# Willa Potosnak

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## Education

**Carnegie Mellon University (CMU), School of Computer Science**          08/22 - 05/27 (expected)

Ph.D. in Robotics
*Advisor*:  Dr. Artur [Dubrawski](#)
**Research Interests:**  Forecasting, Reasoning in Neural Networks, Physics-Informed Machine Learning (ML)
**Relevant Coursework:**  Intermediate Statistics, Probabilistic Graphical Models, Advanced Intro to ML

**Duquesne University, Rangos School of Health Sciences**          05/22

*Summa Cum Laude*

B.S., Biomedical Engineering with Minor in Mathematics

## Selected Research Experience

**PhD Student, CMU**          08/22 - current

- Conducted studies with various deep forecasting models to examine and evaluate implicit reasoning capabilities in zero-shot inference and out-of-distribution scenarios. Currently developing an open-source code package to evaluate model architecture choices and generate insights for optimizing future forecasting model/foundation model development.

- Currently collaborating on research to develop and enhance modeling techniques for long-context, multivariate time series using foundation models.

- Collaborated on research to develop novel time series foundation model intervention techniques that can be used to steer model predictions based on concepts such as periodicity and trends. Concept steering offers diverse applications, including updating out-of-distribution zero-shot predictions without fine-tuning, incorporating domain-specific inductive biases to improve accuracy, and enabling data generation or augmentation.

- Developed a novel hybrid global-local architecture and a pharmacokinetic (PK) encoder that inform deep learning models of patient-specific treatment effects. Our hybrid global-local architecture improves upon patient-specific models by 15.8% on average. Additionally, our PK encoder surpasses baselines by up to 16.4% on simulated data and 4.9% on real-world data for individual patients during critical events of severely high and low glucose levels.

- Collaborated with industry partners to develop a Hybrid ML-Physics model for predicting severe wind events. The model outperformed both purely physics and ML baselines, offering more accurate time-to-event estimates with longer lead times. It predicted 65% of severe wind events for various turbines, with lead times of up to 13 minutes, enabling slower, safer machine shutdowns.

**Research Intern and Robotics Institute Summer Scholar ([RISS](#)), [Auton Lab](#)**          06/20 - 08/22

- Co-developed the [auton-survival](#) code package and demonstrated the application of Propensity Adjusted Treatment Effects and Counterfactual Survival Estimation to provide insight into the effect of geographic region and confounding factors on breast cancer mortality rates.

- Developed ML models using time series patient data recorded during cardiac surgeries. These models demonstrate improved risk predictions for multiple postoperative outcomes, including mortality, compared to the baseline Society of Thoracic Surgeons (STS) models deployed nationally. Our model had improved calibration, measure by the Brier score, and identified hundreds of patients eligible for reassignment to lower-risk categories, enabling more focused triage efforts on higher-risk patients.

**<u>Assistive Technology Project Co-Lead, Duquesne University</u>**                01/19 - 05/19

- Designed and 3-D printed an assistive device to facilitate tasks for those with grip disabilities due to stroke or other hand injuries.
- Designed and printed an assistive device for a disabled faculty member to facilitate instruction with hand-held medical tools.

## Achievements and Awards

Honorable Mention for application to the National Science Foundation Graduate Research Fellowship Program (NSF GRFP), 2024. [Awardee List]

Nominated and accepted to the Undergraduate Consortium (UC) mentorship program at the Thirty-Sixth AAAI Conference on Artificial Intelligence (AI) (AAAI-22).

Student panelist for the 2021 Artificial Intelligence and Data Science Education Leadership meeting hosted by CSforAll and supported by the White House Office of Science and Technology Policy (OSTP) and the National Science Foundation (NSF).

Awarded a 2019 John G. Rangos Prize for Duquesne curriculum proposal that integrated 3-D printing with prosthetic and assistive technology device design for patients.

## Skills

<u>Coding Languages/Software</u>: Python, PyTorch, MATLAB, Linux, HTML, Git, LaTeX

<u>3-D Printing</u>: 3-D printer use and maintenance, Autodesk Fusion 360, Ultimaker Cura

## Publications and Presentations

### Preprints

G1.    **Potosnak, W.**, Challu, C., Olivares, K. G., Dufendach, K. A., Dubrawski, A. W. (2024). Forecasting Response to Treatment with Deep Pharmacokinetic Encoders.
[Paper]   [Code]

G2.    Wiliński, M., Goswami, M., **Potosnak, W.\***, Żukowska, N.\*, Dubrawski, A. W. (2024). Exploring Representations and Interventions in Time Series Foundation Models.
[Paper]   [Code]

### Conference and Journal Publications

C1.    **Potosnak, W.**, Dufendach, K. A., Nagpal, C., Kaczorowski, D. J., Yoon, P., Bonatti, J., Miller, J. K., Dubrawski, A. W. (2024). Intraoperative Features Improve Model Risk Predictions Following Coronary Artery Bypass Grafting. *Annals of Thoracic Surgery Short Reports*.
[Paper]

C2.    Nagpal, C., **Potosnak, W.**, Dubrawski, A. (2022). auton-survival: an Open-Source Package for Regression, Counterfactual Estimation, Evaluation and Phenotyping with Censored Time-to-Event Data. *Proceedings of the 7th Machine Learning for Healthcare Conference*, *PMLR*, 182, 1-24.
[Paper]   [Blog]   [Code]

C3.    **Potosnak, W.**, Caldas, S., Dufendach, K. A., Clermont, G., Miller, J. K., Dubrawski, A. (2022). Robust Rule Learning for Reliable and Interpretable Insight into Expertise Transfer Opportunities. in *Proceedings of the Thirty-Sixth AAAI Conference on Artificial Intelligence.*
[Paper]

**Peer-Reviewed Workshop Papers and Presentations**

P1.    **Potosnak, W.**, Challu, C., Goswami, M.,  Wiliński, M.,Żukowska, N., Dubrawski, A. W. (2024). Implicit Reasoning in Time Series Forecasting. *NeurIPS 2024 Workshop on Time Series in the Age of Large Models* & *NeurIPS 2024 System 2 Reasoning At Scale Workshop.*
[Paper]

P2.    Wiliński, M., Goswami, M., Żukowska, N., **Potosnak, W.,** Dubrawski, A. W. (2024). Unveiling and Manipulating Concepts in Time Series Foundation Models. *NeurIPS 2024 Workshop on Time Series in the Age of Large Models* & *NeurIPS 2024 Workshop on Foundation Model Interventions.*
[Paper]

P3.    Żukowska, N., Goswami, M., Wiliński, M., **Potosnak, W.,** Dubrawski, A. W. (2024). Towards Long-Context Time Series Foundation Models. *NeurIPS 2024 Workshop on Time Series in the Age of Large Models* & *NeurIPS 2024 Fine-Tuning in Modern Machine Learning: Principles and Scalability Workshop.*
[Paper]

P4.    Dufendach, K. A., Liu, M. **Potosnak, W.**, Jacquemyn, X., Pompeu Sá, M., Kaczorowski, D. J., Dubrawski, A. W., Sultan, I. (2024). Machine learning identifies patients who derive survival benefit from coronary revascularization. *Society of Thoracic Surgeons Coronary Conference.*

P5.    **Potosnak, W.**, Challu, C., Olivares, K. G., Miller, J. K., Dubrawski, A. W. (2024). Severe Wind Event Prediction with Multivariate Physics-Informed Deep Learning. *ICLR Tackling Climate Change with Machine Learning Workshop*.
[Paper]   [Poster]   [Slides]

P6.    **Potosnak, W.**, Challu, C., Olivares, K. G., Dubrawski, A. W. (2023). Forecasting Response to Treatment with Deep Learning and Pharmacokinetic Priors. *Machine Learning for Health (ML4H) Findings Track Collection.*

P7.    **Potosnak, W.**, Dufendach K. A., Kaczorowski, D., Miller, J. K., Dubrawski, A. (2022). Machine Learning Models with Intraoperative Features Improve Risk Predictions Following CABG. *Society of Thoracic Surgeons Coronary Conference.*
[Abstract]

P8.    Dufendach, K. A., Nagpal, C., **Potosnak, W.**, Dubrawski, A., Kaczorowski, D., (2022). Novel Machine Learning Technique Defines Patients Who Benefit from Off-Pump CABG. *Society of Thoracic Surgeons Coronary Conference*.
[Abstract]

P9.    **Potosnak, W.**, Caldas, S., Dufendach, K. A., Clermont, G., Miller, J. K., Dubrawski, A. (2021). Robust Interpretable Rule Learning to Identify Expertise Transfer Opportunities in Healthcare. *NeurIPS 2021 Workshop Bridging the Gap: from Machine Learning Research to Clinical Practice.*

P10.   **Potosnak, W.,** Dufendach, K. A., Wertz, A., Miller, J. K., Kilic, A., Dubrawski, A. (2021 January 29-31). Continuous Intraoperative Data Analysis Using Machine Learning Reveals Multiple Parameters to Predict Post-CABG Renal Failure. *Society of Thoracic Surgeons (STS) 57th Annual Meeting.*

P11.   Rühling Cachay, S., **Potosnak, W.*,** Erickson, E.*, Bucker, A. F. C.*, Pokropek, E.**, Osei, S., Lütjens, B. (2020). Graph Neural Networks for Improved El Nino Forecasting. *NeurIPS 2020 Workshop on Tackling Climate Change with Machine Learning*.
[Paper]