CHARM
Canberra Health
Annual Research Meeting

Bridging Expertise Through Open Science: A Transdisciplinary Effort to Develop Artificial Intelligence Equipped Automated Insulin Delivery Systems for Glucose Regulation in Diabetes




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Introduction (Background & Significance)

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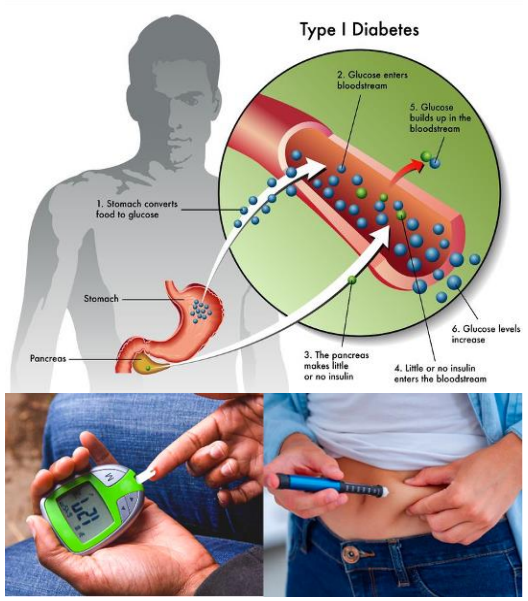
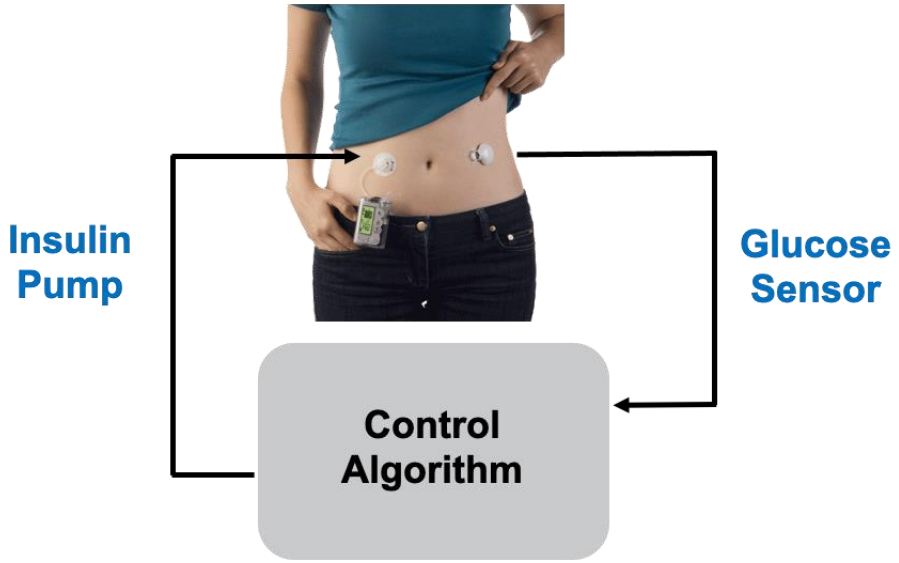
- People with Type 1 Diabetes (PwT1D) are dependent on insulin administration for glucose regulation. Current Automated Insulin Delivery (AID) Systems require user input with meals.





Aims & Questions

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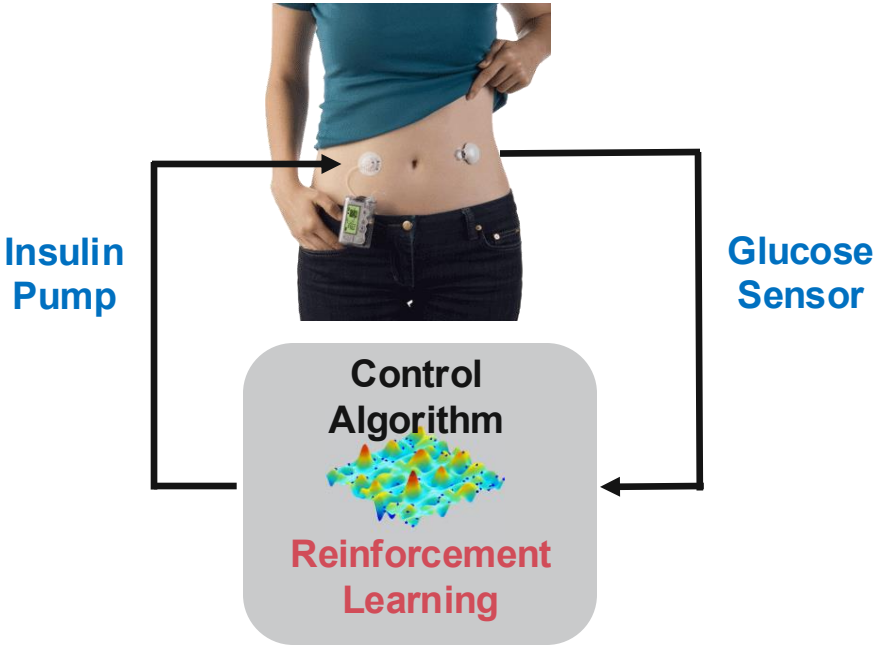
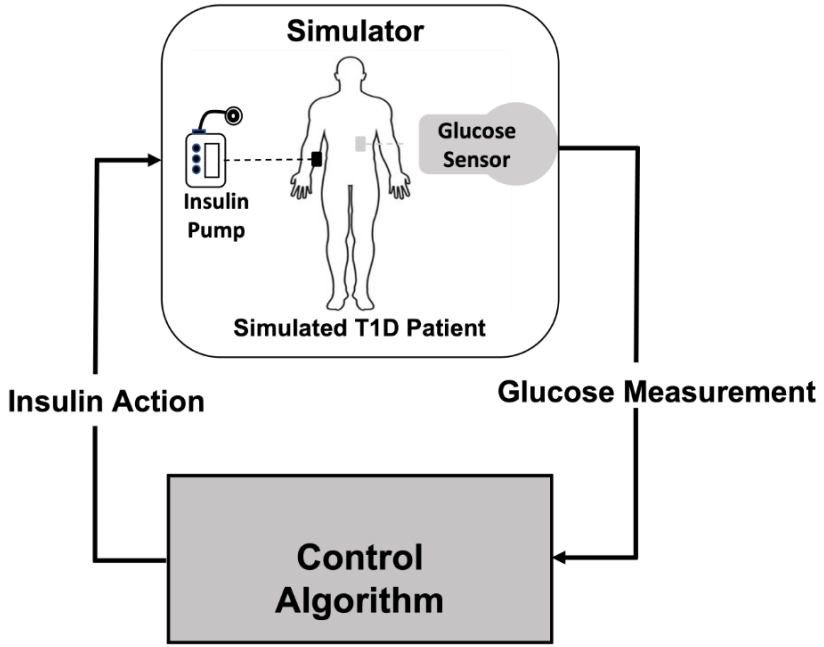
1. **Develop fully automated treatment strategies that eliminate the need for manual input for meals**, while addressing the complexities of the glucoregulatory system and limitations of classical control algorithms.

2. **Foster transdisciplinary collaborations to develop diabetes education & research tools to promote open-science**, while collaborating with PwT1D and their home and hospital-based carers, integrating their expertise to improve AID and disseminate newly discovered knowledge.

Methods

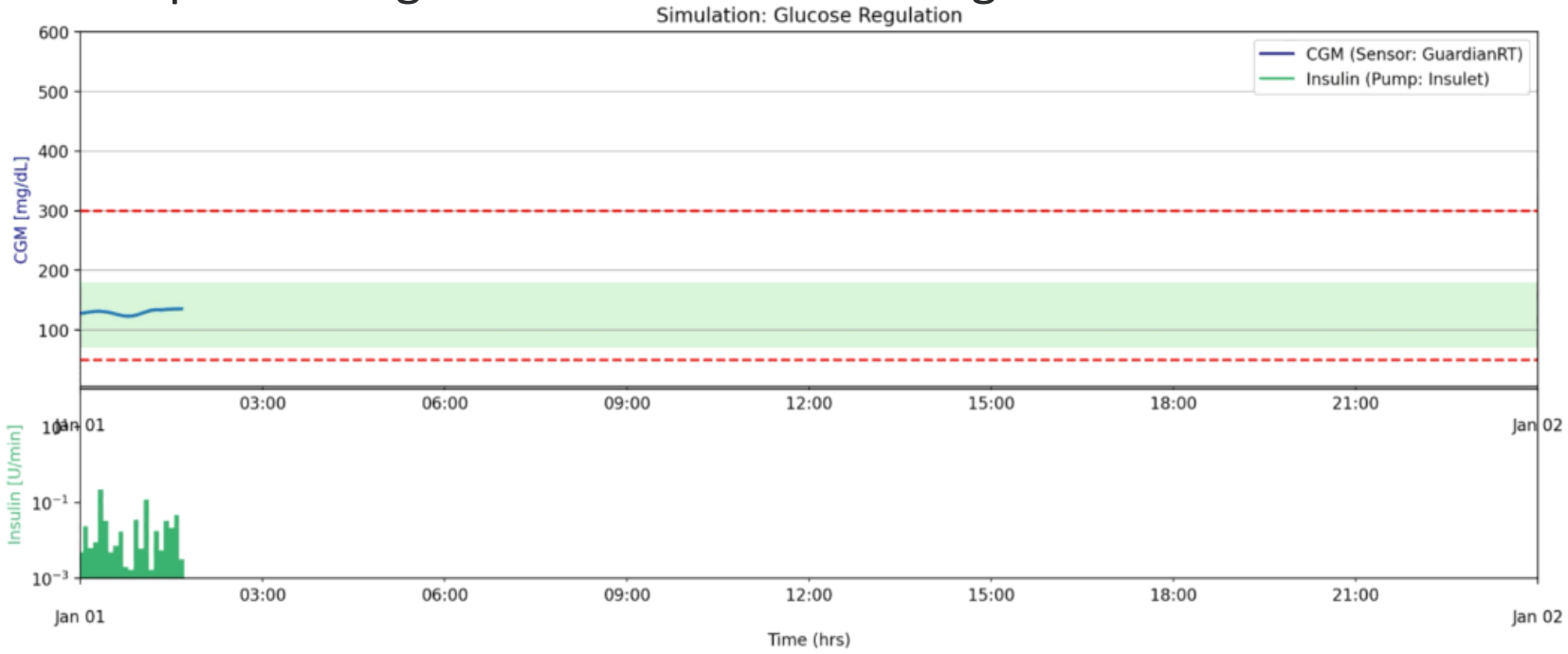
- Our AID was developed using deep Reinforcement Learning *(AI algorithms capable of discovering novel complex treatment strategies),* using United States Food and Drug Administration (FDA) approved computer simulations for pre-clinical trials.





Results

- Our algorithm **G2P2C**, achieved a time-in-normoglycemic range of 73% in *in-silico* adult cohorts, thus outperforming clinical treatment strategies with manual insulin dosing.



Hettiarachchi, Chirath, et al. "G2P2C—A modular reinforcement learning algorithm for glucose control by glucose prediction and planning in Type 1 Diabetes." *Biomedical Signal Processing and Control* 90 (2024): 105839. Codebase: https://github.com/RL4H/G2P2C

Results

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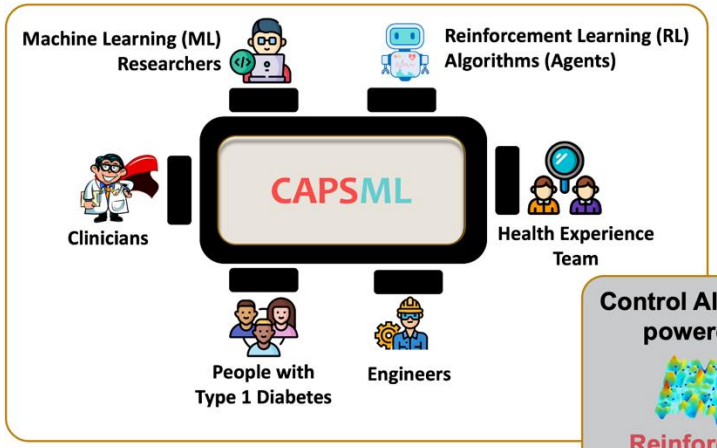
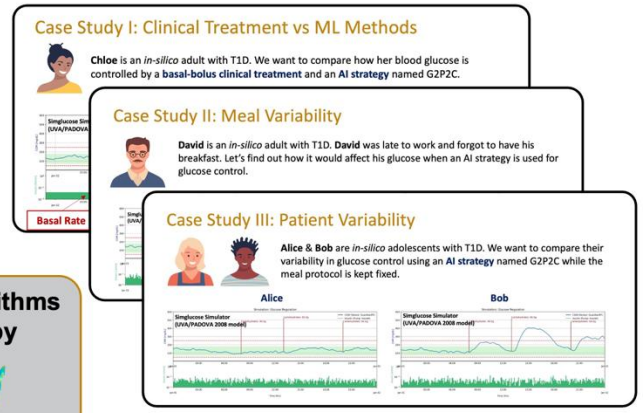
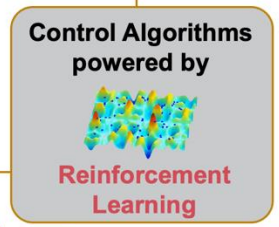
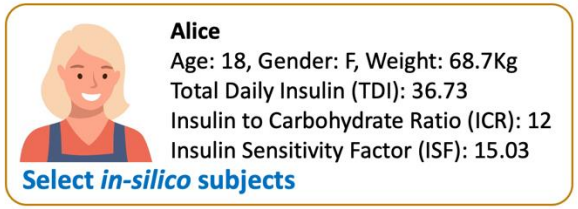
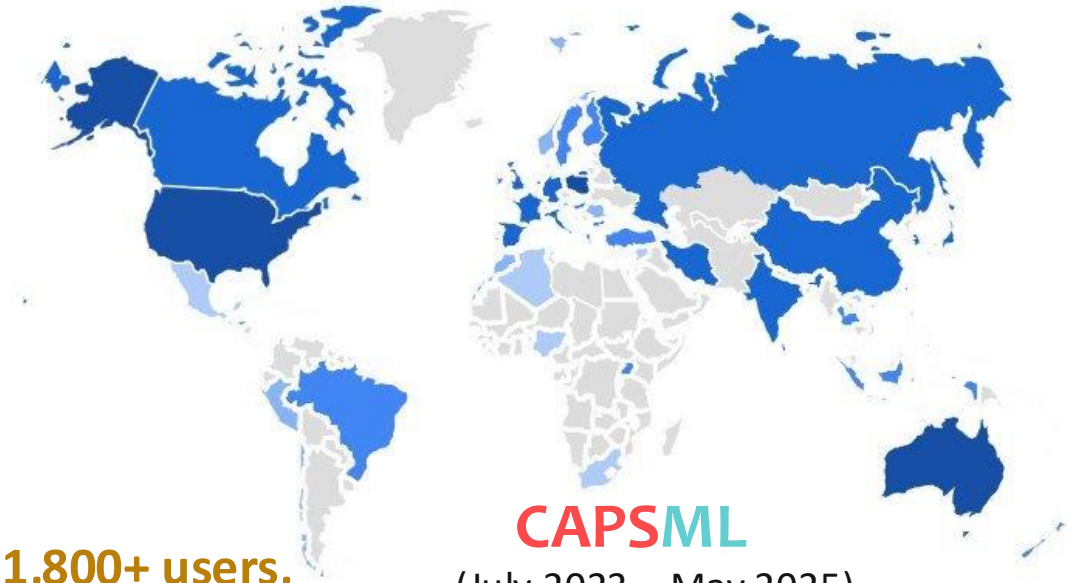
- Launched **CAPSML**, a free online demonstration tool with a suite of RL and clinical algorithms, with the capability to learn about how meals affect glucose regulation.











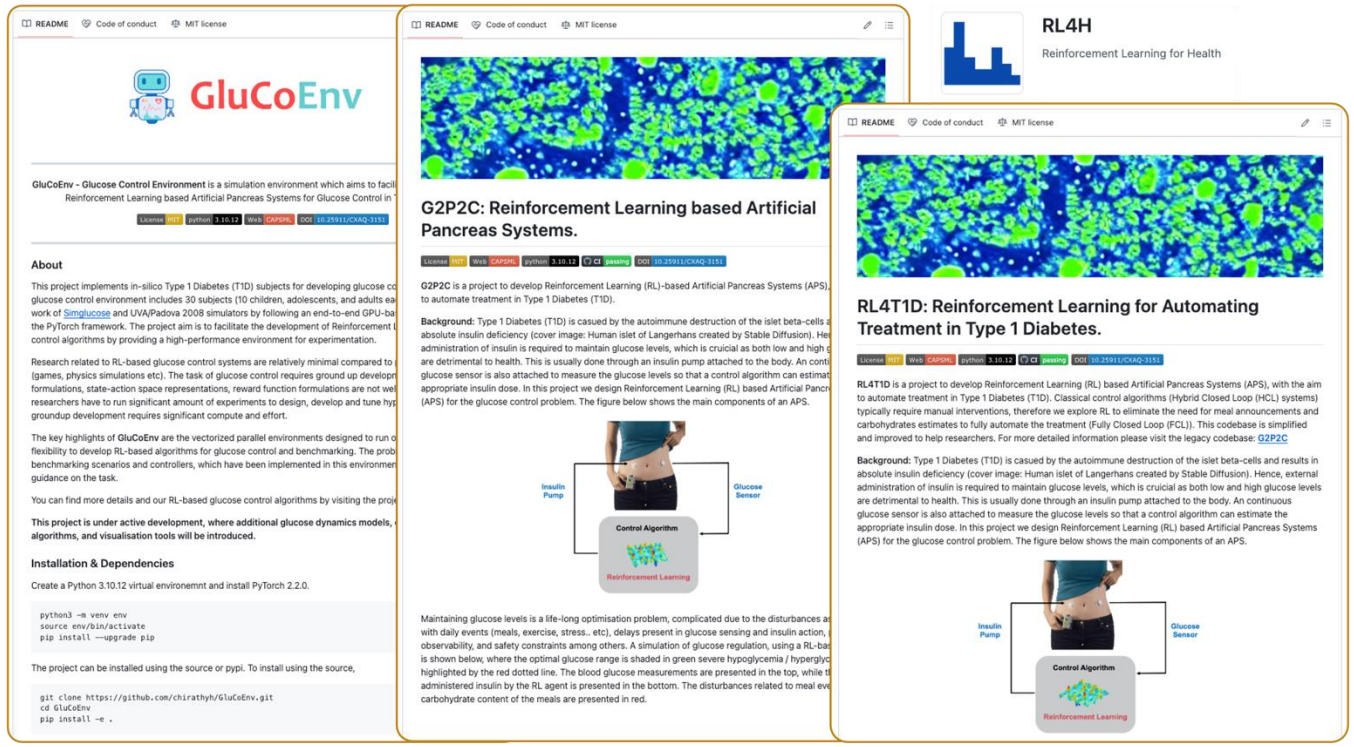
1,800+ users, 55 countries.

CAPSML
(July 2023 – May 2025)

Visit: https://capsml.com

Results

- Released open-source codebases, including developed RL algorithms, a GPU-accelerated simulator, and tools for AI researchers to tackle this complex problem effectively.



Visit: https://github.com/RL4H

Conclusion & Impact

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- Our algorithms show promise in further automation of AID and are currently being enhanced for safety and explainability.
- The shared code/tools are helping diabetes education and research.
- Unlike prior closed-source AID work with limited sharing and replicability, our open-science approach fosters community engagement across disciplines and enhances real-world impact, as demonstrated by its widespread usage.

Acknowledgement

- This research was delivered in partnership with Our Health in Our Hands (OHIOH), a strategic initiative of The Australian National University (ANU), which aims to transform health care by developing new personalized health technologies and solutions in collaboration with patients, clinicians, and health-care providers.

- We also gratefully acknowledge funding from the MRFF 2022 National Critical Research Infrastructure (MRFCRI000138, “Developing a new digital therapeutic for depression: Closed loop non-invasive brain stimulation”).

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Thank you