines [Video], [Report], [Code].
- Collaborating with Dr. Tumanov's research group at Georgia Tech for further experiments.

Neural Architecture Search | Quantization | Efficient Processing of DNN

Jan 2019 – Aug 2021 | **Spatiotemporal Representation Learning for Biomedical Image Analysis**
- Advisors : Dr. Kamrul Hasan
- Proposed a novel Recurrent 3D CNN-based encoder-decoder architecture to perform lung tumor segmentation that captures both temporal and spatial features of volume CT data. [MICCAIW-2019].
- Proposed a novel memory-augmented 3D encoder-2D decoder architecture to enable highly accurate shear-wave elastography imaging [Ultrasonics-2021].

Biomedical Image Analysis | Spatiotemporal Representation | Deep Learning | Convolutional Neural Networks

Jan 2019 – Feb 2018 | **Small Object Detection Under Challenging Conditions**
- Advisor : Dr. Kamrul Hasan
- Implemented a fusion of two state-of-the-art CNN-based segmentation models namely U-Net and SegNet for localizing small traffic signs. [IEEE T-ITS 2019]
- Proposed adaptive preprocessing block enhanced the image quality under challenging weather conditions and reduce performance degradation. [IEEE T-ITS 2021]

Computer Vision | Object Detection | Semantic Segmentation | Convolutional Neural Networks

Professional Experience

Dec 2020 – Aug 2020 | **Brain Station 23 Limited, Bangladesh** – Research Engineer

- Mentor : Dr. Taufiq Hasan
- Integrated anatomical knowledge with deep learning models for better performance and explainability.
- Leveraged semi-supervised learning to utilize the available limited organ-level annotations.
- Developed a novel anatomy-aware spatial attention mechanism that can retain performance in the presence of imperfect anatomy segmentation [IEEE-JBHI, 2022].
- Proposed method achieves SoTA result on chest xray datasets : NIH, CheXpert, and MIMIC-CXR.

Semi-supervised Segmentation | Spatial Attention | Medical Image Analysis | Deep Learning

May 2020 – Jun 2019 | **Neural Semiconductor, Bangladesh** – Research Associate

- Mentor : Dr. A.B.M. Harun-ur Rashid
- Developed a high-level synthesis (HLS) -based ML hardware acceleration framework on FPGA [Code].
- Supported acceleration for several building blocks including convolution, pooling, and linear layers.
- Accelerated inference speed for quantized VGG16 and TinyYOLO architecture on Ultra96 FPGA.

Hardware Acceleration | FPGA | Deep Learning Accelerator | Model Quantization | HLS

Technical Strengths

- Deep Learning, Computer Vision, Optimization
- Python, C++, Matlab
- Pytoch, JAX, Numpy, Pandas

Relevant Courses

Statistical Machine Learning | Advanced DSP | Convex Optimization | Online Decision Making | Deep RL for Intelligent Control | Systems for ML

Honors and Awards

2020 Mentor of the champion team(*BUET Synapticans*) in IEEE SPS Video and Image Processing Cup.[Link]
2019 Member of silver medal winning team(38^{th}) in Kaggle APTOS Blindness Detection Challenge.[Link]
2018 Member of the runner-up team(*Spectrum*) in IEEE SPS Video and Image Processing Cup [Link], [Code].
2017 Member of the champion team (*Neurons*) in IEEE SPS Video and Image Processing Cup [Link], [Code]

Publications

2022 Uday Kamal*, Saurabh Dash*, Saibal Mukhopadhyay. *Associative Memory Augmented Asynchronous Spatiotemporal Representation Learning for Event-based Perception* [ICLR2023 Under Review]
2022 Payman Behnam, Uday Kamal, Saibal Mukhopadhyay. *An Algorithm-Hardware Co-design Framework to Overcome Imperfections of Mixed-signal DNN Accelerators.* arXiv preprint. [Paper]
2022 Uday Kamal, Mohammad Zunaed, Nusrat Binta Nizam, Taufiq Hasan. *Anatomy-XNet : An Anatomy Aware Convolutional Neural Network for Thoracic Disease Classification in Chest X-Rays.* IEEE Journal of Biomedical and Health Informatics (IEEE-JBHI). [Paper]
2021 Sabbir Ahmed, Uday Kamal, Md. Kamrul Hasan. *DFR-TSD : A Deep Learning Based Framework for Robust Traffic Sign Detection Under Challenging Weather Conditions.* IEEE Transactions on Intelligent Transportation Systems (IEEE-T-ITS). [Paper]
2021 Shahed Ahmed, Uday Kamal, Md. Kamrul Hasan. *DSWE-Net : A deep learning approach for shear wave elastography and lesion segmentation using single push acoustic radiation force.* Ultrasonics. [Paper]
2021 Abdul Muntakim Rafi, Thamidul Islam Tonmoy, Uday Kamal, Rakibul Hoque, Md. Kamrul Hasan. *RemNet : Remnant Convolutional Neural Network for Camera Model Identification.* Neural Computing & Application. [Paper]
2020 Uday Kamal, Abdul Muntakim Rafi, Rakibul Hoque, Robert Laganiere, Md Kamrul Hasan. *Lung Cancer Tumor Region Segmentation Using Recurrent 3D-DenseUNet.* International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) Thoracic Image Analysis Workshop. [Paper]
2019 Abdul Muntakim Rafi, Uday Kamal, Rakibul Hoque, Abid Abrar, Sowmitra Das, Robert Laganiere, Md Kamrul Hasan. *Application of DenseNet in Camera Model Identification and Post-processing Detection.* CVPR Media Forensics Workshop. [Paper]
2019 Uday Kamal, Tahmidul Islam Tonmoy, Sowmitra Das and Md. Kamrul Hasan. *Automatic Traffic Sign Detection and Recognition Using SegU-Net and a Modified Tversky Loss Function with L1-Constraint.* Transactions on Intelligent Transportation Systems (IEEE-T-ITS). [Paper]