

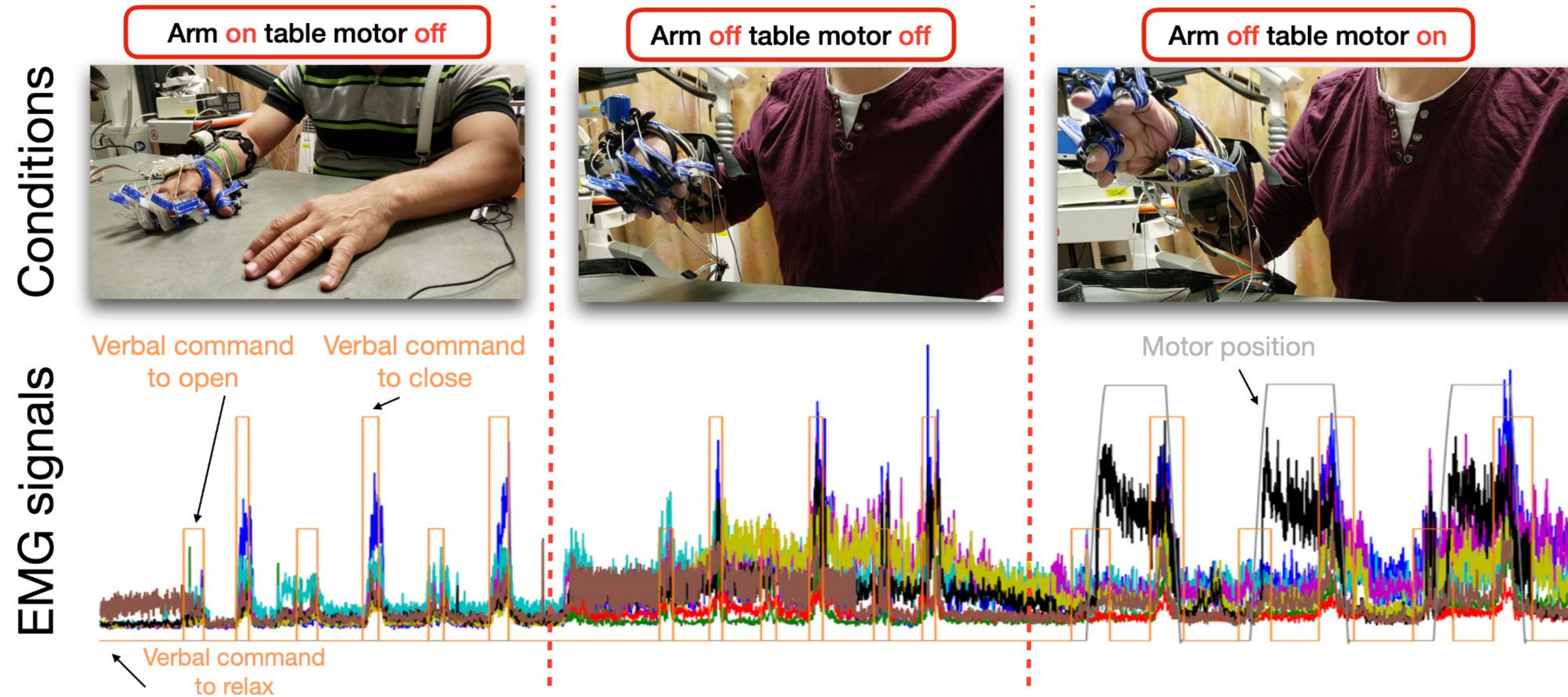
# Adaptive Semi-Supervised Intent Inferral to Control a Powered Hand Orthosis for Stroke

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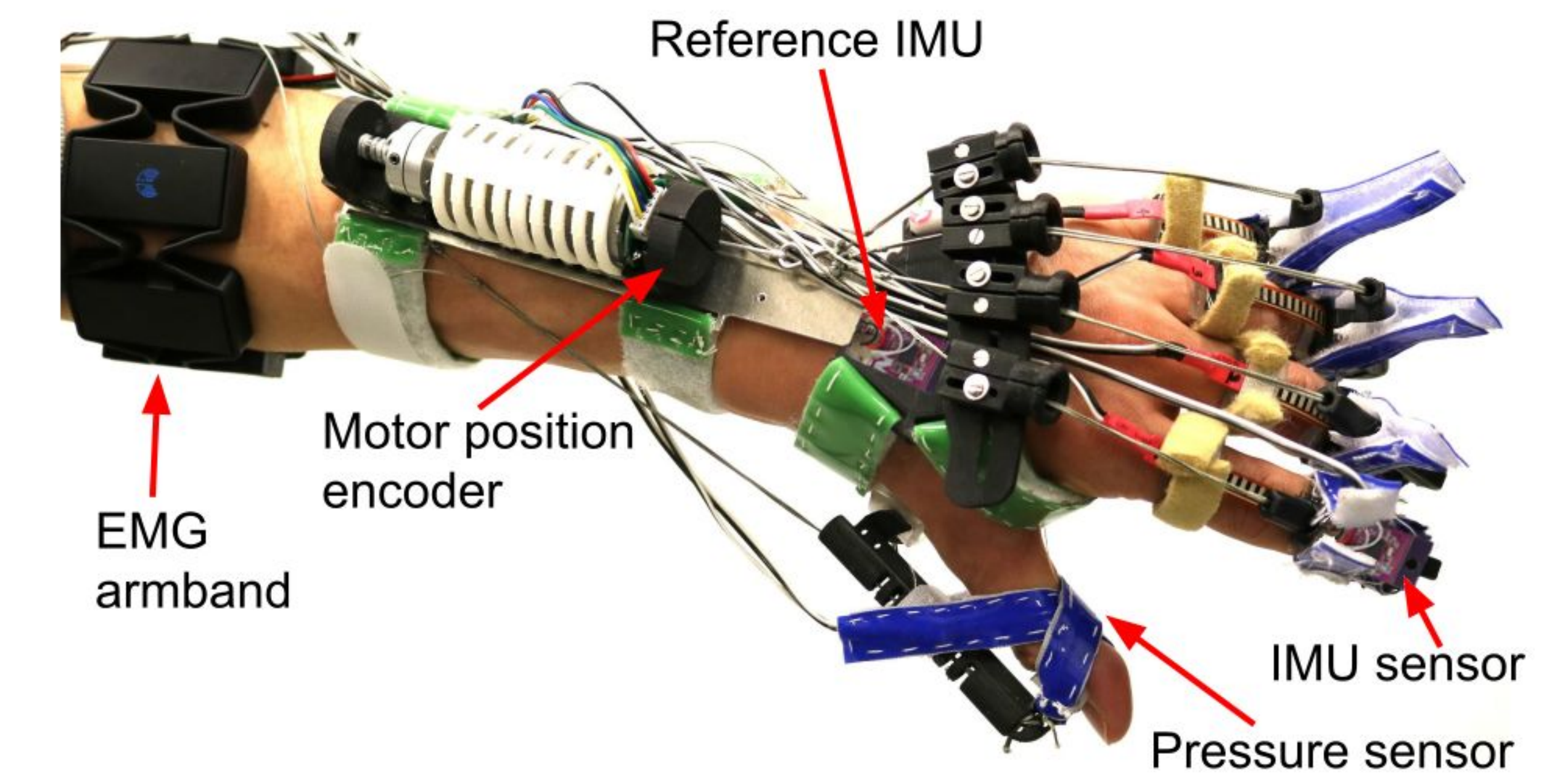


## Concept Drift: a Challenge for Intent Inferral using Biosignals

- Our **wearable hand orthosis** uses learning on biosignals to infer users' intent and provide assistance in finger extension
- **Concept drift**, or the change in input signals due to fatigue, new arm positions, etc., is a significant challenge
- The classic solution to concept drift is to collect training data in as many conditions as possible. However, this extends training and increases user burden.



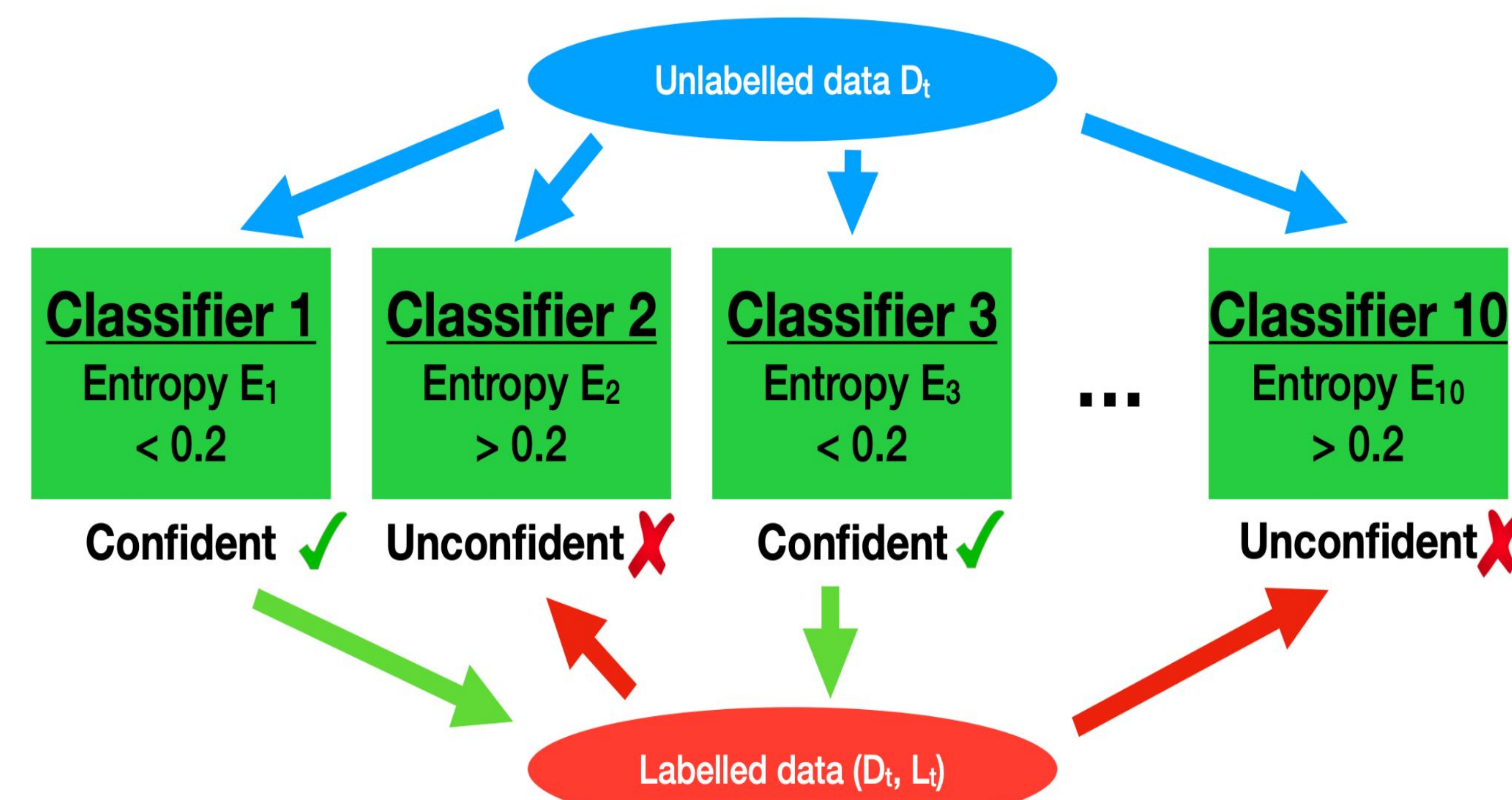
## Hardware and Sensors



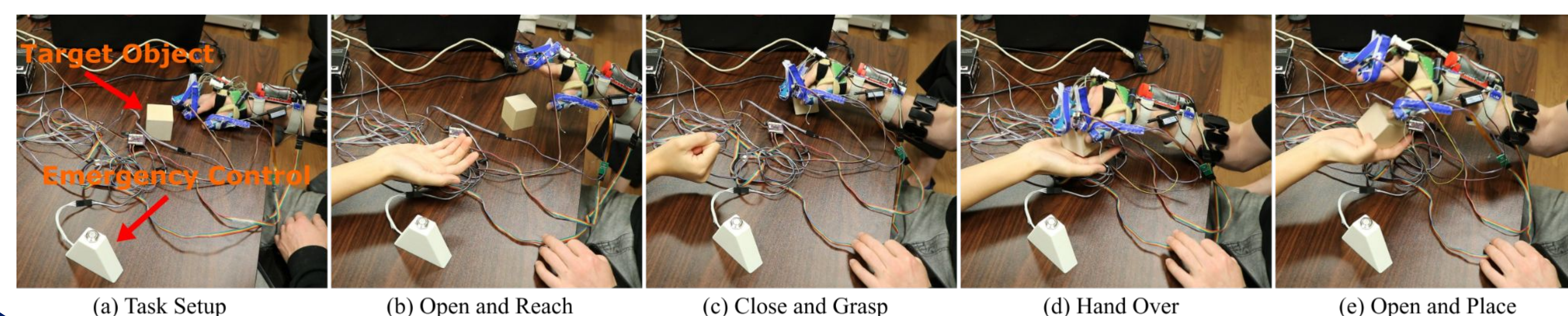
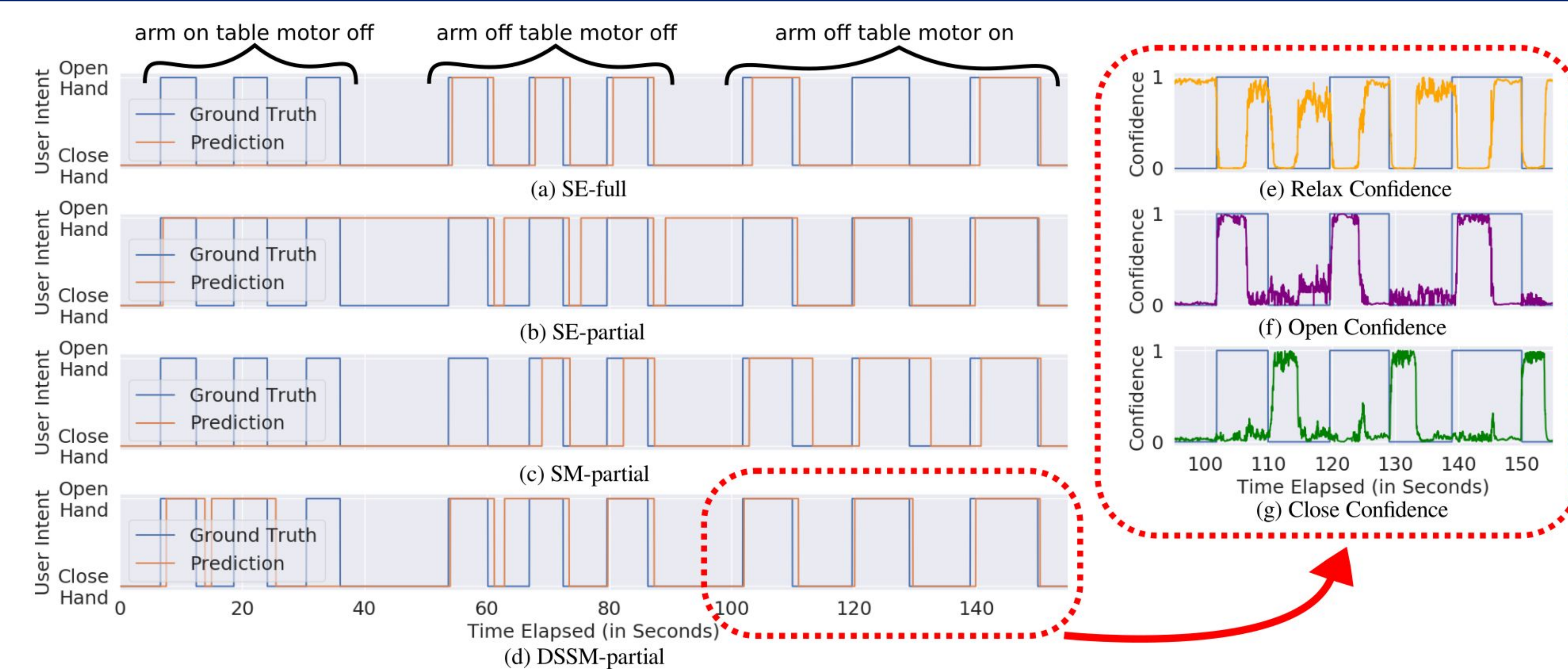
- Our orthosis is an exotendon device consisting of a forearm splint and fingertip components.
- The orthosis is equipped with multiple **sensing modalities**: Forearm EMG, Motor Position, Finger Joint Angles, Fingertip Pressure

## Approach: Disagreement-based Semi-supervision

- We aim to train on a small dataset labeled by the experimenter, then **adapt to concept drift using unlabeled data**.
- Our algorithm uses an ensemble of classifiers. Each classifier uses a randomly sampled subset of the sensing modalities.
- When concept drift occurs, some modalities remain robust. We can use the more confident classifiers to improve less confident classifiers.



## Experiments and Results



- We evaluate our method both offline and online.
- Despite being trained only on one condition, our method outperforms the supervised learning baseline that is trained on all conditions.
- In the online functional task, two subjects successfully completed multiple instances of a pick-and-handover task.