A wearable system to assess walking symmetry in individuals with lower limb impairments

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BACKGROUND

- Individuals with lower limb impairments often experience gait asymmetry
- Quantifying asymmetry is important to guide the focus of rehabilitation

OBJECTIVE

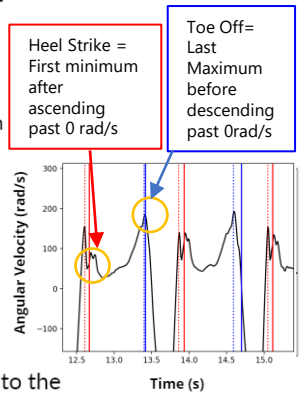
Develop a wearable system that can:

1. Accurately **identify gait events**

2. **Quantify asymmetry** in walking [1]
3. Provide **real-time** data output and **biofeedback** through an **android app**

METHODS

1. Developed an algorithm to detect **Heel Strike** and **Toe Off** Events

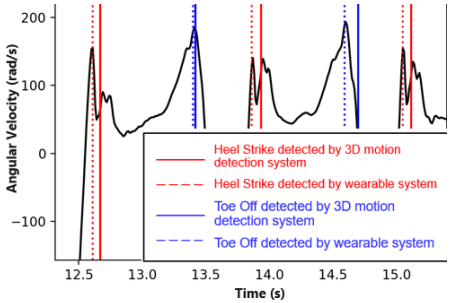


2. Two sensors attached to the shank interface with the app to collect data

3. Angular velocity data along z axis compared to data from 3D motion capture system

A wearable inertial sensor system can be used to analyze walking patterns in real time and provide feedback to improve walking patterns in individuals with lower limb impairments

RESULTS



- Mean timing error for **Heel Strikes was 0.5% ± 1.1** and **1.5% ±0.6 for Toe Off detections** when tested on offline data from individuals with lower-limb amputations
- Algorithm used these events to calculate **stance time**, **swing time**, **stance time symmetry** and **cadence** values

NEXT STEPS

- Continue testing with user receiving biofeedback
- Continue testing with individuals with lower limb amputations

CONCLUSION & RELEVANCE TO BLOORVIEW FAMILIES

- **Reliable detection of gait events** allows this system to perform **real time analysis of gait symmetry** in individuals with lower limb impairments
- Providing **biofeedback guides** the **rehabilitation** focus
- Additional advantages:

Continue **gait training** and **rehabilitation outside of the hospital**

User-friendly and **portable** system promotes **consistent usage**

REFERENCES

[1] B. Mariani, S. Rochat, C. J. Büla and K. Aminian, "Heel and Toe Clearance Estimation for Gait Analysis Using Wireless Inertial Sensors," in *IEEE Transactions on Biomedical Engineering*, vol. 59, no. 11, pp. 3162-3168, Nov. 2012, doi: 10.1109/TBME.2012.2216263.

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