Peiwen Ren

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Education

Northwestern University — Evanston, IL
Bachelor of Arts, *Cumulative GPA: 3.85/4.00* — September 2017 - June 2021

- Majors: Integrated Science Program, Materials Science with Departmental Honors
- Minors: International Studies, Data Science

Academic Publication

Georgescu, A. B.*; **Ren, P.***; Toland, A. R.; Zhang, S.; Miller, K. D.; Apley, D. W.; Olivetti, E. A.; Wagner, N.; Rondinelli, J. M. Database, Features, and Machine Learning Model to Identify Thermally Driven Metal-Insulator Transition Compounds. *Chemistry of Materials.* 2021, 33 (14), 5591–5605. https://doi.org/10.1021/acs.chemmater.1c00905. (* denotes equal contribution)

Internship Experience

QuesTek Innovations LLC — Evanston, IL
Materials Engineer Intern — October 2021 - Present

- Developing algorithms to run thermodynamic and kinetics calculations with Pandat and Thermo-Calc
- Writing software pipelines that carry out Scheil solidification calculations with back diffusion and solute trapping models to enable batch calculations with different alloy compositions
- Designing a helper function to annotate heat treatment curves and utilizing the Python Plotly and Shapely packages to create interactive and automatically-labeled phase diagrams
- Employing symbolic regression to uncover equations that predict fatigue strength in steels
- Screening high-throughput DFT materials databases for Heusler compounds to design ultra-high strength aluminum alloys with precipitation strengthening

Research Experience

Wenhao Sun Group, University of Michigan — Ann Arbor, MI
Visiting Student — July 2021 - Present

- Researching a novel theory based on John Cahn's time cone method to model competitive phase transformation in order to make time-temperature-transformation diagrams to guide predictive solid-state synthesis
- Creating educational animations with the Manim Python package to explain the time cone method in a visual and intuitive way, and have uploaded a YouTube video with 3Blue1Brown-style graphics

Materials Theory and Design Group, Northwestern University — Evanston, IL
Undergraduate Researcher — March 2018 - June 2021

- Published a peer-reviewed paper on using machine learning (ML) models to classify metal-insulator transition (MIT) compounds in the journal *Chemistry of Materials* as the co-first author
- Crafted electronic structure features motivated by domain knowledge, such as the estimated Hubbard U and charge transfer gap from the Zaanen-Sawatzky-Allen framework, to be used as inputs to the ML models
- Employed explainable ML techniques and discovered two previously unappreciated physical descriptors that can be used as effective screening criteria for MIT compounds
- Open-sourced the ML models and served pre-trained MIT classifiers to the wider materials informatics community with Binder Jupyter notebooks that enable CIF structure classification in the web browser
- Conducted a research project that compared human intuition with data-driven algorithms in classifying MIT compounds to establish a baseline performance for the ML models

Applied Materials Division, Argonne National Laboratory — Lemont, IL
Research Intern — June 2019 - August 2019

- Created a natural language processing (NLP) model that can find materials synthesis information in scientific literature with Google's BERT algorithm
- Designed a sentence tagging scheme with PyTorch Transformers and spaCy Python packages that can identify target compounds, precursors and processing conditions in academic paper abstracts
- Improved the NLP model's classification F-1 score from 20% to 67% on a test set of 4700 sentences

Leadership Experience

AIESEC Northwestern — Evanston, IL
Vice President of Finance — December 2019 - January 2021

- Processed cash reimbursements and kept track of financial records
- Delivered financial education presentations to all club members
- Collaborated with other executive board members to create budgets for club-wise events

Project Highlight

Materials Design Class Project: Cobalt Based Alloys for Prosthesis Use
Utilized CES EduPack to select for materials with high yield strength and high corrosion resistance; used Thermo-Calc to investigate the FCC and HCP phase stability with different processing temperatures and alloy compositions; verified the alloy's corrosion resistance with the POURBAIX module from Thermo-Calc

A Visualization Dashboard for COVID-19
Utilized Tidyverse, Shiny and Plotly R packages to create an interactive visualization dashboard of confirmed and death COVID-19 cases in the contiguous U.S.

Open Source Contribution

Pymatgen — Pull request: #2265
Implemented a convenience method to find the minimum distance for one element or between two different elements in a given structure (*pending approval* from the package maintainers)

Online Presentation

Deriving the JMAK Equation Using the Time Cone Method, YouTube, 2021
(available at: `https://youtu.be/kORtdIWZvwc`)
Explained an alternative derivation process for the JMAK equation (also known as the Avrami equation) using the time cone method without the use of "phantom nuclei" and "extended volumes" present in the original derivation

Awards and Honors

Hilliard Award for Undergraduate Research and Design — Department of Materials Science and Engineering
Selected as the only recipient out of the MSE senior class for outstanding achievement in research — June 2021

Departmental Honors in Materials Science — Department of Materials Science and Engineering
Graduated with MSE departmental honors for the senior design project titled — June 2021
"Machine Learning Guided Discovery of Thermally-Driven Metal-Insulator Transition Compounds"

Latin Honors: Cum Laude — Weinberg College, Northwestern University
Graduated with a cumulative GPA in the top 25% of the Weinberg College graduating class — June 2021

Phi Beta Kappa Honor Society Member — Weinberg College, Northwestern University
Selected as one of the 78 recipients out of roughly 1000 graduating Weinberg seniors based on numerous criteria, including GPA, the selection of courses, and instructors' recommendations — May 2021

Annual Data Science Competition: Loan Risk Classification, 1st Place — Department of Statistics
Won *1st* place out of 69 participants in a Kaggle InClass competition where students were asked to predict whether a large amount of the principal of a loan was ever repaid — June 2020

Weinberg Summer Research Grant — Weinberg College, Northwestern University
Received $3500 to conduct an 8-week independent research project — June 2018

Dean's List — Weinberg College, Northwestern University
Recognized for having a quarter GPA greater than 3.70 — 9/11 Quarters

Skills

Relevant Coursework:	Modelling and Simulation in Materials Science and Engineering, Bioinformatics, Functional and Multifunctional Materials, Microstructural Dynamics, Materials Design, Data Science 1-3, Data Visualization, Data Management & Information Processing
Programming Language:	Python, Matlab, R, SQL
Online Certificate:	Coursera: Deep Learning Specialization, Introduction to Mechanical Engineering Design and Manufacturing with Fusion 360