JOSIANE UWUMUKIZA

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EDUCATION

Wellesley College, Wellesley MA
Bachelor of Arts in Computer Science *Expected Graduation May 2026*

- Relevant Courses: Artificial Intelligence, Probabilistic Foundations of Machine Learning, Theory of Computation, Foundations of Computer Systems, Multivariable Calculus, Combinatorics & Graph Theory.

Massachusetts Institute of Technology, Cambridge MA *Jan 2025-May 2026*

- *Cross Registered Student*: Cryptocurrency Design and Engineering, Computer Systems Security, Undergraduate Research in Aerospace Engineering (16.UR).

Queen Mary University of London, England, UK
Semester Abroad Program Fall 2024

- Relevant Courses: Introduction to Scientific Computing, Computability & Complexity and Algorithms, Semi-Structured Data Engineering

RESEARCH INTERESTS

Computer Vision: 3D scene reconstruction, depth estimation, image-to-image translation, object detection and tracking, pose estimation, perception for autonomous systems, vision-based navigation, traffic analysis, computer vision for smart environments, city-scale mapping, Vision Language Models, Visual Place Recognition.

SKILLS

Programming Languages: Languages: Python, R, Java, Assembly (competent); C, Scope, C# (intermediate)
Probabilistic Machine Learning: JAX, NumPyro, Bayesian inference, Maximum Likelihood Estimation (MLE), directed graphical models(DGMs), probability theory.
Computer Vision & Deep Leaning: PyTorch, TensorFlow, Keras, Scikit-learn, OpenCV, Hugging Face, DINOv3, Convolutional Neural Networks (CNNs), CycleGANs, PyTorch3D, Blender.
NLP & LLMs: Prompt engineering, BERT fine-tuning, LLM evaluation, Distributed data processing.
Languages: Kinyarwanda (Native), English(Fluent), French and Swahili(Beginner)

RESEARCH EXPERIENCE

Massachusetts Institute of Technology
Spacecraft Pose Estimation (Honors Thesis) *August 2025-May 2026*

- Developed a single-image and 3D reconstruction based 6-DoF spacecraft pose estimation pipeline for autonomous perception.
- Extracted features using DINOv3 ViT (2D) and a trainable DGCNN 3D encoder in PyTorch.
- Implemented self- and cross-attention matching to learn 2D–3D correspondences, followed by EPnP.
- Applied PCA and exploratory data analysis to visualize correspondences and diagnose failure cases in symmetric spacecraft.

Space Novel View Synthesis (UROP) *January- May 2025*

- Contributed as a co- first author to DreamSat-2.0, a single-view 3D reconstruction pipeline for spacecraft and asteroid imagery.
- Evaluated reconstruction quality using 3D IoU, Chamfer Distance, Hausdorff Distance, and 2D perceptual metrics (PSNR, SSIM, LPIPS), contributing to the analysis and results in the published paper.
- Contributed to writing the code, editing, and preparing the research paper and reproducible codebase for internal review and publication.

National Institute of Health - The Human BioMolecular Atlas Program, Gainesville, FL *May-August, 2024*
Computer Vision intern with Dr.Pinaki Sarder

- Implemented and trained CycleGAN and Attention U-Net deep learning models to segment podocytes from histopathology whole slide images, achieving 0.92 Structural Similarity (SSIM) for image translation.
- Utilized PyTorch, TensorFlow (with CUDA GPU acceleration), OpenCV, Numpy, and TiffSlide and Scikit-Image for model training, data preprocessing and augmentation and visualization of results.
- Exported final annotations in XML and JSON formats for compatibility with platforms like ImageScope and Athena cloud services, enhancing workflow efficiency for downstream analysis.

Sophomore Early Research Program| Wellesley College, MA *September 2023-May, 2025*
Computational Chemistry Research Student with Prof. Don Elmore

- Developed and analyzed molecular dynamics simulations in Gromacs using Shell Scripting to investigate the effects of peptide truncations on protein structure and stability in water and lipids.
- Utilized R and Excel to analyze large datasets, quantifying structural changes and hydrogen bond formation during simulations.
- Performed qualitative analysis of simulation movies and images to gain insights into protein dynamics.

The Jackson Laboratory For Genomic Medicine, Farmington, CT *May-September, 2023*
Research Intern with Prof. Edison T. Liu

- Conducted comprehensive Whole Genome Sequencing (WGS) data analysis of 30 human breast cancer cells.
- Investigated genetic mutations using MutationalPatterns and COSMIC Mutational Signature matrices in R to associate mutations, and gene hyper or hypo expressions to probable cause/etiology.
- Performed wet lab validations of gene mutations, copy number losses, and chromosomal truncations using DNA/RNA isolation, PCR, qPCR, and Gel electrophoresis techniques.

TEACHING AND WORK EXPERIENCE

Microsoft, Redmond, WA
Software Engineer Intern with Microsoft AI *May -August 2025*

- Built a scoring pipeline for advertisement targeting using OpenAI's API improving clicks precision 74% and recall 85%.
- Implemented distributed data preprocessing with partitioned loading allowing daily ad scoring.
- Deployed the pipeline via Azure Data Factory using SQL and C#.

Computer Science Department, Wellesley MA
Teaching Assistant for Mobile App Development *August - December 2025*

- Supported 14 students in building full-stack mobile applications using React Native, Firebase, and Expo.
- Led weekly office hours to provide individualized support, and troubleshoot student projects.

Davis Museum, Wellesley, MA
Student Advisory Committee *September 2022-present*

- Selected as 1 of 10 students to advise the Davis Museum, which holds 11,000+ artworks at Wellesley College.
- Provided input on student-centered exhibitions and programs, helping curators shape inclusive displays.
- Worked with faculty, campus groups, and alumni to support museum events serving thousands of annual visitors.
- Contributed and offered feedback on visitor experience, outreach, and programming to strengthen the museum's role as a teaching and cultural center.

Wellesley College Botanic Gardens, Wellesley, MA
Student Assistant *January 2023-May 2024*

- Supported operations of Wellesley's teaching greenhouse, caring for global plant collections used for research, coursework, and public education.

- Assisted with plant care, display preparation, and visitor engagement, serving hundreds of weekly visitors.
- Helped coordinate the annual Greenhouse Light Show, a campus-wide event drawing 200+ attendees.

PUBLICATIONS AND PRESENTATIONS

J. Uwumukiza*, S. Diaz*, X. Hu*, G. Lavezzi, V. Rodriguez-Fernandez, and R. Linares. *DreamSat-2.0: Towards a General Single-View Asteroid 3D Reconstruction.* AAS/AIAA Astrodynamics Specialist Conference, August 2025. *Co-first author.

Josiane Uwumukiza, Francesca Menghi, Rob Straub, Edison T. Liu (November 2024). Understanding Genomic Integrity in Triple Negative Breast Cancer Cells. Poster presentation at the ABCRMS national conference.

Josiane Uwumukiza, Francesca Menghi, Rob Straub, Edison T. Liu (January 2024). Understanding Genomic Integrity in Triple Negative Breast Cancer Cells. Poster presentation at the Harvard University National Collegiate Research Conference (NCRC).

Josiane Uwumukiza, Ahmed Naglah, and Pinaki Sarder (August, 2024). Podocount: Utilizing Artificial intelligence and Computer Vision to analyse histopathology images. Oral presentation at the HuBMAP 2024 virtual symposium. https://www.youtube.com/watch?v=-wxJ_kZCuOA&t=795s

Uwumukiza, J. et al., (April, 2024). *Investigating the Properties and Characteristics of Antimicrobial Peptides.* Oral presentation given at the 28th annual Ruhlman Conference at Wellesley College**.**

AWARDS & FELLOWSHIPS

Wellesley College Conference Travel Grant, Wellesley MA
Recipient *November 2024*
- *Competitive grant awarded to support research presentation at ABCRMS national conference.*

Wellesley Blue Angels Pitch Competition, Wellesley MA
1st Place Winner *March 2024*
- *Earned 1st Place in Wellesley's most competitive tech venture pitch competition, selected by a distinguished panel of alumni leaders in technology, entrepreneurship, and venture capital.*

D. E. Shaw Research Undergraduate & Master's Fellowship, New York, NY
Fellow *August 2024*
- *Selected for a fully funded, two-day research fellowship in computational biochemistry and scientific computing at D. E. Shaw Research (NYC).*

CREATIVE WORKS

Inyamanza n'Abana Bayo
Book author
- Award-winning children's book written and published at age 14; received 1st Place in the Andika Rwanda National Writing Competition (2017/2018). https://elearning.reb.rw/pluginfile.php/11464/mod_resource/content/1/inyamanza.pdf

ORGANISATIONS AND CLUBS

- WC Blue notes acapella, Wellesley Africans Association, Harvard women founders circle, Wellesley Computer science Club, Code2040 Fellow.