

# Uday Kamal

Ph.D. Student | Georgia Tech | Atlanta, GA

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## 🎓 EDUCATION

Present Jan 2021	<b>Ph.D. in Electrical &amp; Computer Engineering, Georgia Tech, Atlanta, GA</b> <ul style="list-style-type: none"><li>• Focus : Memory Augmented Spatiotemporal Perception   Advisor : <a href="#">Dr. Saibal Mukhopadhyay</a></li></ul>
Dec 2022 Jan 2021	<b>M.Sc. in Electrical &amp; Computer Engineering, Georgia Tech, Atlanta, GA</b> <ul style="list-style-type: none"><li>• Focus : Digital Signal Processing   CGPA : 3.80/4.00</li></ul>
Apr 2019 Feb 2015	<b>B.Sc. in EEE, Bangladesh University of Engineering and Technology, Bangladesh</b> <ul style="list-style-type: none"><li>• Focus : Digital Image Processing   Advisor : <a href="#">Dr. Kamrul Hasan</a>   CGPA : 3.79/4.00</li></ul>

## 🔬 RESEARCH EXPERIENCE

Present Jan 2022	<b>Memory Augmented Spatiotemporal Perception   <a href="#">Dr. Saibal Mukhopadhyay</a></b> <ul style="list-style-type: none"><li>• Proposed a novel memory-augmented representation learning framework for event-based perception.</li><li>• Applied set-based self-attention to learn higher-order interactions among the visual event locations.</li><li>• Proposed method outperforms existing methods both in terms of efficiency and accuracy. <a href="#">[ICLR2023]</a></li><li>• Ongoing research on learning neural radiance field (NeRF)-based 3D reconstruction of challenging, high-speed moving objects in a dynamic scenario using event-camera data.</li></ul> <div>Event-based Perception   Memory-augmented Learning   Attention   Spatiotemporal Representation</div>
Dec 2021 Jan 2021	<b>High-Performance Accelerator for Signal Processing   <a href="#">Dr. Saibal Mukhopadhyay</a></b> <ul style="list-style-type: none"><li>• Developed a software-based emulation framework of a high-performance Radar signal processing accelerator. <a href="#">[RadarConf2023, IMS2023, GomachTech-2023]</a></li><li>• Worked on an end-to-end simulation of the whole system to enable rapid prototyping of the hardware accelerator and enabled software-hardware co-simulation to verify its operation.</li><li>• Implemented a high-performance hardware accelerator for a streaming input-based FIR filter to emulate the monostatic clutter phenomenon in real-time.</li></ul> <div>Deep Reinforcement Learning   Imitation Learning   3D Pose Estimation   Legged Robot Control</div>
Present Aug 2021	<b>Quantization Aware Differentiable Neural Architecture Search   <a href="#">Dr. Alexey Tumanov</a></b> <ul style="list-style-type: none"><li>• Developed a differentiable NAS method that combines the architecture and bit-precision search space.</li><li>• Integrated weight-shared bit precision and partial-channel to reduce the search space.</li><li>• Initial experiments on CIFAR10 show promising results with discovered architecture being an order of magnitude efficient compared to the baselines <a href="#">[Video]</a>, <a href="#">[Report]</a>, <a href="#">[Code]</a>.</li><li>• Collaborating with <a href="#">Dr. Tumanov's</a> research group at Georgia Tech for further experiments.</li></ul> <div>Neural Architecture Search   Quantization   Efficient Processing of DNN</div>
Jan 2019 Aug 2021	<b>Spatiotemporal Representation Learning for Medical Image Analysis   <a href="#">Dr. Kamrul Hasan</a></b> <ul style="list-style-type: none"><li>• 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. <a href="#">[MICCAIW-2019]</a>.</li><li>• Proposed a novel memory-augmented 3D encoder-2D decoder architecture to enable highly accurate shear-wave elastography imaging <a href="#">[Ultrasonics-2021]</a>.</li></ul> <div>Biomedical Image Analysis   Spatiotemporal Representation   Deep Learning   Convolutional Neural Networks</div>
Jan 2019 Feb 2018	<b>Small Object Detection Under Challenging Conditions   <a href="#">Dr. Kamrul Hasan</a></b> <ul style="list-style-type: none"><li>• Implemented a fusion of two state-of-the-art CNN-based segmentation models namely U-Net and SegNet for localizing small traffic signs. <a href="#">[IEEE T-ITS 2019]</a></li><li>• Proposed adaptive preprocessing block enhanced the image quality under challenging weather conditions and reduce performance degradation. <a href="#">[IEEE T-ITS 2021]</a></li></ul> <div>Computer Vision   Object Detection   Semantic Segmentation   Convolutional Neural Networks</div>

## PUBLICATIONS

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- 2023 [Uday Kamal\\*](#), Saurabh Dash\*, Saibal Mukhopadhyay. *Associative Memory Augmented Asynchronous Spatiotemporal Representation Learning for Event-based Perception* **ICLR2023 (Notable-25%)**
- 2023 Mandovi Mukherjee\*, Nael Mizanur Rahman\*, Coleman B. DeLude\*, Joseph W. Driscoll\*, [Uday Kamal](#), Jongseok Woo, Jamin Seo, Sudarshan Sharma, Xiangyu Mao, Payman Behnam, Sharjeel M. Khan, Daehyun Kim, Jianming Tong, Prachi Sinha, Santosh Pande, Tushar Krishna, Justin Romberg, Madhavan Swaminathan, and Saibal Mukhopadhyay. *A High-Performance Computing Architecture for Real-Time Digital Emulation of RF Interactions*. In Proc of IEEE Radar Conference, (RadarConf).
- 2023 Xiangyu Mao\*, Mandovi Mukherjee\*, Nael Mizanur Rahman\*, [Uday Kamal](#), Sudarshan Sharma, Payman Behnam, Jianming Tong, Jongseok Woo, Coleman B DeLude, Joseph W. Driscoll, Jamin Seo, Santosh Pande, Tushar Krishna, Justin Romberg, Madhavan Swaminathan, and Saibal Mukhopadhyay. *FPGA-Based High-Performance Real-Time Emulation of Radar System using Direct Path Compute Model*. International Microwave Symposium (IMS).
- 2023 Mandovi Mukherjee, Nael Mizanur Rahman, Sudarshan Sharma, [Uday Kamal](#), Xiangyu Mao, Payman Behnam, Daehyun Kim, Jianming Tong, Jongseok Woo, Prachi Sinha, Coleman B DeLude, Joseph W. Driscoll, Jamin Seo, Santosh Pande, Tushar Krishna, Justin Romberg, Madhavan Swaminathan, and Saibal Mukhopadhyay. *A Near-Memory Accelerator for Real-Time Emulation of RF Interactions*. GomaTech, USA.
- 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 Laganieri, 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 Laganieri, 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). [\[Paper\]](#)

## HONORS AND AWARDS

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- 2019 Silver medal (38<sup>th</sup>) in Kaggle APTOS Blindness Detection Challenge.[\[Link\]](#)
- 2018 2<sup>nd</sup> place in IEEE SPS Video and Image Processing Cup [\[Link\]](#), [\[Code\]](#).
- 2017 1<sup>st</sup> place in IEEE SPS Video and Image Processing Cup [\[Link\]](#), [\[Code\]](#)

## ACADEMIC SERVICE

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- 2023 Reviewer : AAAI-2024, ICCV-2024, ICLR-2024
- 2022 Reviewer : AAAI-2023, ICLR-2023, CVPR-2023, ICCV-2023
- 2020 Mentor : 1<sup>st</sup> place team (*BUET Synapticans*) in IEEE SPS Video and Image Processing Cup.[\[Link\]](#)

## PROFESSIONAL EXPERIENCE

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Ongoing	<b>Applied Scientist II Intern</b> at <a href="#">Amazon Robotics, North Reading, MA, USA</a>   Mentor : Dr. Chaitanya Mitash& Dr. Jeroen Van Baar
Aug 2023	<ul style="list-style-type: none"><li>Developed semantic scene understanding algorithm for targeted picking of occluded object under heavily cluttered scenario.</li><li>Proposed a scene-graph augmented perception algorithm to predict the pickability of the target object.</li><li>Developed a simulation framework on PyBullet to verify the the proposed solution.</li><li>Currently working on experimenting on the real-world robot setup.</li></ul> <div>Robot Learning Robot Perception Scene Understanding Graph Neural Network</div>
Dec 2020	<b>Research Engineer</b> at <a href="#">Brain Station 23 Limited, Bangladesh</a>   Mentor : Dr. Taufiq Hasan
Aug 2020	<ul style="list-style-type: none"><li>Integrated anatomical knowledge with deep learning models for better performance and explainability.</li><li>Leveraged semi-supervised learning to utilize the available limited organ-level annotations.</li><li>Developed a novel anatomy-aware spatial attention mechanism that can retain performance in the presence of imperfect anatomy segmentation [IEEE-JBHI, 2022].</li><li>Proposed method achieves SoTA result on chest xray datasets : NIH, CheXpert, and MIMIC-CXR.</li></ul> <div>Semi-supervised Segmentation Spatial Attention Medical Image Analysis Deep Learning</div>
May 2020	<b>Research Associate</b> at <a href="#">Neural Semiconductor, Bangladesh</a>   Mentor : Dr. A.B.M. Harun-ur Rashid
Jun 2019	<ul style="list-style-type: none"><li>Developed a high-level synthesis (HLS) -based ML hardware acceleration framework on FPGA [Code].</li><li>Supported acceleration for several building blocks including convolution, pooling, and linear layers.</li><li>Accelerated inference speed for quantized VGG16 and TinyYOLO architecture on Ultra96 FPGA.</li></ul> <div>Hardware Acceleration FPGA Deep Learning Accelerator Model Quantization HLS</div>

## TECHNICAL SKILLS

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

## RELEVANT COURSES

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