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Abdul Muntakim Rafi

LinkedIn:
Google Scholar:
GitHub:
ResearchGate:

Current Research Interest

Deciphering gene regulatory logic using Machine Learning

Education

Doctor of Philosophy in Biomedical Engineering **2021 - present**
University of British Columbia Vancouver, Canada
Supervisor: Carl de Boer, Assistant Professor, School of Biomedical Engineering

Master of Applied Science in Electrical and Computer Engineering **2019 - 2021**
University of Windsor Windsor, Canada
Supervisor: Jonathan Wu, Professor, Department of Electrical and Computer Engineering

Bachelor of Science in Electrical and Electronic Engineering(EEE) **2014 - 2018**
Bangladesh University of Engineering and Technology (BUET) Dhaka, Bangladesh
Supervisor: Md. Kamrul Hasan, Professor, Department of EEE

Research Experience

- ***Graduate Research Assistant, de Boer Lab*** [website] May 2021 - present
  School of Biomedical Engineering, The University of British Columbia.
  Pursuing my Ph.D. in biomedical engineering in this lab under the supervision of Professor Dr. Carl de Boer. We are a mixed computational/experimental group. I apply machine learning to understand how the genome is regulated.
- ***Graduate Research Assistant, Centre for Computer Vision and Deep Learning*** [website] Aug 2019 - Mar 2021
  Department of Electrical and Computer Engineering, University of Windsor.
  Pursued my Master's in Applied Science degree from this lab under the supervision of Professor Dr. Jonathan Wu. I worked on digital image forensics, biomedical image processing, and social media data analysis. During this time, I published four papers.
- ***Research Assistant, Digital Signal Processing Research Laboratory*** [website] Oct 2018 - Mar 2019
  Department of Electrical and Electronic Engineering, BUET.
  Did my undergrad thesis under the supervision of Professor Dr. Md. Kamrul Hasan from this lab. After graduation, I joined the lab as a Research Assistant. I worked on digital image forensics and biomedical image processing. During this time, I published a paper and participated in two international signal processing competitions organized by IEEE.

Job Experience

- ***Graduate Teaching Assistant, Master of Data Science, UBC*** Sep 2021 - Dec 2024
  Joined UBC's Master of Data Science program as a full-time teaching assistant in Fall 2021 and continued working here. Courses I TAed here are Supervised Learning II, Statistical Inference and Computation II, Web and Cloud Computing, Data Science Workflows, Algorithms and Data Structures, and Computing Platforms for Data Science.
- ***Graduate Teaching Assistant, Biology Program, UBC*** May 2022 - June 2022
  Joined UBC's Biology program as a full-time teaching assistant for the Summer 2022 term in the course Fundamentals of Genetics.
- ***Mitacs Accelerate Intern, Lanner Electronics Inc.*** [lanner] Nov 2020 - Mar 2021
  Joined Lanner through the Mitacs Accelerate, which is Canada's premiere research internship program. I worked on the efficient inference of different AI-driven applications in edge devices.
- ***Graduate Teaching Assistant, ECE Department, University of Windsor*** Jan 2020 - Dec 2020
  Worked as a graduate teaching assistant for the courses Engineering Software Fundamentals and Computational Intelligence.
- ***Deep Learning Engineer, IFIVEO*** [i-50] Oct 2019 - Apr 2020
  Joined IFIVEO through the Mitacs Accelerate. Here, my task was to perform activity recognition to measure and improve manufacturing floor production processes using deep learning based vision systems. I collected data from manufacturing floors, supervised the annotation process, and deployed deep learning models using Amazon Sagemaker.
- ***Machine Learning Engineer, REVE Systems Ltd.*** Mar 2019 - July 2019
  Worked on designing a real-time Sign2Text translator for Bangla Sign Language.

List of Publications

- **Abdul Muntakim Rafi**, Daria Nogina, Dmitry Penzar, Dohoon Lee, Danyeong Lee, Nayeon Kim, Sangyeup Kim, Dohyeon Kim, Yeojin Shin, Il-Youp Kwak, Georgy Meshcheryakov, Andrey Lando, Arsenii Zinkevich, Byeong-Chan Kim, Juhyun Lee, Taein Kang, Eeshit Dhaval Vaishnav, Payman Yadollahpour, **Random Promoter DREAM Challenge Consortium**, Sun Kim, Jake Albrecht, Aviv Regev, Wuming Gong, Ivan V. Kulakovskiy, Pablo Meyer, Carl de Boer, "A community effort to optimize sequence-based deep learning models of gene regulation", published in **Nature Biotechnology** 2024. [*nature*]
- Ishika Luthra, Xinyi E Chen, Cassandra Jensen, Asfar Lathif Salaudeen, **Abdul Muntakim Rafi**, Carl G de Boer, "Biochemical activity is the default DNA state in eukaryotes", published in **Nature Structural & Molecular Biology** 2024. [*nature*]
- Dmitry Penzar, Daria Nogina, Elizaveta Noskova, Arsenii Zinkevich, Georgy Meshcheryakov, Andrey Lando, **Abdul Muntakim Rafi**, Carl de Boer, Ivan V Kulakovskiy, "LegNet: a best-in-class deep learning model for short DNA regulatory regions", published in **Bioinformatics** 2023. [*BIOF*]
- Nicholas Mateyko, Omar Tariq, Xinyi E Chen, Will Cheney, Asfar Lathif Salaudeen, Ishika Luthra, Najmeh Nikpour, **Abdul Muntakim Rafi**, Hadis Kamali Deghan, Cassandra Jensen, Carl de Boer, "GIL: A Python package for designing custom indexing primers", published in **Bioinformatics** 2023. [*BIOF*]
- **Abdul Muntakim Rafi**, Thamidul Islam Tonmoy, Uday Kamal, Q.M. Jonathan Wu, Md. Kamrul Hasan, "RemNet: Remnant Convolutional Neural Network for Camera Model Identification", published in **Neural Computing And Applications** 2021. [*SpringerLink*]
- Uday Kamal, **Abdul Muntakim Rafi**, Rakibul Hoque, Jonathan Wu, Md. Kamrul Hasan, "Lung Cancer Tumor Region Segmentation Using Recurrent 3D-DenseUNet", accepted at The Second International Workshop on Thoracic Image Analysis in conjunction with **MICCAI 2020**, October 2020. [*SpringerLink*]
- **Abdul Muntakim Rafi**, Shivang Rana, Rajwinder Kaur, Jonathan Wu, Pooya Moradian Zadeh, "Understanding Global Reaction to the Recent Outbreaks of COVID-19: Insights from Instagram Data Analysis", accepted at **IEEE International Conference on Systems, Man, and Cybernetics, 2020**, October 2020. [*IEEEXplore*]
- **Abdul Muntakim Rafi**, Jonathan Wu, Md. Kamrul Hasan, "L2-Constrained RemNet for Camera Model Identification and Image Manipulation Detection", presented in Advances in Image Manipulation workshop and challenges on image and video manipulation in conjunction with **ECCV 2020**, August 2020. [*SpringerLink*]
- **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", presented in **The IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops, 2019, pp. 19-28**, Long Beach, CA, USA, June 2019. [*CVPR 2019 open access*]
- **Abdul Muntakim Rafi**, Nowshin Nawal, Nur Sultan Nazar Bayev, Lusain Nima, Celia Shahnaz, Shaikh Anowarul Fattah, "Image-based Bengali Sign Language Alphabet Recognition for Deaf and Dumb Community", presented in ***2019 IEEE Global Humanitarian Technology Conference (GHTC)***, Seattle, WA, USA, October 2019. [*IEEEXplore*]

Workshops Conducted

- **Stem Cell Network (Canada)** Jun 2023
  I conducted an one and a half hour workshop for Stem Cell Network (Canada) where I covered three things. (i) How to utilize publicly available machine learning models to aid in genome editing experiments, (ii) how to train a neural network on sequence-to-expression measurements from Massively Parallel Reporter Assays experiments, and (iii) how simpler models can outperform complex neural networks on low complexity problems.
- **Advanced Genomics & Genome Engineering Workshop** Sep 2023
  I was invited to the workshop for a 30-minute lecture on how to design better sequence-based gene regulatory deep learning models. Other notable speakers at the workshop were Mikiko Siomi (uTokyo), Sheila Teves (UBC), Hiroshi Ochiai (Kyushu), Haruhiko Siomi (Keio), Nozomu Yachie (UBC), and Carl de Boer (UBC)]
- **IEEE EMBS Region 9 Conference** Oct 2023
  I was invited to the conference to conduct a three-hours long workshop on how to design better sequence-based gene regulatory deep learning models. Other notable speakers at the conference were Michael Elowitz (Caltech), Pablo Meyer (IBM), and Mayra Furlan Magaril (Universidad Nacional Autonoma de Mexico).

Talks

- **Evaluation and optimization of sequence-based gene regulatory deep learning models** 2024
  Genentech internal seminar
- **Evaluation and optimization of sequence-based gene regulatory deep learning models** 2024
  Biological Data Science, Cold Spring Harbor Laboratory, United States
- **Detecting and avoiding homology-based data leakage in genome-trained sequence models** 2024
  Kipoi Seminar

- **Evaluation and optimization of sequence-based gene regulatory deep learning models using MPRA data from yeast** 2024
  Pacific Northwest Yeast Club Meeting, Fred Hutchinson Cancer Center, United States
- **Predicting gene expression using random promoter sequences - Challenge Overview** 2022
  14th annual RECOMB/ISCB Conference on Regulatory & Systems Genomics with DREAM Challenges, United States
- **Tumor Segmentation from CT Scans Using Deep Learning** 2021
  Guest lecture at graduate level course 'ELEC 8280: Image Processing', University of Windsor
- **L2-Constrained RemNet for Camera Model Identification and Image Manipulation Detection** 2020
  Advances in Image Manipulation workshop and challenges on image and video manipulation in conjunction with ECCV 2020, United Kingdom
- **Lung Cancer Tumor Region Segmentation Using Recurrent 3d-denseunet** 2020
  The Second International Workshop on Thoracic Image Analysis in conjunction with MICCAI 2020, Peru
- **IEEE SPS Video and Image Processing Cup 2018 Final Round** 2018
  2018 IEEE International Conference on Image Processing, Greece
- **Shongket: Bengali Sign Language Alphabet Interpreter for the Deaf Community in Bangladesh** 2018
  4TH IEEE WIECON-ECE 2018 CONFERENCE, Thailand

Posters

- **Detecting and avoiding homology-based data leakage in genome-trained sequence models** 2024
  Biological Data Science, Cold Spring Harbor Laboratory, United States
- **Detecting and avoiding homology-based data leakage in genome-trained sequence models** 2024
  23rd European Conference on Computational Biology, Turku, Finland
- **Detecting and avoiding homology-based data leakage in genome-trained sequence models** 2024
  Machine Learning in Computational Biology, Seattle, United States
- **Evaluation and optimization of sequence-based gene regulatory deep learning models** 2023
  Machine Learning in Computational Biology, Seattle, United States
- **Evaluation and optimization of sequence-based gene regulatory deep learning models** 2023
  Kipoi Summit, Germany

Awards and Scholarships

- **JXTX + CSHL Biological Data Science 2024 Scholarship** [JXTX] 2024
  Award: 1125 USD
  The JXTX Foundation and Cold Spring Harbor Laboratory provided support to six outstanding graduate students in genomics and data sciences acknowledging their contribution to open science to attend the 2024 CSHL Biological Data Science Conference.
- **Stem Cell Network Trainee Award** [Stem Cell] 2023
  Award: 4,000 CAD
  This one-time stipend top-up was awarded to 100 trainees at the Masters, PhD and post-doctoral levels.
- **Amgen Pitch competition** 2023
  Award: 1,000 CAD
  Placed **3rd** in the Amgen pitch competition at the School of Biomedical Engineering, UBC where students presented their unique and innovative ideas for solutions that can address real-world problems.
- **Four Year Doctoral Fellowship (4YF)** [UBC 4YF] 2021-2025
  Award: 96,000 CAD in 4 years
  The Four Year Doctoral Fellowship (4YF) program ensures UBC's best Ph.D. students are provided with financial support plus tuition for up to four years of their doctoral studies.
- **SBME Graduate Support Initiative-Entrance Award** [UBC GSI] 2021
  Award: 4,000 CAD
  This one-time award is granted to top-ranked incoming Ph.D. students, or top-ranked Ph.D. students in the first year of their program in SBME (School of Biomedical Engineering).
- **International Tuition Award** [UBC ITA] 2021-graduation
  Award: 3,200 CAD per year
  International Tuition Awards assist international graduate students with their tuition fees if they are registered full-time in research-oriented masters and doctoral programs at UBC - Vancouver campus.
- **President's Academic Excellence Initiative Ph.D. Award** [UBC President's] 2021-graduation
  Award: 1,500 CAD per year
  Awards totalling approximately 4.3 million CAD per year are provided to recognize the significant contributions of Ph.D. students to the research activities of the university.

- **PharmaHacks 2022** [PharmaHacks] [GitHub] 2022
  Member of the team that won the hackathon's Phyla Challenge 'Classification of Diseases Based on the Gut Microbiome'.
- **IEEE SPS Video and Image Processing Cup 2018** [IEEE SP Magazine] 2018
  Award: 2,500 USD
  Member of the team that won **2nd** place among 28 teams from the whole world.
- **4th IEEE-WIECON-ECE 2018 Humanitarian Project Competition** [IEEE SIGHT BLOG] [YouTube] 2018
  Award: 500 USD
  Member of the team that placed **2nd** among top 8 teams.
- **Bangladesh Math Olympiad** 2011-2013
  Regional Champion
- **Bangladesh Astro Olympiad** 2012
  National 4th
- **Bangladesh Physics Olympiad** 2012
  Regional Champion
- **Bangladesh Science Olympiad** 2011
  National 3rd

Funded projects

- **Evaluation, optimization, and continual improvement of sequence-based cis-regulatory models** Aug 2023 - June 2024
  Funding Source: ***Advanced Research Computing, UBC***
  Principal investigator: ***Carl de Boer***
  Total Funding: 20,000 CAD Microsoft Azure credit
  My Role: I wrote the proposal as a co-applicant for this grant.
- **Lossless preprocessing of the sequence and expression space to improve sequence-based gene regulatory models** May 2023 - Aug 2023
  Funding Source: ***School of Biomedical Engineering, UBC***
  Principal investigator: ***Carl de Boer***
  Total Funding: 6,000 CAD
  My Role: I wrote the proposal as a co-applicant for this grant. Through this grant, we hired a Co-op student to pursue the project.
- **DREAM Challenge 2022** [website] May 2022 - July 2022
  Funding Source: ***TPU Research Cloud, Google***
  Principal investigator: ***Carl de Boer (UBC), Pablo Meyer (IBM research), Jake Albrecht (Sage Bionetworks)***
  Total Funding: 50 TPU quotas (each TPU quota consists of 5 v3-8s, 5 v2-8s, and 100 preemptible v2-8s)
  My Role: I co-organized the competition with Professor de Boer, Dr. Meyer, and Dr. Albrecht as the only graduate student in the committee.
- **Identifying selection on human gene expression with gene regulatory models** 2022 - 2024
  Funding Source: ***The Digital Research Alliance of Canada***
  Principal investigator: ***Carl de Boer***
  Total Funding: Priority access to GPUs
  My Role: I assisted Professor de Boer with writing the proposal for this grant.
- **Efficient edge inference benchmarking for AI-driven applications** [lanner] Nov 2020 - Mar 2021
  Funding Source: ***Mitacs Accelerate***
  Principal investigator: ***Jonathan Wu***
  Total Funding: 15,000 CAD
  My Role: I was the only co-applicant in this project. I wrote the proposal with Professor Wu's supervision.
- **Spatio-Temporal Human Activity Recognition on Manufacturing Floors** [i-50] Oct 2019 - Apr 2020
  Funding Source: ***Mitacs Accelerate***
  Principal investigator: ***Jonathan Wu***
  Total Funding: 22,500 CAD
  My Role: I was one of the co-applicants in this project. I assisted Professor Wu with writing this proposal.

Peer-review Activities

- *Nature Communications*
  Number of papers reviewed: **1**
- *Bioinformatics*
  Number of papers reviewed: **1**

- *Neurocomputing*
  Number of papers reviewed: **4**
- *Data in Brief*
  Number of papers reviewed: **1**
- *Journal of Real-Time Image Processing*
  Number of papers reviewed: **1**
- *Cyber-systems and Robotics*
  Number of papers reviewed: **1**

Mentorship

- **Talaria Summer Institue** [website] 2023-
  Talaria Summer Institute (TSI) is a free summer STEM research mentorship program for female and genderqueer students. I supervised a high school student on genomics sequence analysis.
- **de Boer Lab** [website] Jan 2023-
  I have been the sole supervisor for three Co-op students at de Boer lab. All students worked on projects designed by me and one of them won the SBME Synergy funding.
- **SUS-GSS Mentorship Program** [website] 2022
  Mentored second-year undergrads from the University of British Columbia regarding professional development skills.

Extracurricular Activities

- **Project manager**, *SynBIO6.0* [website] 2024
  SynBio6.0, held on May 16-17, 2024 at the University of British Columbia, was a significant conference that gathered $\sim$ 100 Canadian researchers to celebrate advancements in synthetic biology. The event fostered collaboration and facilitated the exchange of ideas among Canada's leading synthetic biology research groups.
- **President**, *Bangladeshi Grad Alliance UBC*, University of British Columbia 2024-2025
  Organized social events for Bangladeshi graduate students.
- **Project co-ordinator and organizer**, *DREAM Challenge 2022* [website] 2022
  Over 100 teams of $\sim$ 300 scientists from over 75 universities and companies worldwide participated in DREAM Challenge 2022 to create machine learning models that predict gene expression from DNA sequences. I co-organized the competition with Carl de Boer (UBC), Pablo Meyer (IBM research), and Jake Albrecht (Sage Bionetworks) as the only graduate student in the committee. I was responsible for the daily operation of the competition.
- **Secretary**, *Biomedical Engineering Graduate Association*, University of British Columbia 2021-2022
  Organized social events for SBME graduate students to increase interaction between different research groups.
- **Graduate Student Rep**, *SBME Sustainability Committee*, University of British Columbia 2021-2022
  Worked towards adopting sustainable thinking into the daily operations and culture of the SBME.
- **Assistant Treasurer**, *IEEE Joint Chapter SP/COM, IEEE Windsor Section*, University of Windsor 2020-2021
  Researched and analyzed financing alternatives and provided recommendations.
- **Vice President**, *Satyen Bose Science Club*, BUET 2017 - 2018
  Arranged scientific talks, seminars, and debates for university students to create an environment where students engage in active discussions on different topics of science.
- **Assistant General Secretary**, *Satyen Bose Science Club*, BUET 2017
  Worked as the foot soldier in the events organized by the club.
- **Volunteer tutor** for *illiterate workers of BUET dormitory canteen* 2014-2015
  Taught illiterate kids and adults to read and write who were working at the dorm canteen.
- **Volunteer tutor** for *Bholananda Night High School*, Sylhet 2011-2012
  Taught underprivileged kids who were required to work during day to support their families. I tried my best to inspire them to continue their education despite their circumstances.

Memberships

- **International Society for Computational Biology** 2022, 2024-
  Member of the International Society for Computational Biology, participating in conferences, webinars, and contributing to the global computational biology community.
- **Synbio Canada** [website] 2024–present
  Class A voting member, contributing to decisions and directions in the Synbio Canada community.
- **IEEE Signal Processing Society** [website] 2018, 2020,2021
  Participated in international student competitions and conferences, engaging with the latest advancements in signal processing.

- **Institute of Electrical and Electronics Engineers (IEEE)** [website] 2018, 2020,2021
  Engaged in various technical committees and professional development opportunities.

Skills

- **Programming Languages:** Python (Advanced), R (Advanced), MATLAB (Advanced), C++ (Intermediate), C (Intermediate), Assembly(Intermediate), Verilog (Basic)
- **Machine Learning Libraries:** Pytorch, Tensorflow, Scikit-learn, OpenCV
- **Machine Learning Inference:** Amazon SageMaker (cloud), Intel OpenVINO (edge), Nvidia TensorRT (edge)
- **Cloud Computing:** Amazon Web Services, Google Cloud Platform
- **Simulation & Design Tools:** OrCAD PSpice, Cadence EDA Tools (Virtuoso), Proteus7, Auto-CAD, emu8086, AVRstudio, CYME PSAF
- **Typesetting Software:** LaTeX(Advanced)
- **Graphic Design:** Adobe Illustrator (Advanced), Adobe Photoshop (Intermediate), Adobe Premiere Pro(Intermediate)