SHASHWAT MAHARJAN, E.I.T.

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CliftonStrengths: Developer | Includer | Positivity | Harmony | Analytical

PROFILE SUMMARY

Shashwat is a PhD student at Villanova University, specializing in the application of machine learning to design biologically inspired composite materials for dental applications. With a strong background in machine learning and structural health monitoring, he has authored multiple publications in esteemed peer-reviewed journals and conferences. His academic excellence has been recognized through several prestigious awards, including the Undergraduate President's Award for Research at Central Michigan University and the Outstanding Undergraduate Student of the Year 2022 by the Engineering Society of Detroit. Additionally, Shashwat was selected for a Department of Energy research internship at Geologica Geothermal Group, where he helped pioneer a machine learning technique to estimate static formation temperature within sub-surface geothermal reservoirs.

EDUCATION

PhD in Mechanical Engineering	Villanova University	GPA: 3.7	2024 - 2028
Masters of Engineering	Central Michigan University	GPA: 3.8	2022 - 2024
Bachelors of Mechanical Engineering	Central Michigan University	GPA: 3.8	2018 - 2022

SKILLS

Modeling: ABAQUS, ANSYS, SolidWorks, Fusion360, NX Siemens, and Volsung.
Programming: Python, Julia, MATLAB, SQL, Linux, TensorFlow, PyTorch, LabView, and FANUC Robot Controls.
Courses Taken: Advanced Engineering Analysis, Machine Learning, Finite Element Analysis, Biomimicry.

PROFESSIONAL EXPERIENCE

Research Assistant   August 2024 - Present
Villanova University   *Villanova, PA*

- Developed a FEM and ML model, improving tibia injury prediction and enabling early injury identification.
- Optimized simulation frameworks for self-healing biomaterials, increasing durability and performance.
- Designed bio-inspired metamaterial architecture modeled on the ant cuticle, enhancing resilience and adhesion.

Geothermal Research Intern   July 2023 - May 2024
Geologica Geothermal Group   *San Diego, CA*

- Optimized Volsung automation to streamline data processing using Python, reducing processing time by 70%.
- Developed an ML model using Tensorflow for static formation temperature estimation, boosting accuracy by 35%.
- Transformed conventional SFT estimation methods using physics-informed ML, reducing error margins by 15%.

Research Assistant   August 2020 - May 2024
Central Michigan University   *Mount Pleasant, MI*

- Automated workflows and improving simulation efficiency, increasing data throughput by 50%.
- Optimized structural designs using FEM, reducing iterative testing cycles by 30% for faster predictive modeling.
- Accelerated computational simulations from days to real-time (1 sec), decreasing processing time by over 99%.

Research Fellow   May 2023 - June 2023
King's College   *Kathmandu, Nepal*

- Led a team of three to improve employee workflow and facilitate promotions in a startup.
- Focused on addressing the developer code activity logging issue by coordinating with diverse stakeholders.
- Effectively collaborated with a global team across to perform root cause analysis.

Neuroscience Research Intern   May 2022 - Aug 2022
Brown University   *Providence, RI*

- Automated data analysis by developing MATLAB and Python scripts, reducing manual processing time by 80%.
- Applied advanced signal processing on high-resolution sensor data, doubling data throughput and accuracy.
- Achieved 1ms verification accuracy for neurophysiological results, boosting experimental reliability by 25%.

CONFERENCE PRESENTATIONS

Poster Presentation at at the Society of Biomaterials (SFB) Conference 2025. Presentation Link.

Short Paper at at the Engineering Mechanics Institute (EMI) Conference 2024. Presentation Link.

Poster at International Mechanical Engineering Congress & Exposition (IMECE) 2022. Presentation Link.

Short Paper at the Engineering Mechanics Institute (EMI) Conference 2022. Presentation Link.

PUBLICATIONS

Kim, B., **Maharjan, S.**, Pranto, F. M., Guidio, B., Schaal, C., & Jeong, C. (2024). Convolutional neural network and level-set spectral element method for ultrasonic imaging of delamination cavities in an anisotropic composite structure. Ultrasonics, 107254. https://doi.org/10.1016/j.ultras.2024.107254. Journal Paper Link.

Maharjan, S., Guidio, B., & Jeong, C. (2024). Convolutional neural network for identifying effective seismic force at a DRM layer for rapid reconstruction of SH ground motions. Earthquake Engineering & Structural Dynamics, 53(2), 894-923. https://doi.org/10.1002/eqe.4049. Journal Paper Link.

Pranto, F. M., **Maharjan, S.**, & Jeong, C. (2023). Level-Set and Learn: Convolutional Neural Network for Classification of Elements to Identify an Arbitrary Number of Voids in a 2D Solid Using Elastic Waves. Journal of Engineering Mechanics, 149(6), 04023035. https://doi.org/10.1061/jenmdt.emeng-6840. Journal Paper Link.

Maharjan, S., Guidio, B., Fathi, A., & Jeong, C. (2022). Deep and Convolutional Neural Networks for Identifying Vertically Propagating Incoming Seismic Wave Motion into a Heterogeneous, Damped Soil Column. Soil Dynamics and Earthquake Engineering, 162, 107510. https://doi.org/10.1016/j.soildyn.2022.107510. Journal Paper Link.

PROJECTS

Accelerating SH Ground Motion Reconstruction via Convolutional Neural Networks for Evaluating Domain Reduction Method Layer Seismic Force Efficacy   June 2023
Developed a Convolutional Neural Network (CNN)-based method to accurately detect seismic forces in a 2D area with sparse ground motion data and shear waves, showing faster processing than traditional PDE-based methods in numerical experiments, confirming its effectiveness in identifying forces at a DRM layer.

Convolutional Neural Network for the identification of structural defects in a bridge   December 2022
Applied CNN to identify the material profile of a bridge structure using an unknown moving wave source (e.g. a vehicle) and its measured vibration displacement data. Reduced the computational prediction time from 10 hours to 1 second using Convolutional Neural Network compared to Genetic Algorithm with an average error of less than 5%.

Convolutional Neural Network for Void Detection in Surfaces   November 2022
Implemented CNN architecture to detect random number of voids with 90% accuracy within 1 second. Traditional optimization methods are limited to one-dimensional settings or take several hours for inaccurate prediction. Existing Machine Learning approaches only predict the presence of a void and cannot reconstruct the shape of the void.

Developmental stimulation of pyramidal neurons during a defined temporal window alters single unit activity in adult mice   August 2022
Performed extensive data filtering, analysis, and feature extraction on the electrophysiology recordings recorded after optogenetic stimulation of the pyramidal neurons of the barrel cortex in adult mice. Verified the result of Medendorp et al. (2021) paper with highly temporal recordings with a precision of 1 millisecond.

Prototype for Foreign Metal Detection in Trees   May 2022
Prototyped a metal-detector to prevent foreign-metallic objects destroying Bandit Industries $500,000 machines.

Machine Learning for Seismic-Wave Reconstruction April 2022

Designed Deep and Convolutional Neural Network architectures to reconstruct the incoming seismic-wave motion with less than 3% error in under 1 second based on measurements made at the ground surface. Traditional optimization methods take several hours for seismic-wave reconstruction with higher error percentages.

CERTIFICATIONS

- Passed the Fundamentals of Engineering (FE) Exam issued by the Michigan Board of PE.

- FANUC Handling Tool Operation and Programming Software in Robotics Control from FANUC America.

AWARDS AND HONORS

- **$110,000 grant** by the **US Department of Energy** for geothermal research internship at Geologica.

- Exclusive **Google Computer Science Research Mentorship Program**.

- **Outstanding Undergraduate Student of the Year 2022** by the Engineering Society of Detroit.

- **Most Enthusiastic Presenter** at IMECE-22 Conference by the **American Society of Mechanical Engineers**.

- **National Science Foundation Student Poster Competition Travel Grant** for the IMECE-22.

- **Undergraduate President's Award** for research excellence at Central Michigan University.

- **Richtmeyer-Foust Award** for outstanding Mathematics senior at Central Michigan University.

- **Best Undergraduate Poster** at the IMECE-21 Conference by the National Science Foundation.

- **Undergraduate Summer Scholars 2021** to pursue machine learning research in structural health monitoring.

- **Runner Up** in the **Integration Bee 2019** hosted by the American Mathematical Society.

- **Winner** of the **Integration Bee 2018** hosted by the American Mathematical Society.

- **World Prestige Award** for a full scholarship at Central Michigan University, covering tuition, housing, and food for four years.

IN THE PRESS

Graduate student receives internship from National Science Foundation January 2024
Central Michigan University - Office of Research and Graduate Studies

Passion, Challenge, and Inspiration: How the First Geothermal INTERN Cohort Came to Geothermal October 2023
U.S. Department of Energy - Geothermal Technologies Office

National Science Foundation INTERN Program September 2023
U.S. Department of Energy - Geothermal Technologies Office

Hackathon: Reimagine sparks ideas for the future March 2023
The Morning Sun

Undergraduate Summer Scholars Award February 2023
Central Michigan University - Office of Research and Graduate Studies

Summer Adventures in Brain Science September 2022
Central Michigan University - Office of Research and Graduate Studies

REFERENCES

David Cereceda, Ph.D.	**Santiago Orrego, Ph.D.**	**Sridhar Santhanam, Ph.D.**
Assistant Professor	Assistant Professor	Professor
Villanova University	Temple University	Villanova University
david.cereceda@villanova.edu	sorrego@temple.edu	sridhar.santhanam@villanova.edu
Primary Research Adviser	Research Adviser	Mechanical Engineering Department Chair