



# Predicting GRF from EMG

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Vision

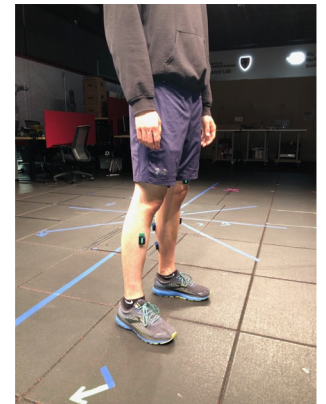
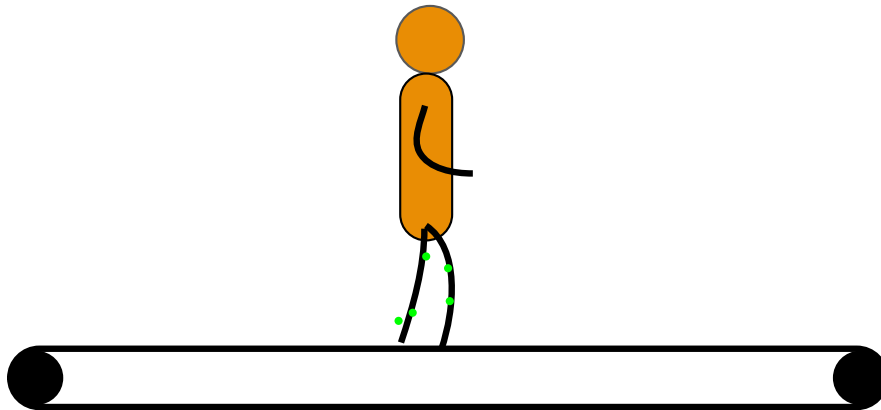
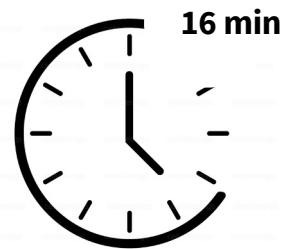
## **Ground Reaction Forces without Elaborate Lab**

Measure Gait Asymmetry | Inverse Dynamics | Long Form Data Collection

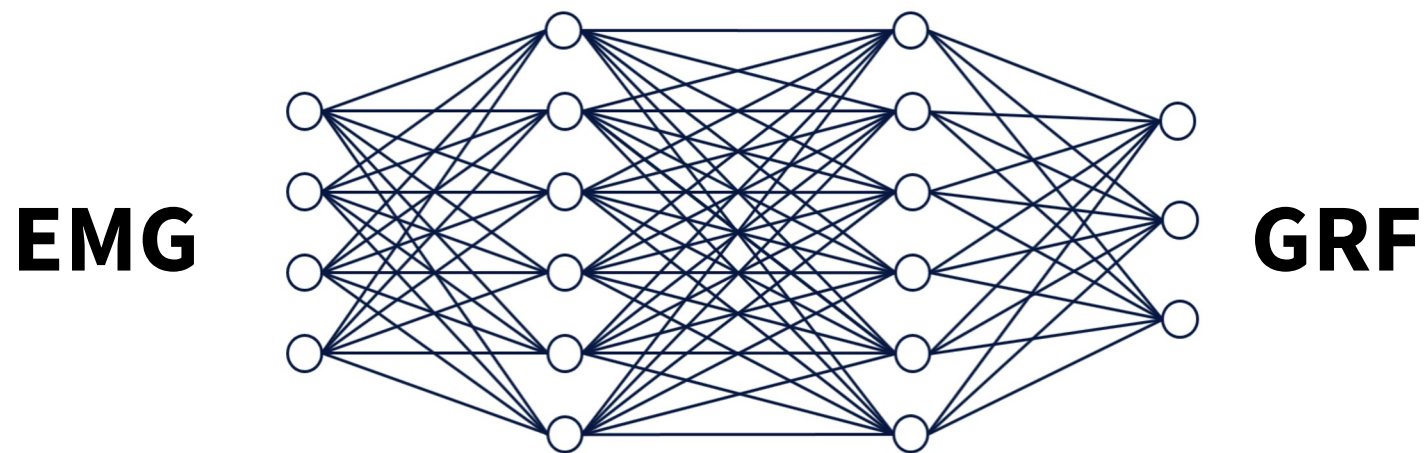
# Data Collection

**3 Subjects**

**14 EMG Sensors**

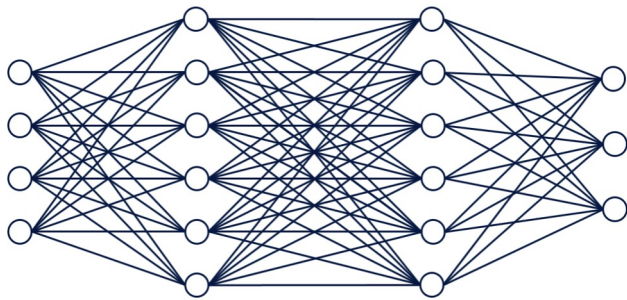


## General Approach

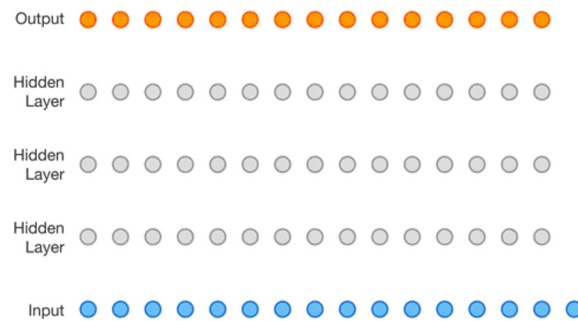


# Model Architectures

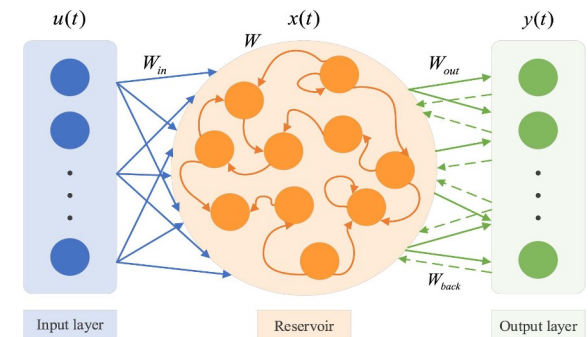
## Simple Linear Regression & NN



## WaveNet NN



## Echo State NN



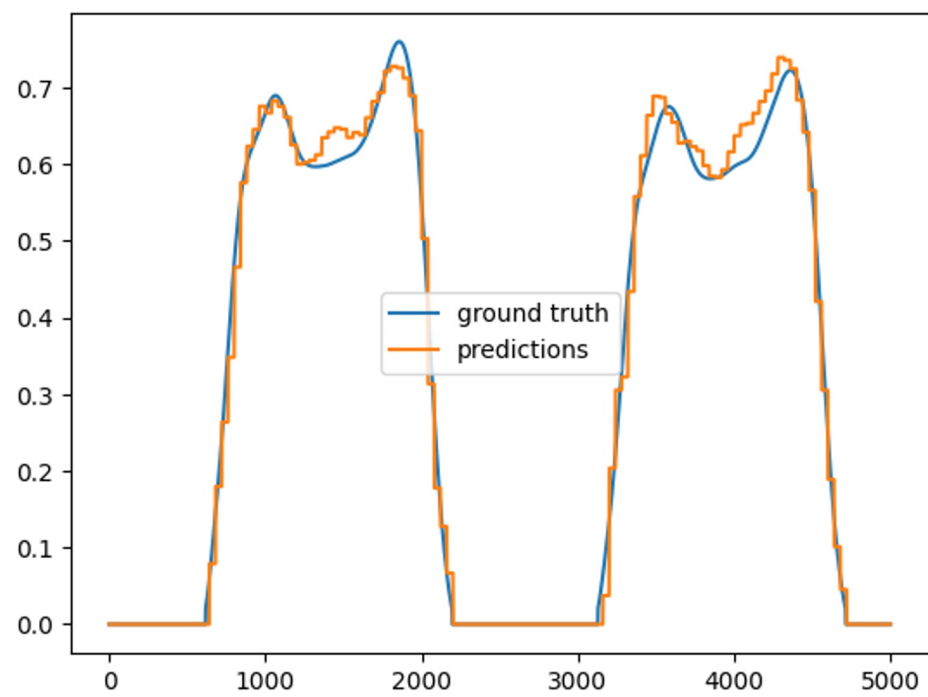
# Optimization

## First-Order Gradient Descent & Adam Optimizer

Fixed Learning Rate:  $\alpha = 0.01$  | Batch Size:  $n = 32$

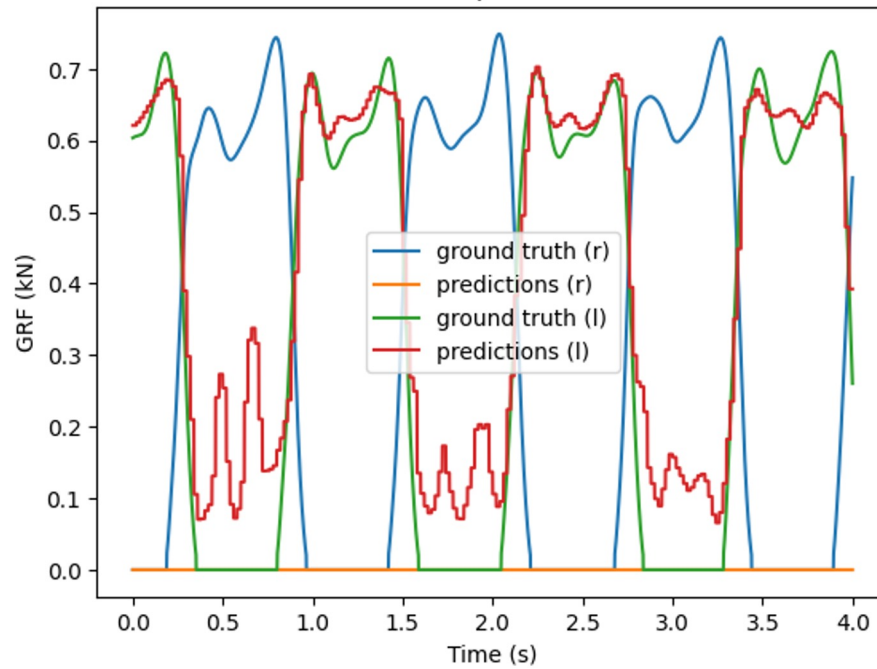
Model Architecture	Parameter Count
Simple Linear Model	17
Deep Neural Network	13057
WaveNet	32

## Preliminary Results

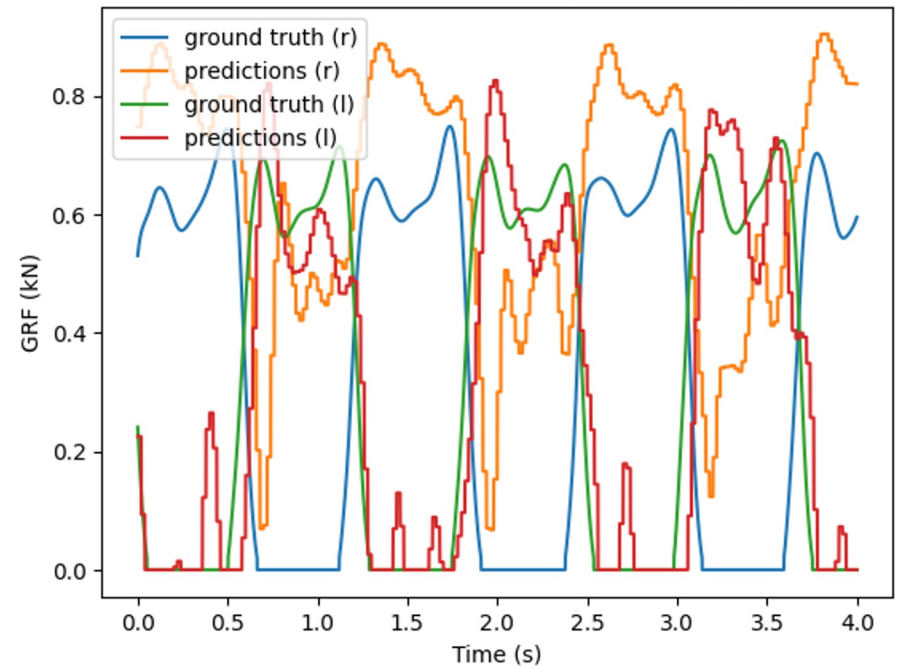


# Final Results

GRF for Deep Linear Model

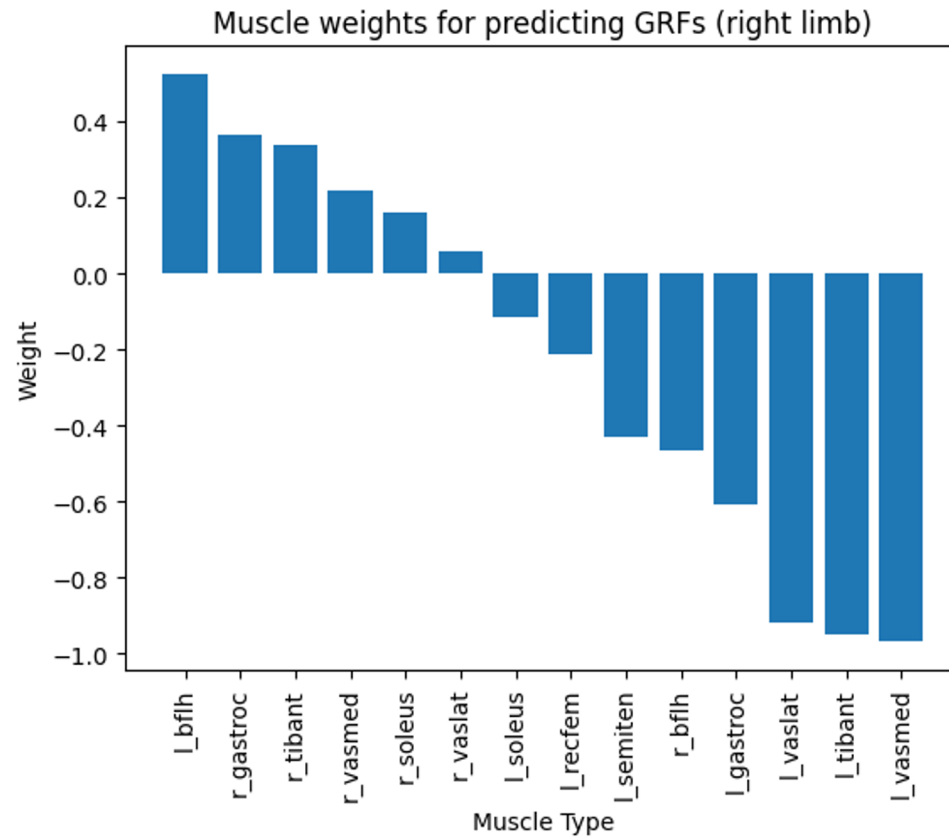


GRF for Wavenet Model (Generalized)





# Interpretability





## Future Work

### **Improve Model**

Parameters | Simultaneous Limb Prediction

### **Fewer EMG Streams**

Identify Biggest Influencers

### **Different Activities**

Jumping | Running

### **Atypical Motion**

Crouch Gait | Limp

# Thank you!

**Professor  
Mentor  
Shoutout**

Scott Delp

Carmichael Ong

Mykel Kochenderfer

485 Teaching Team

HPL Team

David “orange cartoon” Delp

