Predicting GRF from EMG

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Vision

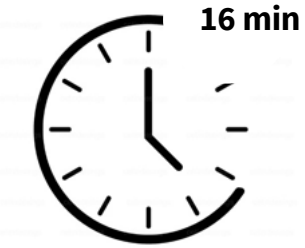
Ground Reaction Forces without Elaborate Lab

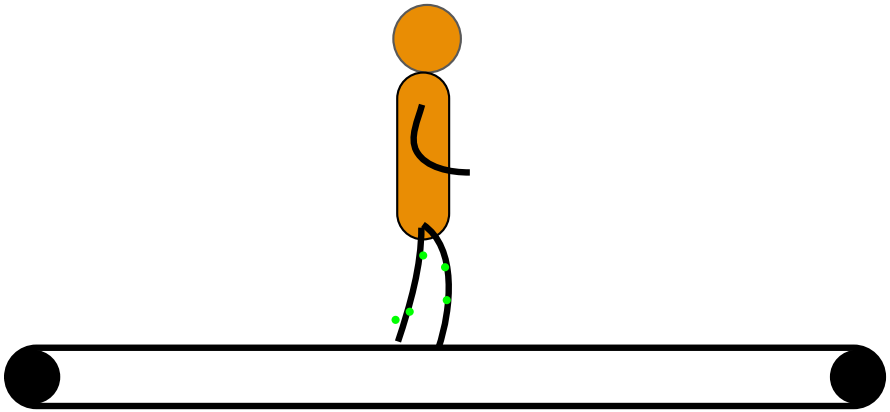
Measure Gait Asymmetry | Inverse Dynamics | Long Form Data Collection

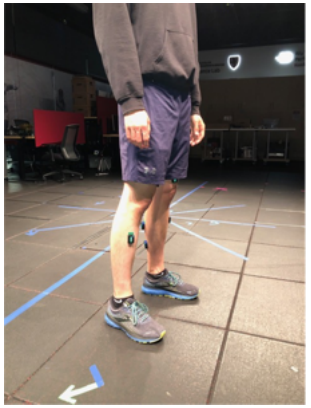
Data Collection

3 Subjects

14 EMG Sensors

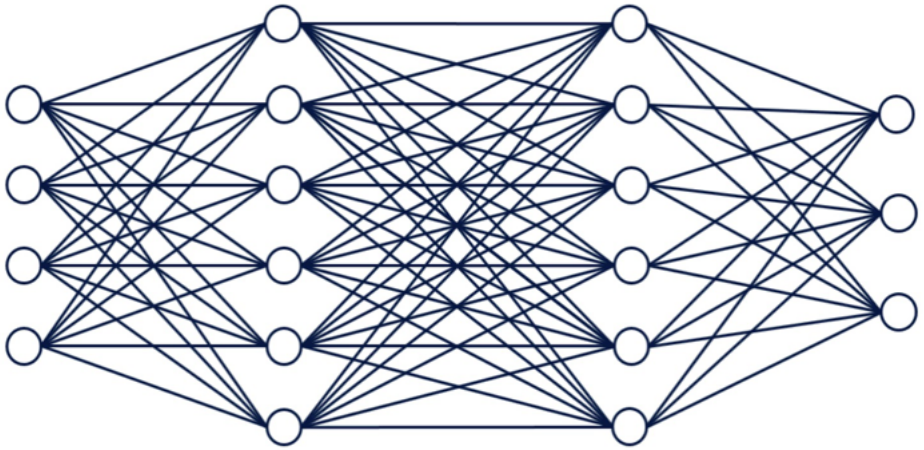






General Approach

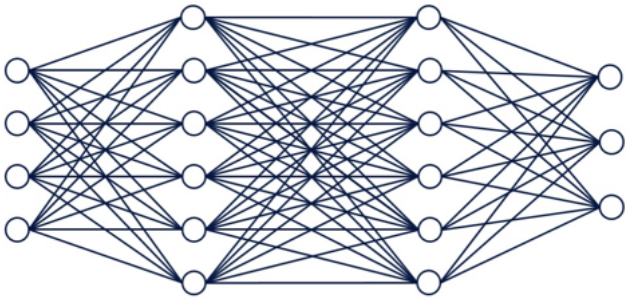
EMG



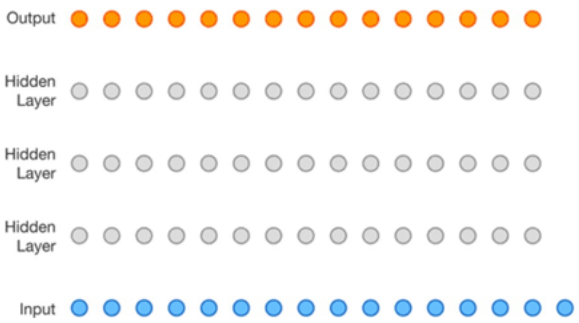
GRF

Model Architectures

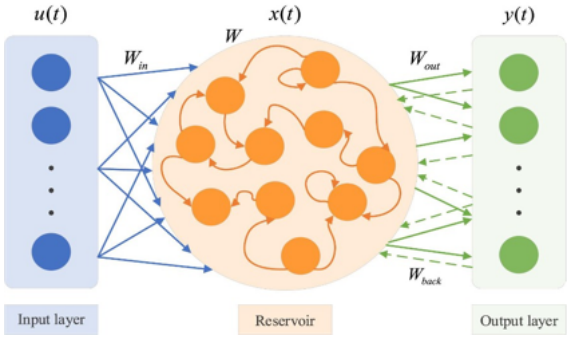
Simple Linear Regression & NN



WaveNet NN



Echo State NN



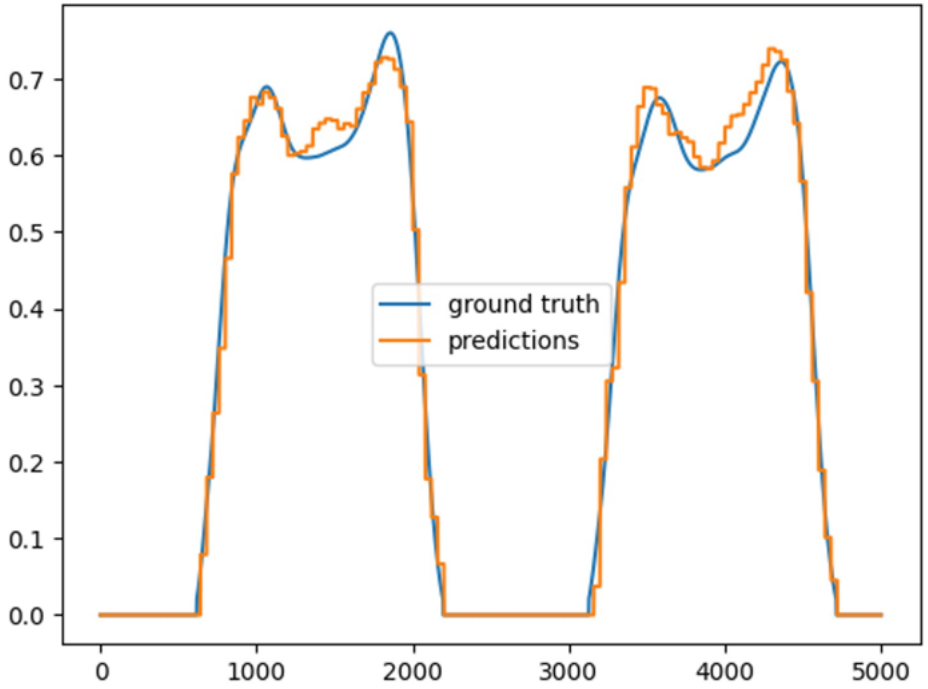
Optimization

First-Order Gradient Descent & Adam Optimizer

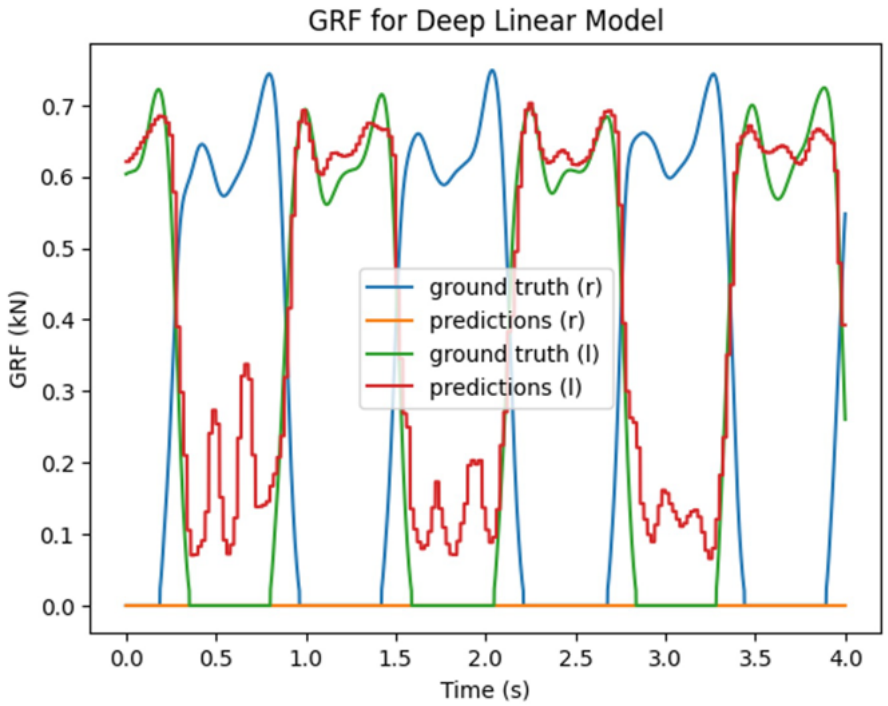
Fixed Learning Rate: $\alpha = 0.01$ | Batch Size: $n = 32$

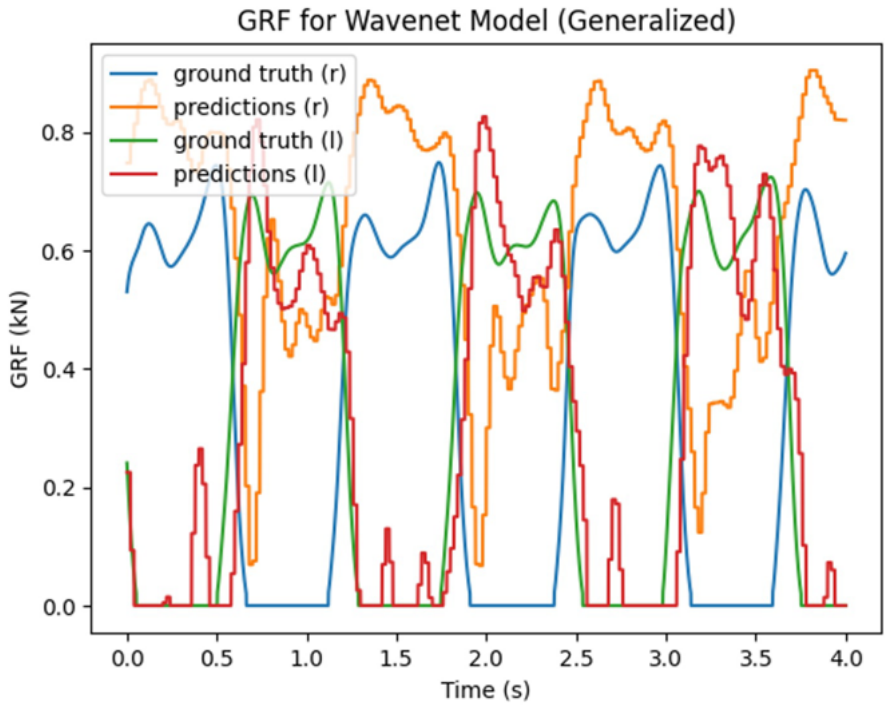
Model Architecture	Parameter Count
Simple Linear Model	17
Deep Neural Network	13057
WaveNet	32

Preliminary Results

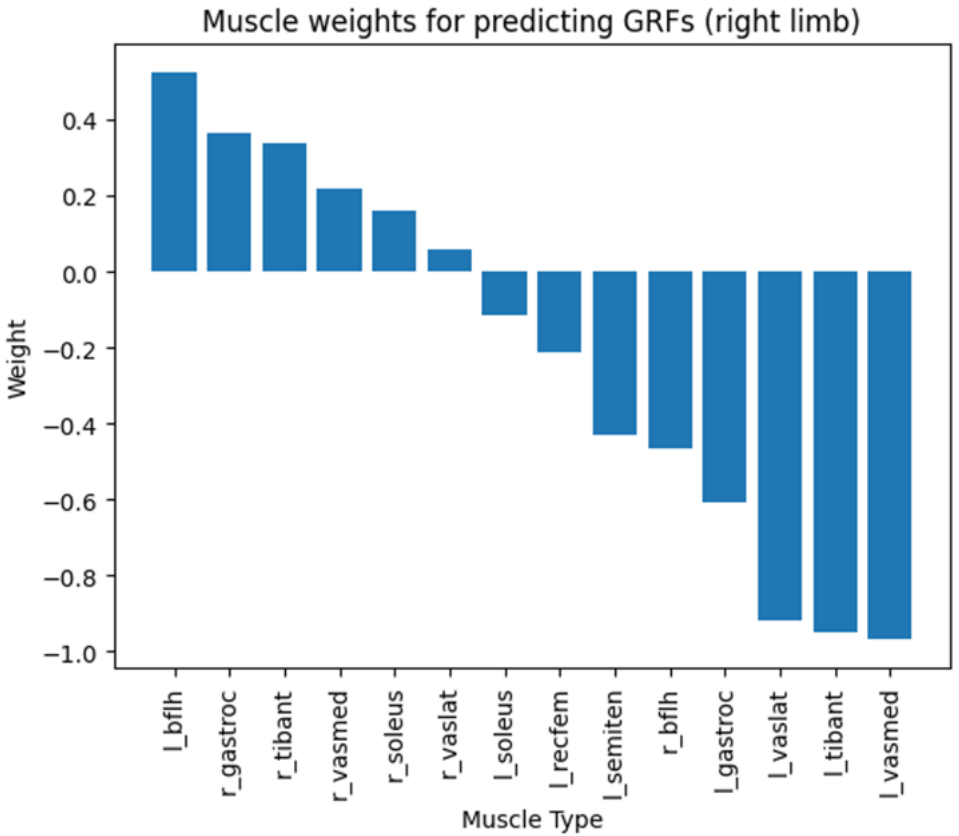


Final Results





Interpretability



Future Work

Improve Model

Parameters | Simultaneous Limb Prediction

Different Activities

Jumping | Running

Fewer EMG Streams

Identify Biggest Influencers

Atypical Motion

Crouch Gait | Limp

Thank you!

Professor Scott Delp
Mentor Carmichael Ong
Shoutout Mykel Kochenderfer
485 Teaching Team
HPL Team
David “orange cartoon” Delp