Tanmoy Sarkar Pias, PhD

Postdoctoral Scholar - AI/ML - Stanford University | PhD in Computer Science

Contact: tspias@stanford.edu, Address: San Jose, California, United States

Profile: LinkedIn, Google Scholar, GitHub, Lab, Portfolio

Education

Postdoctoral Training 09/2021-Present
Stanford University Stanford, CA, US
Working with multimodal foundation models

Ph.D., Computer Science 01/2021 - 09/2025
Virginia Tech Blacksburg, VA, US
Dissertation title: "Advancing Trustworthiness in Machine Learning Models: Methodologies for Systematic Evaluation and Deficiency Mitigation Strategies"

Masters of Science (MSc.), Computer Science Spring 2021 - Fall 2023
Virginia Tech Blacksburg, VA, US

Bachelor of Science (BSc.), Computer Science and Engineering Jul 2014 - Oct. 2018
B. University of Engineering and Technology (BUET)

Professional Experience

Postdoctoral Scholar 09/2021-Present
Stanford University Stanford, CA, US

- Multimodal deep learning models
- Foundation models
- LLMs
- Application of machine learning in healthcare

Research Assistant [link] May 2021 - Present
Department of Computer Science, Virginia Tech Blacksburg, VA, USA
My selected projects from the Human-centric Machine Intelligence Lab

- **Evaluating and Fine-Tuning LLMs for Enhanced Trustworthiness and Domain-Specific Adaptability**
  - *Delivered domain-specific LLM pipelines* by fine-tuning open-source models (e.g., Llama, DeepSeek, Qwen), raising robustness.
  - *Built an interpretability toolkit* that layers SHAP, LIME, and neural-activation visualizers into the model-validation workflow.
  - *Bias-stress testing and counterfactual augmentation*, retraining models to meet fairness benchmarks and guidelines.
  - *Optimized training and inference efficiency* through LoRA, QLoRA, and Quantization.
- **ML Testing: Trustworthiness and Consistency of AI Prediction**
  - *Designed an end-to-end machine learning testing and validation framework* before deployment
  - *Implemented synthetic data generation* targeting edge cases to stress-test AI/ML models
  - *Modified for data types* such as Tabular, Signal, Image, Time-series, and Text data
- **Knowledge-Guided Machine Learning**
  - *Engineered domain-aware loss functions* in PyTorch/ TensorFlow for domain-bounded penalties, monotonic risk constraints, etc.
  - *Integrated fairness regularizers and posthoc debasers* (re-weighing, equalized odds, adversarial parity) to mitigate performance gaps
  - *Personalized model development* through selective data training and fine-tuning to enhance effectiveness.
- **Time-series Analysis**
  - *Invented a gradient-based explainability method* for temporal data exposing how models reach predictions.
  - *Built an automated case-generation framework* that performs gradient-ascent in input space to synthesize challenging sequences.
  - *Engineered single and multi-channel gradients* to visualize the decision boundary of time-series models.

- **Key Skills**: Large Language Models (LLM), Generative Adversarial Networks (GANs), Vision Transformers, Retrieval-Augmented Generation (RAG), Autonomous Agents, Time-series Analysis, Transfer Learning, Fine-tuning, Custom Loss Function Design, Model Optimization, Model Compression, Model Quantization, Hyperparameter Tuning, GPU-accelerated Training, Multimodal Models, BERT, GPT, Transformer, Feature Engineering, Model Explainability, Fairness in AI, PyTorch, TensorFlow, Keras, Scikit-learn, Python, R, MATLAB.

Researcher January 2023 - Present
Sanghani Center for Artificial Intelligence and Data Analytics: Tanmoy Sarkar Pias Virginia Tech

- *Cultivated cross-lab collaborations* by pairing computer science researchers with statisticians, data scientists, and domain experts.
- *Showcased research to diverse audiences* by delivering invited talks at seminars, presenting posters, and translating technical findings to alumni and industry sponsors.

Research Intern (Machine Learning) May 2023 - August 2023

ThinkSense Inc. Arlington, VA

- ❖ *Built end-to-end activity-recognition and fall detection pipelines for wearables*: implemented using Transformer, CNN, and Bi-LSTM architectures in PyTorch that classify accelerometer & gyroscope streams in real time on end devices.
- ❖ *Applied advanced signal processing techniques:* change-point detection (CPD), Fast-fourier transformation (FFT), and wavelet transforms to segment activities accurately under varying movement patterns and sampling conditions.

Teaching Assistant Jan. 2021 - Dec. 2023

Department of Computer Science, Virginia Tech Blacksburg, VA, USA

- ❖ CS 5244: Web Application Development with Vue - Mentored professional students and supervised projects.
- ❖ CS 3114: Data Structures and Algorithms - Mentored to understand, implement, and apply data structures and algorithms
- ❖ CS 2505: Computer Organization - Mentored to understand coding problems and helped to debug using GDB.

Faculty (Lecturer) Oct. 2018 - Dec. 2020

University of Asia Pacific

- **Pattern Recognition:** The theory and implementation of machine learning models
- **Object-Oriented Programming II:** Python, OOP, Class, Object, Abstract Class, Interface, etc.
- **Visual and Web Programming:** Python, Django, back-end, front-end, HTML, CSS, JS, web development, and projects.
- **Digital System Design**: Taught and demonstrated digital circuit designs and supervised hardware projects.
- **Supervising Thesis and Project groups**

Key Technical Skills

10+ years of experience in Python & R, 6+ years of experience in AI/ML, 5+ years of experience in database & web dev

- **Large Language Models (LLMs):** Llama-2/3, DeepSeek, Qwen, GPT, BERT, Transformer, RAG, LoRA, QLoRa, Fine-tuning, Few-shot learning, Prompt-engineering, Zero-shot learning, Autoencoders, Encoders, Decoders, Model quantization, Model distillation.
- **Time-Series & Forecasting**: Long Short-Term Memory (LSTM), Recurrent Neural Networks (RNN), Transformer, Time-series gradient, Temporal Data Analysis, Signal processing.
- **Generative AI (GenAI):** Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Gradient customization (Gradient descent/ascent), Time-series gradient.
- **Computer Vision:** Vision Transformer (ViT), Computer vision, Image processing, Image filtering, Object Detection (YOLO, Faster R-CNN), Image Segmentation, Convolutional Neural Networks (CNN), Image Classification, Optical Character Recognition (OCR).
- **Robust ML**: Out-of-distribution detection, model shift, concept drifting, Domain Adaptation, Loss function customization, Model Monitoring, Responsiveness analysis. Model evaluation, Model blind-spot detection, A/B testing, Dimensionality reduction, PCA, t-SNE.
- **AI Explainability (XAI), Fairness & Privacy:** SHAP, Lime, Model visualization, Decision boundary visualization, Neural map, Fairness constraints, Bias detection and mitigation, AI safety, Ethical AI, Data privacy (Model inversion, member inference, homo-morphic cryptography, ML as service.
- **Statistics**: ANOVA, t-test, p-test, chi-square, PCA
- **Language/Frameworks**: Python, R, Huggingface, TensorFlow, PyTorch, NumPy, SciPy, Pandas, JAVA, C/C++, Django (Web dev), Matplotlib, R, Seaborn, Origin Lab, Database (SQL, MySQL), Sci-Kit Learn, OpenCV, CUDA, Origin Lab.

Honors and Awards

Fellowship: Awarded with Kafura Fellowship from the Department of Computer Science at Virginia Tech 2025

Spotlight Student: Selected as spotlight student at Sanghani Center for Artificial Intelligence and Data Analytics (link) 2025

Featured Research: My PhD research and publication featured at Virginia Tech (link) 2025

Fellowship: Awarded with BitShare Fellowship from the Department of Computer Science, Virginia Tech. 2021

Best Conference Paper Award: IEEE ECICE conference, Yunlin, Taiwan. 2019

Dean's Award: Awarded for outstanding result in the 3rd year during undergraduate studies at BUET 2017

Publications (First Author)

1. **Tanmoy Sarkar Pias** and Danfeng Yao***, "** Medical Knowledge Guided Machine Learning Models to Improve Responsiveness." (In preparation)
2. **Tanmoy Sarkar Pias,** Sharmin Afrose, Moon Das Tuli, Ipsita Hamid Trisha, Xinwei Deng, Charles B. Nemeroff, and Danfeng Yao*. "Low Responsiveness of Machine Learning Models to Critical or Deteriorating Health Conditions**."** ***Communications Medicine (Nature Portfolio)***, 5, 62 (2025). https://doi.org/10.1038/s43856-025-00775-0
3. **Tanmoy Sarkar Pias**, Y. Su, X. Tang, H. Wang, S. Faghani and D. Yao, "Enhancing Fairness and Accuracy in Diagnosing Type 2 Diabetes in Young Adult Population," in IEEE Journal of Biomedical and Health Informatics, 2025, doi: 10.1109/JBHI.2025.3616312.
4. **Tanmoy Sarkar Pias**, David Eisenberg, and Jorge Fresneda Fernandez. "Accuracy improvement of vehicle recognition by using smart device sensors." Sensors 22, no. 12 (2022): 4397.
5. **Tanmoy Sarkar Pias**, Raihan Kabir, David Eisenberg, Nadeem Ahmed, and Md Rashedul Islam. "Gender recognition by monitoring walking patterns via smartwatch sensors." In 2019 IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE), pp. 220-223. IEEE, 2019.
6. **Tanmoy Sarkar Pias***, David Eisenberg, and Muhammad Aminul Islam. "Vehicle recognition via sensor data from smart devices." In 2019 IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE), pp. 96-99. IEEE, 2019.

Publications (*corresponding author)

7. Simon Bin Akter, Sumya Akter, Moon Das Tuli, David Eisenberg, Aaron Lotvola, Humayera Islam, Jorge Fresneda Fernandez, Maik Hüttemann, and **Tanmoy Sarkar Pias***. "Fair and explainable Myocardial Infarction (MI) prediction: Novel strategies for feature selection and class imbalance correction." ***Computers in Biology and Medicine*** 184 (2025): 109413.
8. Simon Bin Akter, Sumya Akter, Rakibul Hasan, Md Mahadi Hasan, Riasat Azim, Jorge Fresneda Fernandez, Md Golam Rabiul Alam, David Eisenberg, and **Tanmoy Sarkar Pias***. "Optimizing Stability of Heart Disease Prediction Across Imbalanced Learning with Interpretable Grow Network." Computer Methods and Programs in Biomedicine 2024
9. Md Hasan, Mahbuba Suchi, Md Habib, Sumya Akter, Zarin Tasnim Rothy, A.M.Tayeful Islam, David Eisenberg, **Tanmoy Sarkar Pias***, Simon Bin Akter, medRxiv doi: https://doi.org/10.1101/2024.12.11.24318858, 2025 (Submitted: Computers in Biology and Medicine)
10. Mridula Danastan Tasaouf, Abu Ahmed Ferdaus, and **Tanmoy Sarkar Pias***. "Exploring Emotions in EEG: Deep Learning Approach with Feature Fusion." In 2023 26th International Conference on Computer and Information Technology (ICCIT), pp. 1-6. IEEE, 2023.
11. Akter Simon Bin, Sumya Akter, and **Tanmoy Sarkar Pias***. "Stroke Probability Prediction from Medical Survey Data: AI-Driven Analysis with Insightful Feature Importance using Explainable AI (XAI)." In 2023 26th International Conference on Computer and Information Technology (ICCIT), pp. 1-6. IEEE, 2023.
12. Akter Sumya, Rumman Ahmed Prodhan, **Tanmoy Sarkar Pias***, David Eisenberg, and Jorge Fresneda Fernandez. "M1M2: deep-learning-based real-time emotion recognition from neural activity." Sensors 22, no. 21 (2022): 8467.
13. S. Barman, M. Hasan, P. Arafin, T. Helaly and **Tanmoy Sarkar Pias***, "Deep Convolutional Neural Network Based Automatic COVID-19 Detection from Chest X-ray Images," 2022 4th International Conference on Electrical, Computer & Telecommunication Engineering (ICECTE), Rajshahi, Bangladesh, 2022, pp. 1-4, doi: 10.1109/ICECTE57896.2022.10114540.
14. Mazumder, Tanmoy, Shawan Das, Md Hasibur Rahman, Tanjina Helaly, and **Tanmoy Sarkar Pias***. "Performance Evaluation of Different Word Embedding Techniques Across Machine Learning and Deep Learning Models." In 2022 25th International Conference on Computer and Information Technology (ICCIT), pp. 932-937. IEEE, 2022.
15. Prodhan, Rumman Ahmed, Sumya Akter, Muhammad Bin Mujib, Md Akhtaruzzaman Adnan, and **Tanmoy Sarkar Pias***. "Emotion Recognition from Brain Wave Using Multitask Machine Learning Leveraging Residual Connections." In International Conference on Machine Intelligence and Emerging Technologies, pp. 121-136. Cham: Springer Nature Switzerland, 2022.
16. Prodhan, Rumman Ahmed, Sumya Akter, **Tanmoy Sarkar Pias***, and Md Akhtaruzzaman Adnan. "Optimal EEG Electrode Set for Emotion Recognition From Brain Signals: An Empirical Quest." arXiv preprint arXiv:2311.17204 (2023). (accepted in Springer)
17. Akter Sumya, Rumman Ahmed Prodhan, Muhammad Bin Mujib, Md Akhtaruzzaman Adnan, and **Tanmoy Sarkar Pias***. "Evaluating the Effectiveness of Classification Algorithms for EEG Sentiment Analysis." In Sentiment Analysis and Deep Learning: Proceedings of ICSADL 2022, pp. 195-212. Singapore: Springer Nature Singapore, 2023.
18. Shawon Md Shahedul Haque, Sagor Biswas, Nirob Arefin, **Tanmoy Sarkar Pias***, and Ashikur Rahman. "On age prediction from facial images in presence of facial expressions." International Journal of Applied Pattern Recognition 6, no. 4 (2021): 345-369.
19. Hasan Mahmudul, Samina Yasmin, and **Tanmoy Sarkar Pias***. "Fine-grained emotion recognition from eeg signal using fast fourier transformation and cnn." In 2021 Joint 10th International Conference on Informatics, Electronics & Vision (ICIEV) and 2021 5th International Conference on Imaging, Vision & Pattern Recognition (icIVPR), pp. 1-9. IEEE, 2021.
20. Islam Muhammad Aminul, Riad, and **Tanmoy Sarkar Pias***. "Enhancing security of image steganography using visual cryptography." In 2021 2nd International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST), pp. 694-698. IEEE, 2021.
21. Rahman Rashik, Abdul Fattah Rakib, Mariam Rahman, Tanjina Helaly, and **Tanmoy Sarkar Pias***. "A Real-time End-to-End Bangladeshi License Plate Detection and Recognition System for All Situations Including Challenging Environmental Scenarios." In 2021 5th International Conference on Electrical Engineering and Information Communication Technology (ICEEICT), pp. 1-6. IEEE, 2021.
22. Apu Md Remon Hasan, Fahmeda Akter, Mst Farzana Akhtar Lubna, Tanjina Helaly, and **Tanmoy Sarkar Pias***. "ECG Arrhythmia Classification Using 1-D Convolution Neural Network Leveraging the Resampling Technique and Gaussian Mixture Model, " In 2021 Joint 10th International Conference on Informatics, Electronics & Vision (ICIEV) and 2021 5th International Conference on Imaging, Vision & Pattern Recognition (icIVPR), pp. 1-8. IEEE, 2021.
23. Hassan Reshad, Sakib Hasan, Md Jubaer Hasan, Md Rafat Jamader, David Eisenberg, and **Tanmoy Sarkar Pias***. "Human attention recognition with machine learning from brain-EEG signals." In 2020 IEEE 2nd Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability (ECBIOS), pp. 16-19. IEEE, 2020.
24. Sarif Mesbah, **Tanmoy Sarkar Pias***, Tanjina, Md Tutul, and Md Rahman. "Deep learning-based Bangladeshi license plate recognition system." In 2020 4th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), pp. 1-6. IEEE, 2020.
25. Islam Muhammad Aminul, Md Al-Amin Khan Riad, and **Tanmoy Sarkar Pias***. "Performance Analysis of Steganography Tools." In 2020 2nd International Conference on Advanced Information and Communication Technology (ICAICT), pp. 428-433. IEEE, 2020.
26. Rashik, **Tanmoy Sarkar Pias***, and Tanjina. "GGCS: A Greedy Graph-Based Character Segmentation System for Bangladeshi License Plate, " In 2020 4th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), pp. 1-7. IEEE, 2020.

Publications (co-author)

27. Mohimenul Karim, **Tanmoy Sarkar Pias,** Bimal Viswanath, and Danfeng Yao*. "Differential Impact Testing and Its Application in Assessing the Fairness of Mortality Prediction.". (Submitted to Conference on Health, Inference, and Learning (CHIL) 2025)
28. Simon Bin Akter, Sumya Akter, Rakibul Hasan, Md Mahadi Hasan, AM Tayeful Islam, **Tanmoy Sarkar Pias**, Jorge Fresneda Fernandez, Md Golam Rabiul Alam, and David Eisenberg*. "Early detection of subjective cognitive decline from self-reported symptoms: An interpretable attention-cost fusion approach." Journal of Biomedical Informatics (2025): 104770.
29. Ovi, Md Ohiduzzaman, Maliha Sanjana, Fahad Fahad, Mahjabin Runa, Zarin Tasnim Rothy, **Tanmoy Sarkar Pias**, A. M. Islam, and Rumman Ahmed Prodhan*. "Enhanced Pediatric Dental Segmentation Using a Custom SegUNet with VGG19 Backbone on Panoramic Radiographs." accepted in 27th International Conference on Computer and Information Technology (ICCIT), arXiv:2503.06321 (2025).
30. Frantz Miles, Ya Xiao, **Tanmoy Sarkar Pias**, Na Meng, and Danfeng Daphne Yao*. "Methods and Benchmark for Detecting Cryptographic API Misuses in Python." IEEE Transactions on Software Engineering (2024).
31. Bin Akter Simon, **Tanmoy Sarkar Pias**, Shohana Rahman Deeba, Jahangir Hossain, and Hafiz Abdur Rahman*. "Ensemble learning based transmission line fault classification using phasor measurement unit (PMU) data with explainable AI (XAI)." Plos one 19, no. 2 (2024)
32. Bhattacharjee Ananya, **Tanmoy Sarkar Pias**, Mahathir Ahmad, and Ashikur Rahman*. "On the Performance Analysis of APIs Recognizing Emotions from Video Images of Facial Expressions." In 2018 17th IEEE International Conference on Machine Learning and Applications (ICMLA), pp. 223-230. IEEE, 2018.

Poster

- **Tanmoy Sarkar Pias, "**Low Responsiveness of Machine Learning Models to Critical or Deteriorating Health Conditions.", Conference on Health, Inference, and Learning (CHIL), 2025
- **Tanmoy Sarkar Pias,** "Improve the Responsiveness of Clinical AI Model." Virginia Tech Ut Prosim Society, 2025.
- **Tanmoy Sarkar Pias**, "Mitigating Age-based bias from Diabetic Diagnostic Model." BioIT Conference and Expo, 2024.
- Frantz, Miles, Ya Xiao, **Tanmoy Sarkar Pias**, and Danfeng Daphne Yao*. "Precise Detection of Unprecedented Python Cryptographic Misuses Using On-Demand Analysis." In The Network and Distributed System Security (NDSS) Symposium. 2022.
- **Tanmoy Sarkar Pias,** "Reducing Bias from Clinical ML Models", VTTI, 2022.
- **Tanmoy Sarkar Pias**, "Effect of Facial Expressions on Age Prediction: A view from online age detection APIs", NSysS, 2019.

Reviewer

- Journal of Nature-Scientific Reports
- Journal of BMC Artificial Intelligence
- Journal of Expert Systems With Applications
- Journal of Discover Artificial Intelligence
- Journal of Neural Networks
- Journal of Transactions on Dependable and Secure Computing
- Journal of Knowledge and Information Systems
- Advanced Computational Intelligence and Intelligent Informatics
- Journal of Computers in Biology and Medicine
- Journal of Frontiers - Digital Health
- Journal of Frontiers - Cardiovascular Medicine
- Journal of Frontiers - Oncology
- Journal of Frontiers - Neuroscience
- Journal of PeerJ Computer Science
- Journal of Biomedical Signal Processing and Control
- Journal of Cluster Computing

External Research Collaboration

- Professor Charles B. Nemeroff—Professor, Dell Medical School, University of Texas at Austin, USA
- Dr. Jorge Fernandez—Associate Professor, New Jersey Institute of Technology, USA
- Dr. David Eisenberg—Assistant Professor, Montclair State University, USA
- Professor Maik Hüttemann—Professor, Wayne State - School of Medicine. USA
- Ipsita Hamid Trisha (MS, MBBS)—Resident Neurology at Banner University Medical Center, Univ. of Arizona, USA
- Dr. Humayera Islam—Postdoc, Precision Health, University of Chicago, USA

Advisory and Supervisory Responsibilities

Date	*Name of trainee*	*Type of supervision*	*Current position*
2022-2024	Rumman Ahmed Prodhan	Undergrad thesis co-supervisor	Faculty, Northern University
2022-2024	Sumya Akter	Undergrad thesis co-supervisor	Faculty, Northern University
2022-2024	Danastan Tasaouf Mridula	MS thesis co-supervisor	Faculty, Northern University
2021-2022	Tanmoy Mazumder	Undergrad thesis co-supervisor	Faculty, Northern University
2020-2022	Md Shahedul Haque	Undergrad thesis co-supervisor	PhD student, Virginia Tech
2020-2022	Sagor Biswas	Undergrad thesis co-supervisor	PhD student, Central University of Florida
2019-2020	Muhammad Aminul Islam	Undergrad thesis supervisor	Faculty, Central Univ. of Sci. and Tech.

Selected Class Projects

- Reducing the Effect of Data Imbalance from NLP Model — Graduate Spring 2022
- Collaborative Learning Through Multiple Private Datasets Ensuring Data Privacy — Graduate Spring 2021
- Confused Student Recognition from EEG signal — Graduate Spring 2021
- Gender Recognition From Image (Deep Learning Project) — Undergraduate Fall 2017
- Enterprise Resource Planning (Software) — Undergraduate Spring 2017
- Space Fight Dual (Hardware project) — Undergraduate Fall 2016
- Space Fight Game (Hardware project) — Undergraduate Spring 2016
- Online Super Shop (Web Project) — Undergraduate Fall 2015
- Bus Ticket Management System (Java, MySQL) — Undergraduate Spring 2015

Selected Media Coverage

- **Virginia Tech News**: Machine learning models fail to detect key health deteriorations, Virginia Tech research shows (Read)
- **Becker's Health IT**: AI models struggle to detect patient deterioration (Read)
- **News Medical**: Machine learning models fall short in predicting in-hospital mortality (Read)
- **Bioengineer**: Study Reveals Machine Learning Models Struggle to Identify Critical Health Declines (Read)
- **Healthcare in Europe**: Will an AI recognize patient deterioration in the ICU? Not quite yet (Read)
- **Scienmag**: Virginia Tech Study Reveals Machine Learning Models Struggle to Identify Critical Health Declines (Read)
- **EurekAlert**: Machine learning models fail to detect key health deteriorations, Virginia Tech research shows (Read)
- **Medicalxpress**: Machine learning models fail to detect key health deteriorations, research shows (Read)
- **Miragenews**: Machine Learning Misses Key Health Deteriorations (Read)
- **N+1**: Machine learning scans critical and progressive medical conditions (Read)