

HUMAYRA TASNIM

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RESEARCH OBJECTIVE

My research is focused on understanding complex systems, particularly analyzing biological systems and biomedical images. I have employed information theory, computer modeling, simulations, statistics, and HPC in my research, and I am now integrating these approaches with deep learning techniques. My research has the potential to significantly contribute to understanding biological phenomena, including the immune response to infections, using novel scientific visualizations.

EDUCATION

PhD in Computer Science	<i>Fall 2016 - Present</i>
University of New Mexico, Albuquerque, NM	
MS in Computer Science	<i>Fall 2021</i>
University of New Mexico, Albuquerque, NM	
MS in Computer Science & Engineering	<i>2014 - 2015</i>
University of Dhaka, Dhaka, Bangladesh	
BS in Computer Science & Engineering	<i>2009 - 2013</i>
University of Dhaka, Dhaka, Bangladesh	

RESEARCH EXPERIENCE

Research Assistant, *Moses Biological Computation Lab, CS, UNM* *Summer 2017 - Present*

- Use computer modeling, statistical tools, and simulations to analyze and comprehend complex biological systems scenarios such as spatial association, cell motility, signaling, search behaviors, and localization.
- Develop information theory-based frameworks that enable the analysis and identification of spatial and temporal relationships within large-scale image datasets.

Selected Projects:

- **Quantitative Measurement of Spatial Association in Biological Systems**
 - Developed and applied **Normalized Mutual Information (NMI)** to quantitatively measure the spatial association of naive T cells with other cell types in lymph nodes.
 - This analysis is important for T cell activation and motility to understand the rapid response of the immune system to novel infections.
- **Information-Theoretic Feature Analysis in Multivariate Time-Varying Image Databases**
 - Developed an information-theoretic framework for automatic salient feature exploration in image databases.
 - Propose a feature-based temporal data summarizing technique for large-scale data reduction using information-based fusion.
- **Spatial Features Analysis of SARS-CoV-2 in Lung CT scans**
 - Propose a computational model to identify and track the progression of SARS-CoV-2 infection from Computed Tomography (CT) scans.
 - This model will be used to validate SimCoV (computer-simulated agent-based model) developed in the Moses lab to study SARS-CoV-2 infection by analyzing the spatial distribution of infected cells and immune response in patients.

INTERNSHIPS AND FELLOWSHIPS

Summer Research Intern, *Lawrence Berkeley National Laboratory* *June 2023 - August 2023*

- Intern at Computer Languages and Systems Software Group.
- Topic: Analyzing T-Cell Behavior for Immune Response in SARS-CoV-2 Patients using CT Scans and SIMCoV Model

Summer Research Intern, *Lawrence Berkeley National Laboratory* *June 2022 - August 2022*

- Research internship funded by Sustainable Research Pathways for High-Performance Computing (SRP-HPC) program.
- Topic: Analyzing Spatial Features of SARS-CoV-2 Infection Spread in Human Lung using CT Scans Compared to SIMCoV Model.

- Research fellowship at Data Science at Scale Summer School Program.
- Developed an information-theoretic analysis framework that works on multivariate time-varying Cinema databases (image database developed at LANL) and performs automatic identification of salient regions.
- The technique serves as an interactive customized tool for the existing Cinema viewer presenting pre-analyzed results for further research.

APPLICATION BASED PROJECTS

- **Technical Lead - Swarmathon : The Next Generation** *2020 - 2022*
 - Taught a course (Spring 2022) and organized a workshop (Spring 2021) sponsored by Google exploreCSR outreach program to encourage women undergrad students to pursue research careers, focusing on AI and machine learning. Link: <https://swarmathon-tng.cs.unm.edu/>
 - The Workshop provided basic ideas to use machine learning framework, TensorFlow, to train neural network models. As an application, I integrated object detection features into the swarm robots developed in the Moses lab for autonomous detection and collection of objects.
- **Graduate Student Advisor: UNM Chili House - NASA MINDS Challenge** *Spring 2021*
 - Part of the winning team *UNM Chili House* at NASA MINDS Challenge that proposed the use of robots to autonomously water and grow plants (New Mexico Chiles) on Mars and Moon to provide fresh food for astronauts. Link: <https://news.unm.edu/news/could-plants-control-robots-on-mars>
 - I worked on the approach to implementing the autonomous path-planning procedure of the robots and mentored undergraduate students.
- **Finalist: Team Swarmathon - NASA Space Robotics Challenge Phase 2** *Spring 2021*
 - Competition to develop software to increase the autonomy of mobile robots during space travel.
 - In the qualification round, as a part of the team, my work focused on resource detection and localization of the robots on the simulated environment.

SELECTED PUBLICATIONS

- **Tasnim, H.**, Dutta, S., Moses, M., 2023. Dynamic spatio-temporal summarization using information-based fusion. arXiv:2310.01617. submitted to Image and Vision Computing, Elsevier (under review)
- **H. Tasnim**, S. Dutta, T. L. Turton, D. Rogers, and M. E. Moses, (2022) “Information-theoretic Exploration of Multivariate Time-Varying Image Databases”, *Computing in Science & Engineering*
- Soumya Dutta, **Humayra Tasnim**, Terece L. Turton, and James Ahrens, “In Situ Adaptive Spatio-Temporal Data Summarization”, IEEE International Conference on Big Data (IEEEBigdata) 2021, pp. 315-321.
- Moses, M.E., Hofmeyr, S., Cannon, J.L., Andrews, A., Gridley, R., Hinga, M., Leyba, K., Pribisova, A., Surdidijaja, V., **Tasnim, H.** and Forrest, S., “Spatially distributed infection increases viral load in a computational model of SARS-CoV-2 lung infection”, *PLoS Computational Biology*.2021;17(12):e1009735.
- Judy L Cannon, Melanie E Moses, Janie R Byrum, Paulus Mrass, G Matthew Fricke, **Humayra Tasnim**. “Modeling T Cell Motion in Tissues During Immune Responses.” *Biophysical Journal* 116 (3), 322a, Elsevier, 2019
- **Humayra Tasnim**, G. Matthew Fricke, Janie R. Byrum, Justyna O. Tafoya, Judy L. Cannon, Melanie E. Moses. “Quantitative Measurement of Naive T cell Association with Dendritic Cells, FRC, and Blood Vessels in Lymph Nodes.” *Frontiers in Immunology, section Microbial Immunology*, 2018, Front.Immunol.9:1571.doi: 10.3389/fimmu.2018.01571
- Sadia Nowrin, Lafifa Jamal, **Humayra Tasnim**, “An Efficient Approach To Design A Reversible Signed Multiplier,” in *TENCON 2014 - 2014 IEEE Region 10 Conference*, vol., no., pp.1-6, 22-25 Oct. 2014

Google Scholar: <https://scholar.google.com/citations?hl=en&user=Q-v01KQAAAAJ>

TECHNOLOGY SKILLS

Programming Python, Matlab, C, Java, Haskell, HTML, CSS, PHP, Assembly, SQL, Shell Scripting
Tools/Software TensorFlow, Keras, Git, Latex, ParaView, MySQL, Apache Tomcat server

TEACHING EXPERIENCE

Teaching Assistant, Computer Science, UNM

Fall 2016 - Spring 2017

- Data Structure and Algorithm I (CS 262)- Course Instructor: Dr. Shuang Luan. (Fall 2016)
- Data Structure and Algorithm II (CS 362)- Course Instructor: Dr. Thomas Hayes. (Spring 2017)
- Responsibilities: Grading homework and exam scripts, holding office hours to assist students with coursework, and proctoring exams.

Lecturer in Computer Science & Engineering, Eastern University, Bangladesh *2014 - 2016*

- Courses: Structured and Object-Oriented Programming, Theory of Computation, Software Engineering

COURSE PROJECTS

Text Categorization using Naïve Bayes Classifier and Logistic Regression	<i>Fall 2018</i>
Classification of DNA Sequence using Machine Learning Decision Tree Algorithm	<i>Fall 2018</i>
Implement and Analyze Forest Fire Behavior as Cellular Automata Model	<i>Spring 2017</i>
Evolving Core War Warriors Using a Genetic Algorithm	<i>Spring 2017</i>
Discovering Structure and Behavior in Complex Adaptive Systems	<i>Spring 2017</i>

LEADERSHIP, AWARDS AND HONORS

Recipient , UNM School of Engineering Outstanding Graduate Student Award from CS Department	<i>2023</i>
Recipient , Student Scholarship recipient to attend 2022 Grace Hopper Celebration	<i>2022</i>
Recipient and Student Lead , Google exploreCSR Award (2 consecutive Years)	<i>20-21, 21-22</i>
Graduate Student Advisor , UNM Chili House Team, NASA MINDS Challenge	<i>2021</i>
Participant , Team Swarmathon, NASA Space Robotics Challenge Phase Two	<i>2021</i>
Recipient , NSF scholarship recipient to attend 2020 ACM Richard Tapia Conference	<i>2020</i>
Co-Organizer , Student -Faculty Panel, 16th and 17th UNM CS Student Conference	<i>2021-2022</i>
Recipient , CRA-W Grad Cohort Workshop Participation Grant	<i>2019</i>
Recipient , UNM GPSA Professional Development Grant (Spring)	<i>2019</i>
Mentor , Summer intern project for a high school student.	<i>2019</i>
President , Computer Science Graduate Student Association at UNM	<i>2018-19</i>
Lead Organizer , 15th UNM CS Student Conference and effectively secured exemplary external funding	<i>2019</i>
Representative , Woman in Computing chapter at UNM in 2018 Grace Hopper Celebration	<i>2018</i>
Recipient , Student Conference Award Program to attend 2018 Grace Hopper Celebration	<i>2018</i>
Organizer , 14th UNM Computer Science Student Conference	<i>2018</i>
General Secretary , Computer Science Graduate Student Association at UNM	<i>2017-18</i>
Treasurer , Woman in Computing (WinC) Chapter at UNM	<i>2017-18</i>
Reviewer , IEEE Symposium on Artificial Life (ALIFE)	<i>2017</i>
Volunteer , 13th UNM Computer Science Student Conference	<i>2017</i>
Ministry of ICT Fellowship from Bangladesh Government for MS thesis	<i>2014-15</i>
7th place in National Collegiate Programming Contest (Women), Bangladesh	<i>2011</i>