Reconstructing Full Human Arm Motion from Inertial Measurements of a Single Sensor

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Ambitious-Kudus | Arrogant Ambassadors

Background

- Inertial measurement units (IMUs) have been increasingly popular in rehabilitation research. However, despite their accessibility and potential advantages, their uptake and acceptance by health professionals remain a big challenge (Routhier et al. 2020).
- Inertial measurement datastreams often rely on **multiple** sensors placed directly on body parts of interest to track movements in a controlled environment .
- These collection techniques are not be feasible for long-term measurements in a public setting.

Wearable Inertial Measurement Units for Assessing Gait in Real-World Environments (Reggli et al. 2020)

Question

- Can we use a single, commonly placed wrist IMU sensor to predict motions and accelerations of other body parts such as the full arm for clinical uses such as stroke detection and rehabilitation?

An example of current generation arm rehabilitation sensor suite | Analysis for Rehabilitative Motion Sensing (ARMS)

A current generation smart watch with IMU sensor

MoVi Dataset

RESEARCH ARTICLE

MoVi: A large multi-purpose human motion and video dataset

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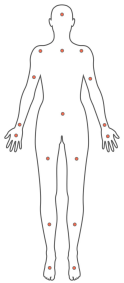
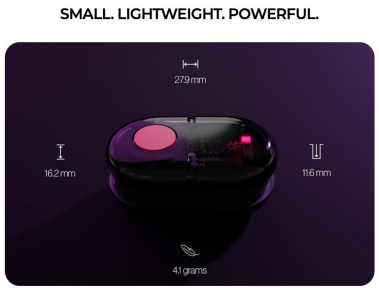
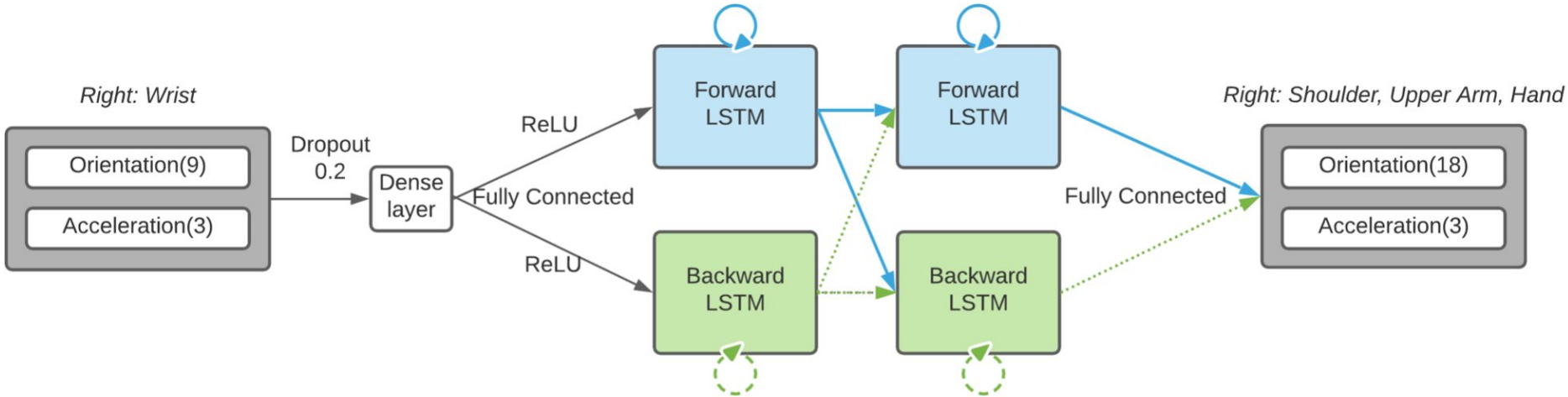




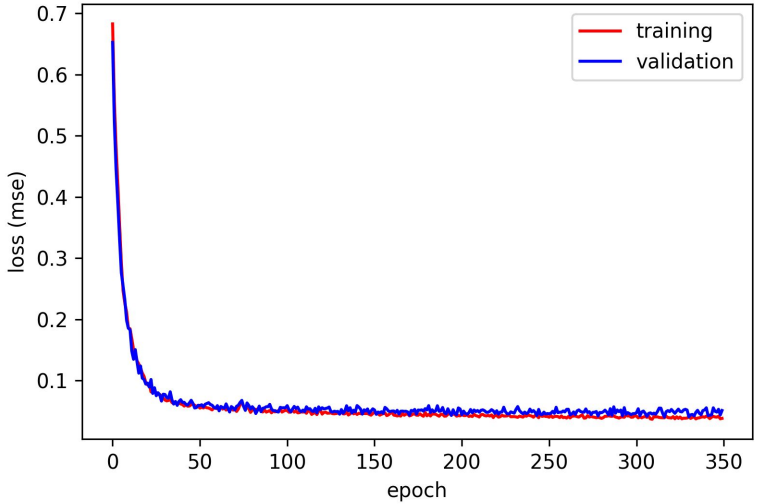
Bidirectional LSTM



Results

Training and Validation

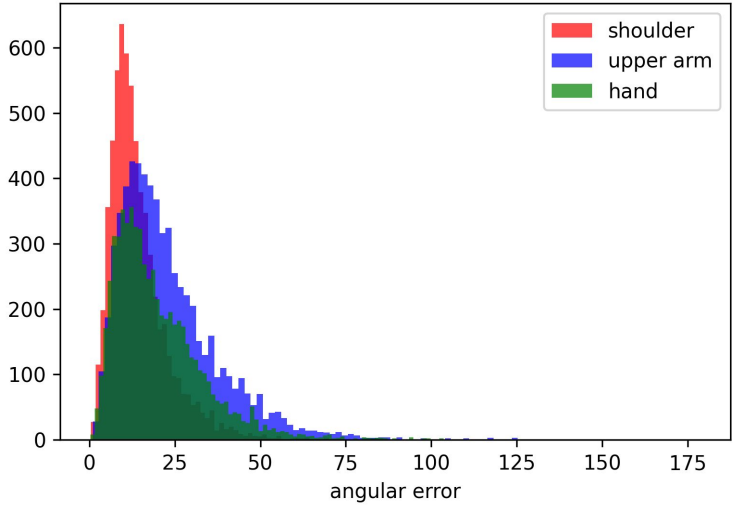
Loss Curves (MSE)



Test set MSE: 0.0362

Test Set Evaluation

Absolute Angular error (Deg)



mean angular errors: shoulder: 14.36 deg, upper arm: 23.42 deg, hand: 20.23 deg

Animations

Conclusion and Future Work

- Obtained a mean accuracy of 19.33° joint angular error (shoulder, upper arm, hand), using only wrist IMU as input.

- Future work should address whether wrist IMU sensor could predict motions and accelerations of other body parts (e.g., upper torso, etc)

Q/A