ANTHONY PINECI

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EDUCATION

California Institute of Technology   **Pasadena, CA**
Bachelor of Science in Computer Science and Mathematics | GPA: 4.0/4.3   *Sep 2018 - Jun 2022*

PATENTS, PUBLICATIONS, AND CONFERENCES

S. Sahu, E. Chuba, A. Pineci, A. Indurkhya, C. Donalek, and M. Amori, "Systems with software engines configured for detection of high impact scenarios with machine learning-based simulation and methods of use thereof," U.S. Patent 11734157 Aug 2023.

A. Pineci, P. Sadowski, E. Gaidos, and X. Sun, "Proxy-based Prediction of Solar Extreme Ultraviolet Emission Using Deep Learning," *The Astrophysical Journal Letters*, vol. 910, no. 2, p. L25, Apr. 2021, Extension of a paper that appeared at AAAI 2020.

A. Pineci, P. Sadowski, E. Gaidos, and X. Sun, "EUV-Net: Predicting Solar Extreme Ultraviolet Emission from He I Line Absorption using Deep Learning," PGAI-AAAI, Nov. 2020.

PROJECT HIGHLIGHTS

Supply Chain Management - RSP   **Virtualitics**
DoD, Small Business Innovation Research (SBIR) Phase I

· **Background:** In the Air Force, collections of spare parts and equipment are assembled into **Readiness Spares Packages** (RSP) to be transported and deployed when needed. When a new list of items is requested to be packed in an RSP, it takes weeks to distribute and pack these items among multiple bins.
· **Project Goals:** Optimize RSP packing process by minimizing the packing time and the number of required bins. The inputs are a list of boxes including dimensions and weights while the target output is the assignment of each item to a position and orientation within a bin.

Methods and Conclusions

· Developed offline 3D multi-bin packing algorithms for use with multiple bin types, shelf configurations, as well as weight and center of gravity constraints
· Conducted literature review of conventional and state-of-the-art approaches for bin packing
· Applied multiple algorithmic approaches including satisfiability modulo theory formulations, mixed integer program formulations, and deep reinforcement learning based approaches
· Ultimately employed greedy heuristic-based methods due to the project's need for speed, determinism, and adaptability to current and future constraints
· Implemented a 3D rendering environment for visualizing and interacting with bin-packing solutions
· Solution ran in less than 5 seconds and demonstrated close to 80% packing efficiency with respect to performance metrics including spatial and weight utilization

Solar Extreme Ultraviolet Prediction   **University of Hawai'i at Mānoa**
Caltech/UH, Samuel P. and Frances Krown SURF Fellowship

· **Background:** Stars absorb and emit radiation across a broad spectrum observable through ground observatories and satellite imagery. Estimations of Extreme Ultraviolet (EUV) emissions aid in understanding stellar system dynamics, yet this radiation is blocked by interstellar medium. Unlike other stars, our sun provides observable EUV emissions and suitable proxy data.
· **Project Goals**: Predict pixel-wise solar EUV emissions using a ground observable Helium I absorption line as a proxy.

Methods and Conclusions

· Constructed a labeled dataset by pairing solar images of different wavelengths from the SOLIS facility and the SDO spacecraft
· Created physics-informed deep neural networks by adding radial distance and solar latitude as input feature channels to account for spherical projection of solar images and equatorial emission patterns
· Compared the prediction accuracy of different deep network architectures such as U-Net and FCN
· Concluded that convolutional models achieved the lowest relative error, beating out non-spatial models
· Results agree with existing literature indicating that He I absorption contributes to EUV emission and that surface solar features may invert the typical correlation
· Presented results at PGAI-AAAI '20 and published them in *The Astrophysical Journal Letters*

PROFESSIONAL EXPERIENCE

Virtualitics, *Senior Data Scientist*   *Oct 2024 - Present*, **Pasadena, CA**
· Leading Data Science effort for Air Force SBIR Phase III contract
· *Project Description:* Virtualitics is developing a multi-warehouse storage optimization solution using SMT solvers (Z3). The solution produces inventory movement plans that improve stakeholder relevant storage and operations KPIs by 10-20% and are available through a web-based interactive interface that can be used without an internet connection
· *Personal Contributions:* Developing an automated evaluation suite and expanding capabilities of multi-warehousing algorithm

Virtualitics, *Senior AI Platform Engineer*   *Nov 2023 - Oct 2024*, **Pasadena, CA**
· Designed and conducted validation experiments for Virtualitics AI tools through Citibank's model risk management review
· Developed prototype and backend for OpenAI Assistant API integration into the Virtualitics AI platform to utilize Large Language Model (LLM) function-calling capabilities for users to ask business questions and run routines through a text interface
· Led the Data Science effort for the RSP project
· Managed project planning, engineering, research, and inter-team communications for the Virtualitics AI Innovation Team

Virtualitics, *Machine Learning Engineer*   *Aug 2022 - Nov 2023*, **Pasadena, CA**
· Developed big data algorithms for anomaly detection and distribution preserving sampling methods on Apache Spark
· Organized and led discussions with the Virtualitics Scientific Advisory Board consisting of Caltech and MIT professors
· Led research and engineering efforts for incorporating LLMs into the Virtualitics AI platform
· Managed a summer intern project creating an LLM test suite for evaluating different prompts and prompting strategies

Virtualitics, *Machine Learning Internship, Virtualitics Campus Ambassador*   *Jan 2021 - Jun 2022*, **Pasadena, CA**
· Developed a core backend module for Virtualitics Predict, a dashboarding tool for data visualization and model predictions
· Prototyped and integrated explainable AI tools to provide instance-level explanations of a blackbox model's prediction

RESEARCH EXPERIENCE

Prof. Yisong Yue Group, *Undergraduate Researcher*   *Sep 2020 - Oct 2021*, **Caltech**
· Constructed image segmentation models for cancerous tissue samples captured with multiplexed ion beam imaging (MIBI)
· Applied new methods for hierarchical classification of taxonomic data to improve classification accuracy with specificity trade-off
· Combined the image segmentation model class probabilities with a linear program that maximizes classification accuracy, with greater rewards for increased specificity

Prof. Peter Sadowski Group, *Machine Learning Researcher*   *Jun 2020 - Sep 2020*, **University of Hawaiʻi at Mānoa**
· Led the project on solar EUV emission prediction using a ground-based proxy measurement

Prof. Shinsuke Shimojo Group, *Computer Science Researcher*   *Jun 2019 - Oct 2019*, **Caltech**
· Conducted study to investigate methods to create a 'choke' brain state in a lab setting, found statistically significant method
· Used a modified rhythm video game by telling players that they lost their success streak at predefined intervals

TEACHING & EXTRACURRICULAR ACTIVITIES

California Institute of Technology, *Teaching Assistant*   *Jan - Mar 2020, Sep - Dec 2020*, **Pasadena, CA**
· Decidability and Tractability – Assisted students with concepts in computability theory; graded weekly homework
· Introduction to Computing Systems – Helped students with conceptual understanding and debugging code on homework

Caltech Y, *Tutor*   *Sep 2018 - Jun 2021*, **Pasadena, CA**
· Tutored high school students weekly, taught skills and confidence to perform well in Math and Physics

Viewpoint School, *Mentor*   *Jan 2023 - Present*, **Calabasas, CA**
· Advised high school programming students on Kalman filters and Computer Vision methods for the FIRST Robotics competition

OTHER EXPERIENCES AND SKILLS

Grad Course Projects	**CS/CNS/EE/IDS 159**, *Spring 2021* - Adversarial Feature Perturbation **CS/CNS/EE/IDS 159**, *Spring 2020* - RL Graph Combinatorial Optimization **CS/CNS/EE 156b**, *Spring 2020* - COVID-19 Mortality Prediction
Programming Languages & Tools	**Proficient:** Python, PyTorch, Scikit, Pandas, Numpy, Apache Spark, LaTeX, Git, Bash, Docker, Gurobi, Z3, FastAPI, Pydantic, SQLAlchemy **Familiar:** C/C++, Java, R, MATLAB/Octave, Scheme, C#, Assembly
Hobbies & Interests	Skiing, Tennis, Surfing, Painting, Cooking