Joseph Boogun Choi

nmf8dm@virginia.edu

EDUCATION

The University of Virginia — Charlottesville, VA
Ph.D. candidate at School of Data Science — MAY 2021 - Present

The University of Iowa — Iowa City, IA
M.S./Ph.D Industrial Engineering (degree not acquired) — AUG 2018 - MAY 2021

The University of Iowa — Iowa City, IA
B.S. Computer Science, B.S. Mathematics — JAN 2014 - MAY 2016

Kirkwood Community College — Iowa City, IA
Associate of Science — SEP 2011 - DEC 2013

RESEARCH EXPERIENCE

AI-assisted Framework for Microstructural Design of Shocked Materials
Department of Defense / Air Force Office of Scientific Research — AUG 2021 - Present

- Constructed a framework for optimizing the microstructural design of shocked material for the targeted property by combining Physics Informed Machine Learning and Generative AI with hybrid of Bayesian and gradient-free optimization

ImagiQ: Asynchronous and Decentralized Federated Learning for Medical Imaging
NSF Convergence Accelerator - Track D — AUG 2020 - MAY 2021

- Designed a prototype for asynchronous and decentralized federated learning in the form of Python library on top of the NVIDIA Clara and Monai

Quantitative Interstitial Lung Disease (ILD) Imaging
Department of Environment (South Korea) — JUN 2019 - JUL 2021

- Investigated methods to quantify lung texture geometry (e.g. honeycombing, ground glass, reticular) using generative deep neural networks by learning a texture manifold from pulmonary computed tomography (CT) images
- Designed a graphical user interface (GUI) tool to deploy the neural network algorithm in clinical workflow

Pneumothorax Detection in Chest X-rays using Deep Neural Networks
Iowa Initiative for Artificial Intelligence (IIAI) - Radiology Pilot Grant (University of Iowa) — JUN 2019 - MAY 2021

- Developed and compared U-Net and Mask R-CNN algorithms to detect and segment Pneumothorax in chest X-rays
- Investigated how Pneumothorax segmentation model can fit into radiology workflow to increase efficiency
- Designed a graphical user interface (GUI) tool to deploy the neural network algorithm in clinical workflow

Synthesis of Material Microstructure based on User controlled Parameters using Generative Adversarial Networks
Department of Defense / Air Force Office of Scientific Research — SEP 2019 - MAY 2021

- Investigated a method to synthesize microscopic images of energetic materials utilizing Generative Adversarial Networks

Developing Connected Simulation to Study Interactions between Drivers, Pedestrians, and Bicyclists
Department of Transportation — JAN 2018 - JUN 2019

- Designed a statistical parametric model that generates infinite number of humanoid models
- Designed a model that puts skeleton on the surface human model by utilizing 2D pose estimation model

WORK EXPERIENCE

Computer Vision / Artificial Intelligence Engineer
Mantis Grading — AUG 2021 - OCT 2023

- Lead engineer to develop computer vision algorithms and utilize state-of-the-art artificial intelligence methods to quantitatively evaluate card collections

PUBLICATIONS

10. **Choi, J. B.**, Nguyen, P. C. H., Sen, O., Udaykumar, H. S., Baek, S., "Artificial Intelligence approach for materials-by-design and their application to energetic materials: state-of-the-art, challenges, and future direction". *Prop., Explos., Pyrotech.,* 2023, *48.*
9. Nguyen, P. C. H., Nguyen, Y. T., **Choi, J. B.,** Seshadri, P. K., Udaykumar, H. S., Baek, S., "PARC: Physics-aware recurrent convolutional neural networks to assimilate mesh scale reactive mechanics of energetic materials". *Sci. Adv.,* 2023, *9.*
8. Nguyen, P. C. H., **Choi, J. B.,** Udaykumar, H. S., Baek, S., "Challenges and opportunities for machine learning in multiscale computational modeling", *Journal of Compute. Inf. Sci. Eng.,* 2023, *23(6).*
7. Nguyen, P. C. H., Nguyen, Y. T., Seshadri, P. K., **Choi, J. B.,** Udaykumar, H. S., Baek, S., "A Physics-Aware deep learning model for energy localization in multiscale shock-to-detonation simulations of heterogeneous energetic materials". *Prop., Explos., Pyrotech.,* 2023, *48.*
6. **Choi, J. B.**, Nguyen, P. C. H., Nguyen, Y. T., Udaykumar, H. S., Back, S, "A Novel AI-assisted framework for microstructure design of shock materials", *Bulletin of the American Physical Society,* 2022*, 67.*
5. Nguyen, P. C. H., **Choi, J. B.**, Nguyen, Y. T., Udaykumar, H. S., Back, S, "establishing the structure-property-performance linkage of pressed energetic materials using physics-aware recurrent convolutional neural networks (PARC)", *Bulletin of the American Physical Society,* 2022*, 67.*
4. Pati, S., Baid, U., Edwards, B,. Et al., "Federated learning enables big data for rare cancer boundary detection", *Nat Commun,* 2022, *13 (7346).*
3. Chun, S., Roy, S., Nguyen, Y. T., **Choi, J. B.**, Udaykumar, H. S., & Baek, S., "Deep learning for synthetic microstructure generation in a materials by design framework for heterogeneous energetic materials", *Sci Rep,* 2020**,***10,* (13307).
2. Chun, S., Hamidi Ghalehjegh, N., **Choi, J. B.**, Schwarz, C. W., Gaspar, J. G., McGehee, D. V., & Baek, S., "NADS-Net: A nimble architecture for driver and seat belt detection via convolutional neural networks", *International Conference on Computer Vision (ICCV)-Autonomous Driving Workshop.* 2019**,** Seoul, Korea.
1. Moon, B., **Choi, J. B.**, Lee, H. D., & Baek, S., "Asphalt pavement crack detection based on deep learning", In *International Conference on Smart Cities.* 2019**,** Seoul, Korea.

Conference Presentations

3. **Choi, J. B.**, Ngyuen, P. C. H., Nguyen, Y. T., Udaykumar, H. S., Baek, S., 2022, "Physics-Aware AI-directed Framework for Microstructural Design of Shocked Materials", In *The USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP) ,* Arlington, Virginia **(Received Best Poster Award)**
2. **Choi, J. B.**, Ngyuen, P. C. H., Nguyen, Y. T., Udaykumar, H. S., Baek, S., 2022, "A Novel Physics-Aware AI-Assisted Framework for Microstructural Design of Shocked Materials", In *ASME International Mechanical Engineering Congress & Exposition (IMECE),* Columbus, Ohio.
1. **Choi, J. B.**, Ngyuen, P. C. H., Nguyen, Y. T., Udaykumar, H. S., Baek, S., 2022, "A Novel {AI}-Assisted Framework for Material Microstructure Discovery", In *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter (SHOCK22)*, *Anaheim, CA*.

AWARDS

University of Iowa Iowa City, IA

ISE Best Grad; 2020 College of Engineering Research Open House

UQ-MLIP Crystal City, VA

Best Poster Award.

SERVICE | LEADERSHIP

University of Iowa
Teaching Assistant
- Big Data Analytics (Fall 2020)
- Numerical Analysis and Optimization for Data Science (Spring 2024)

U.S. Army Bedford, VA
Specialist (E4); 92A (Automated Logistics Specialist); 92F (Petroleum Supply Specialist) MAR 2016 - Present
- Awarded the army achievement medal for QLLEX-E 19 mission for leadership, dedication, and devotion

Crozet Volunteer Fire Station Crozet, VA
Runs night duty crew on Thursday and Saturday as Red Helmet. AUG 2023 - Present

Korean-American Scientists and Engineers Association Young Generation (KSEA) Iowa City, IA
Project Team Leader / Organizer / Board Member OCT 2015 - MAY 2016
- Founded the "Undergraduate Research / Project Team"
- Advertised and recruited 12 new members, 4 mentors from Academics, 4 mentors from Practice, 1 advisor professor
- Organized the Structure and Hierarchy of the system
- Planned the event "KSEA Research / Project Competition" which awarded and motivated the project members
- Taught Logics of Programming by Java to 4 members

International Tennis Club of University of Iowa Iowa City, IA
Club President / Vice President JAN 2013 - DEC 2013
- Led 60 members with diverse ethnicities and ages weekly
- Coordinated different tennis events: tournaments within the team and with other universities, such as the University of Minnesota, the University of Wisconsin-Madison, Iowa State University

COMPUTER SKILLS & LANGUAGE PROFICIENCIES

Language: Korean, English
Programming Languages: Python, Java, shell, PHP, R, C, C++, C#, JavaScript, SQL, SAS, MATLAB