Mini Intro

REACH

Reinforcement-learning for Enhanced Arm Control in Humans

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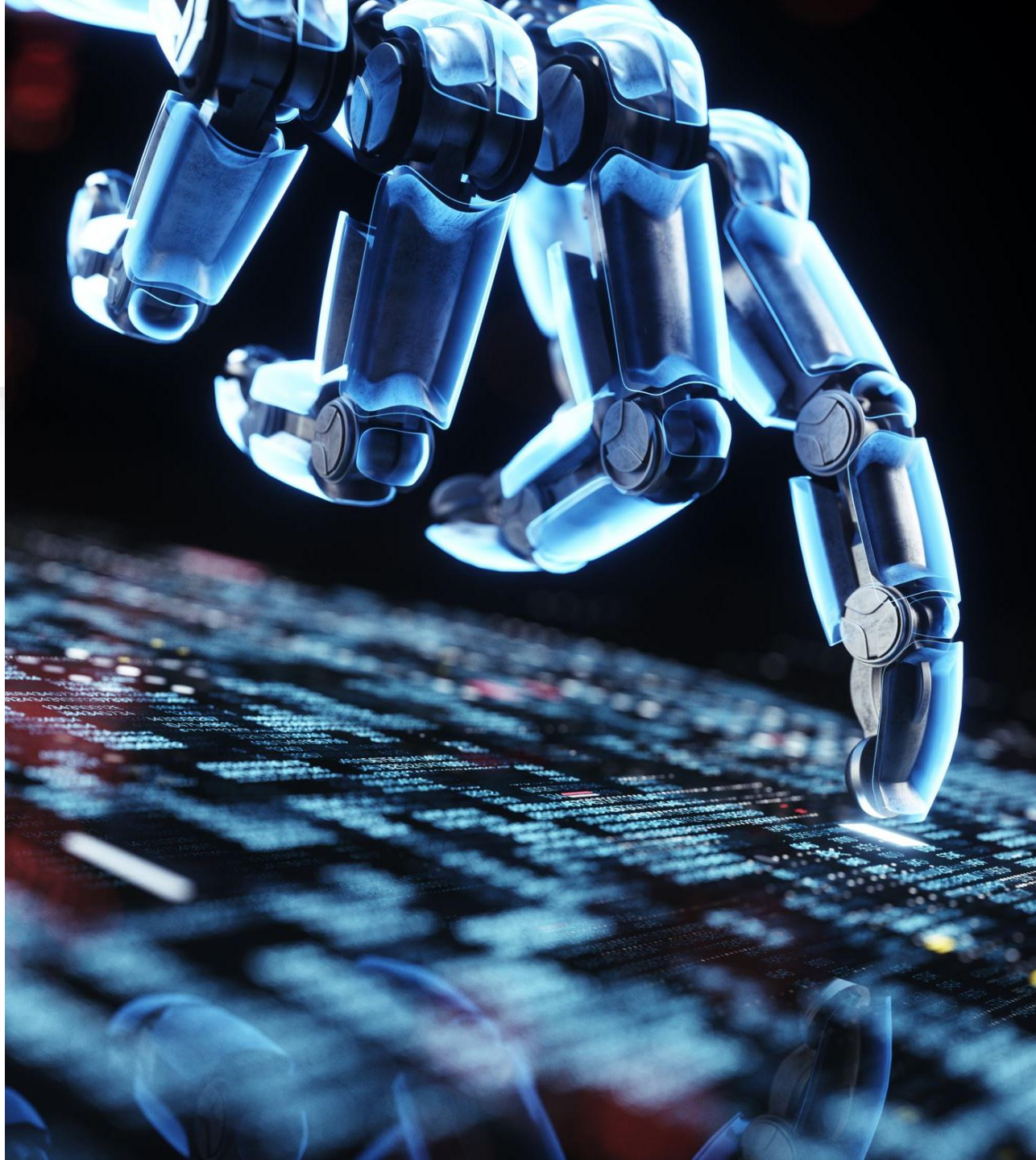
Mentor: Bailey Hall

Client: Biomechatronics Lab, NAU

Helping People Regain Independence Through Intelligent Robotics

- Assistive devices are limited, especially in complex real-world scenarios.
- There is a need for smarter rehabilitation tech that adapts to real-life environments.

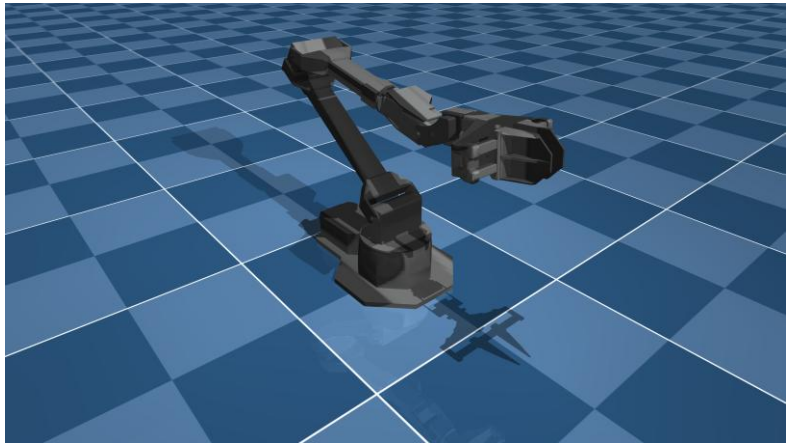


The Biomechatronics Lab & The Challenge

Biomechatronics *Laboratory*

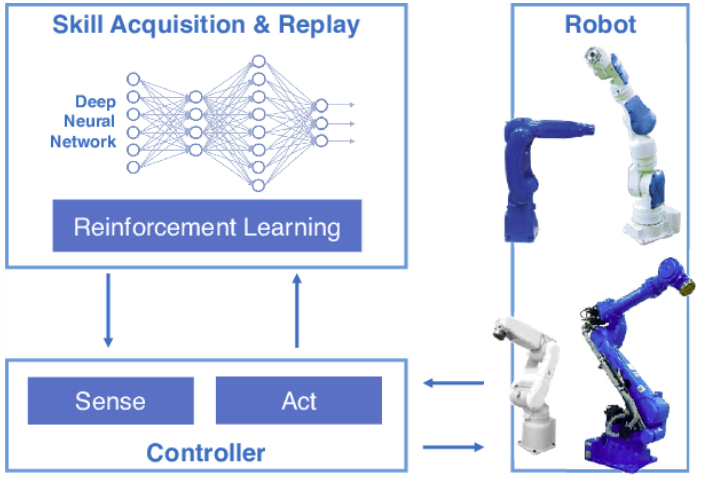
- Client:
  - Dr. Zach Lerner, Associate Professor, Mechanical Engineering, NAU
  - Dr. Carlo da Cunha, Assistant Professor, Electrical Engineering, NAU
- Problem:
  - Robotic arms are too rigid: they use hardcoded movements that break down in dynamic environments.
  - The lab needs a smarter, adaptive solution for real-world use.

Building a Smart Control Framework with Reinforcement Learning



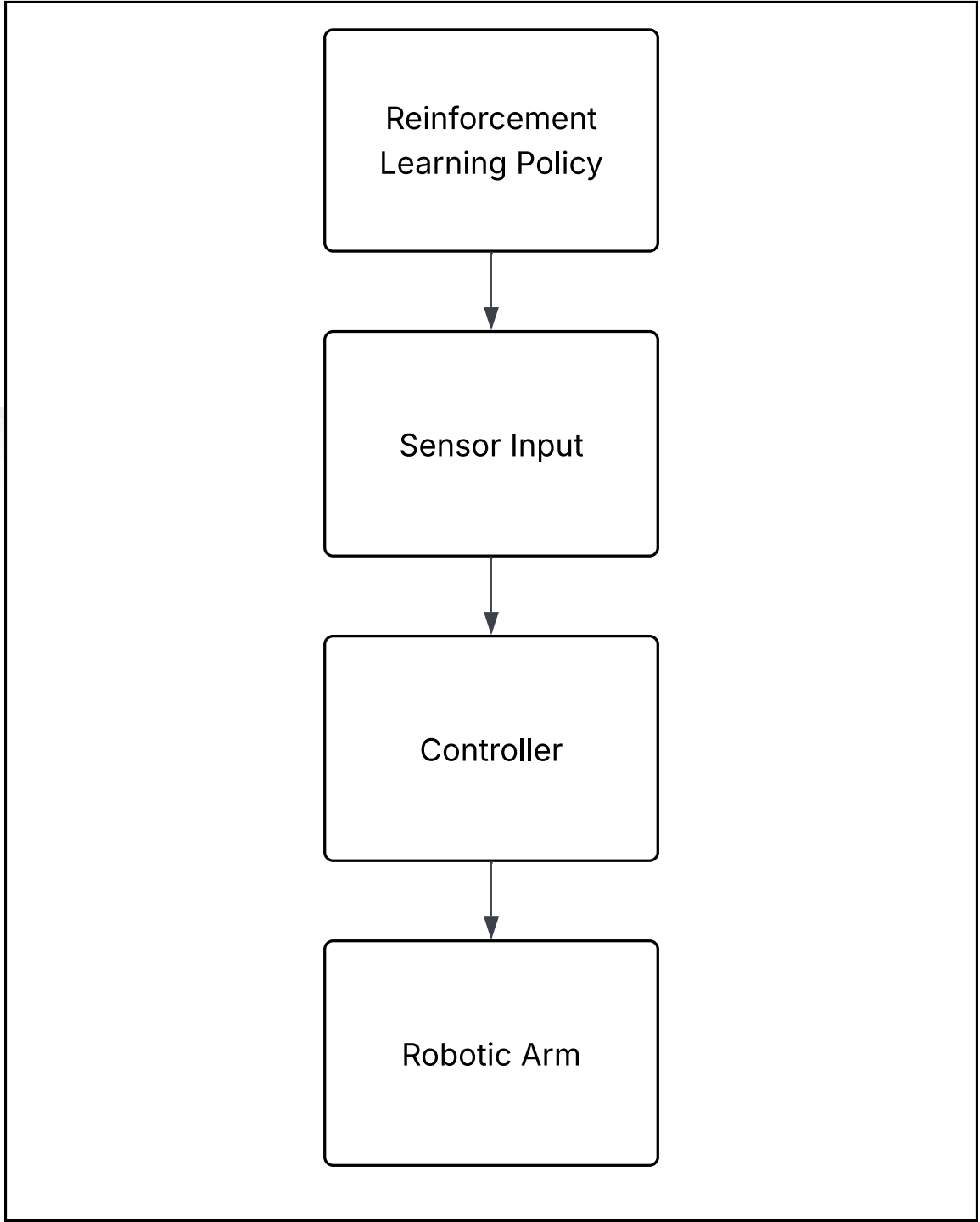
What we want to build:

- A simulation-based RL framework that learns how to move a robotic arm to assist with daily tasks.
- Goal: smooth, responsive, and energy-efficient assistance.



What the System Will Do

- Train on tasks like shaking hands using RL algorithms
- Detect objects in the environment via YOLO
- Adapt to the environment using proprioceptive and visual input
- Deploy to embedded hardware for real-time control



Roadmap

1: Start Small

- Simple robots and tasks
- Experiment with different algorithms
- Biweekly meetings with the clients
- Build iterative drafts

2: Schematic Specific Build

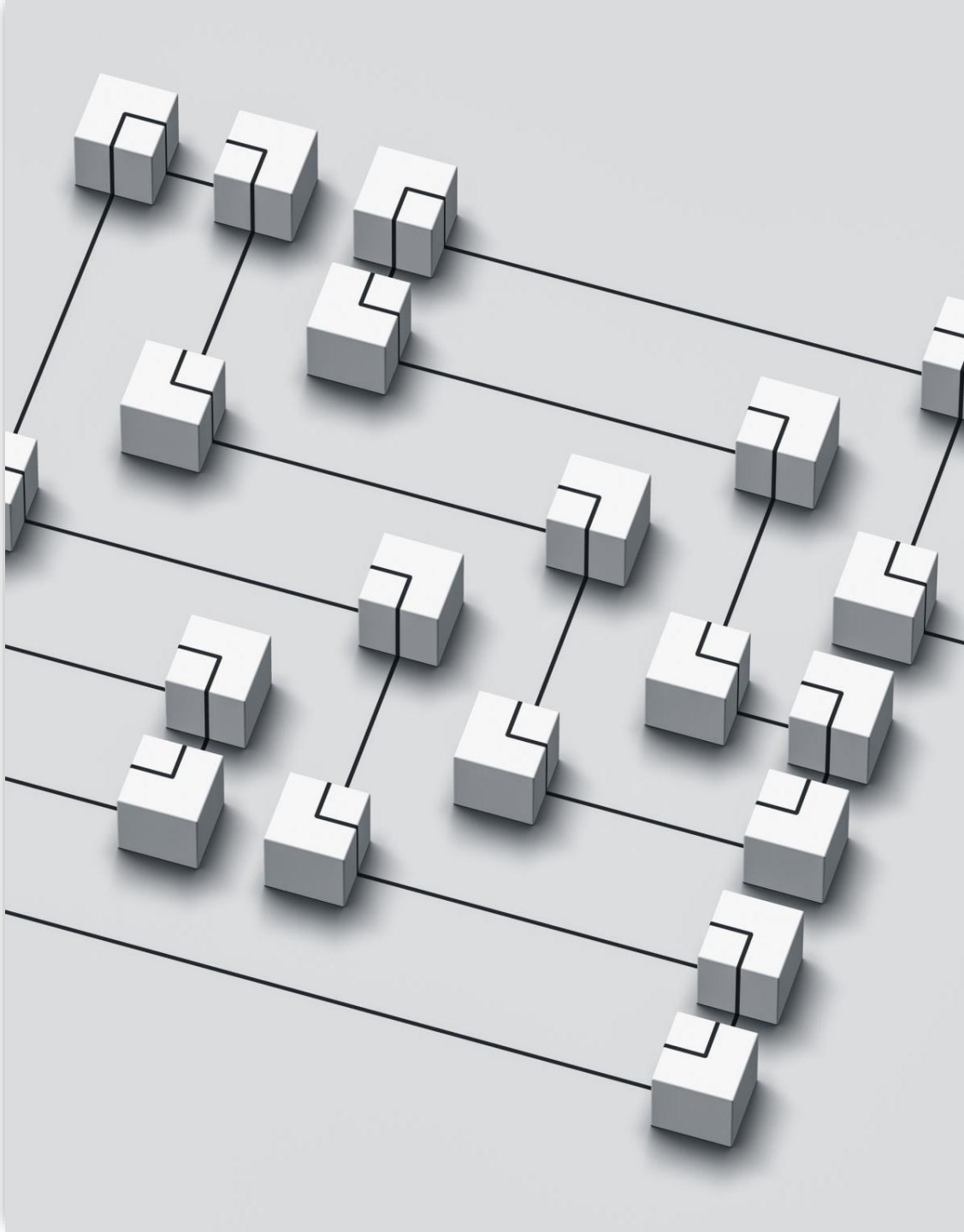
- Ready for deployment to hardware counterpart

3: Develop the Full Framework

- Add a layer of abstraction
- Simple to add tasks

Key Technical Investigations:

- Sim-to-Real transfer
- Safety and impedance control
- Complex Task Training on HPC Cluster



Why This Project Matters

- Studies show that robot assisted rehabilitation is proven to be effective in regaining upper limb control
- Team REACH is creating an RL-based framework to power wearable robotic arms for stroke rehab
- Our work could improve safety, adaptability, and independence for people with upper-limb disabilities

Thank You
Any questions?

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