DULA: A Differentiable Ergonomics Model for Postural Optimization in Physical HRI

Amir Yazdani, Roya Sabbagh Novin, Andrew Merryweather, Tucker Hermans

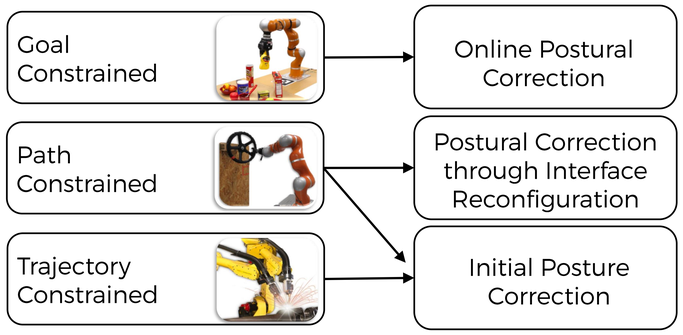
amir.yazdani@utah.edu
https://amir-yazdani.github.io/
amirreza_yz

Introduction

- An **accurate computational model** for ergonomics and comfort is the key to postural optimization.
- Ergonomics assessment tools such as **RULA** and **REBA** are
  - ✓ Easier to calculate
  - ✓ **Validated effectiveness** on lowering the risk by subject studies
  - ✓ Posture oriented
  - × Discrete score
  - × Plateaus
  - × Non differentiable

Methodology

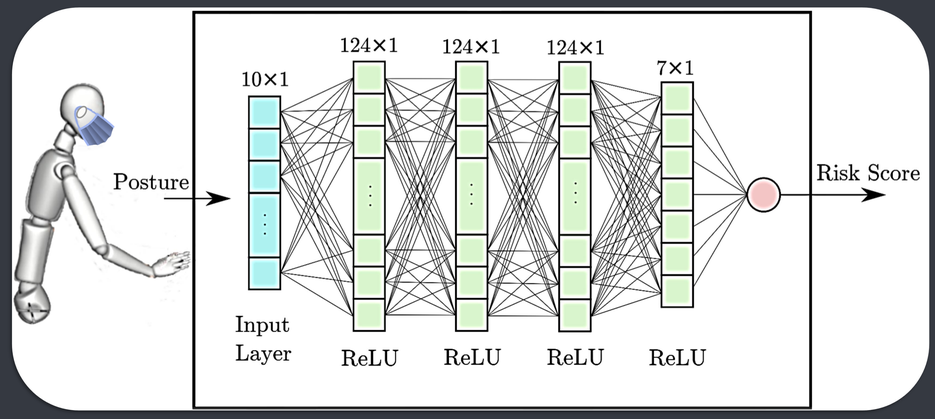
- Learn a **differentiable** and **continuous** neural network model for RULA
- Posture optimization framework for **teleoperation** tasks
- **Gradient-based** (using DULA) and **gradient-free** (using RULA) postural optimization
- **Simulated** environment for teleoperation



Results

- **99.73% accuracy** of prediction for DULA
- Accurate among all ranges of scores
- Successfully lowering the risk score after applying the optimal postural correction
- Gradient-based approach using DULA has **lower time complexity** and **smoother result**.

DULA is a **differentiable** and **continuous** ergonomics model for gradient-based **postural optimization** in physical **HRI** and other related applications.



Take a picture to download the full paper

This work is supported by DARPA under grant N66001-19-2-4035.

ROBOTICS SCIENCE AND SYSTEMS
ROBOTICS CENTER
THE UNIVERSITY OF UTAH