Pressure Insoles for Gait and Balance Estimation

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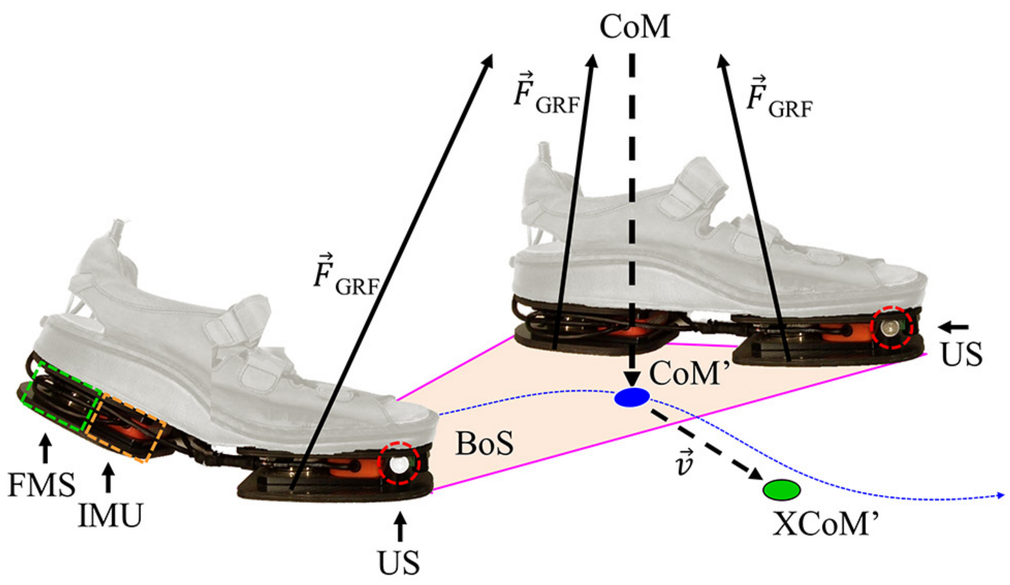
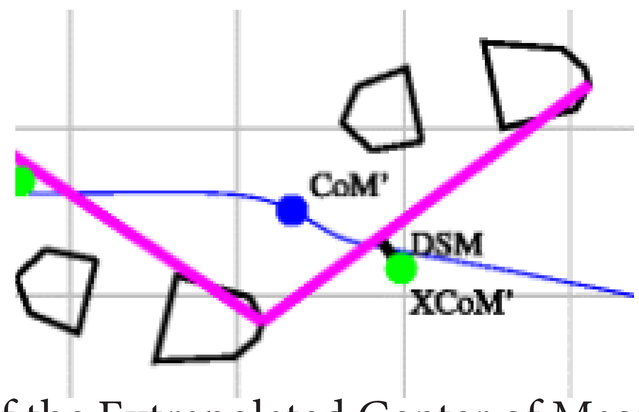
Introduction

ForceShoes™ can provide estimation of ambulatory gait and balance parameters using intertial, force and distance sensors [1,2]. However, the shoe is bulky. A lightweight and inconspicous alternative would be ideal for activities of daily life, especially for stroke survivors. Pressure Insoles are investigated as an alternative. Subject specific models are used to improve accuracy of estimation [3].

ForceShoes™: A History



Dynamic Stability Margin: Gait Balance



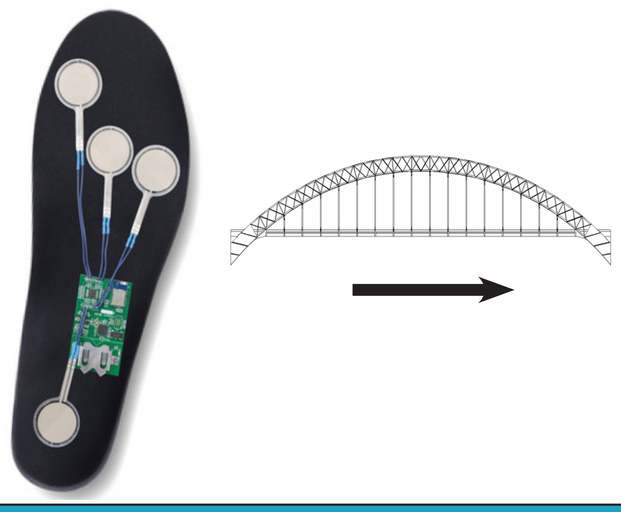
$$XCoM' = CoM' + \frac{\mathbf{v}_{CoM}}{\omega_0}$$

If the Extrapolated Center of Mass (XCoM) is beyond base of support, the DSM is positive, or gait is dynamically unstable. This indicates a healthy gait pattern.

Everyday Use?

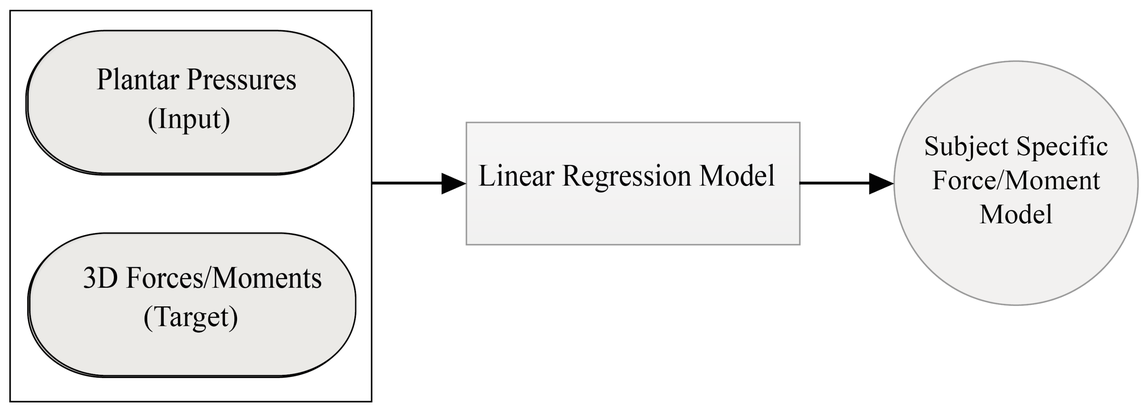
- Lightweight
- Inconspicous

Pressure Insoles?

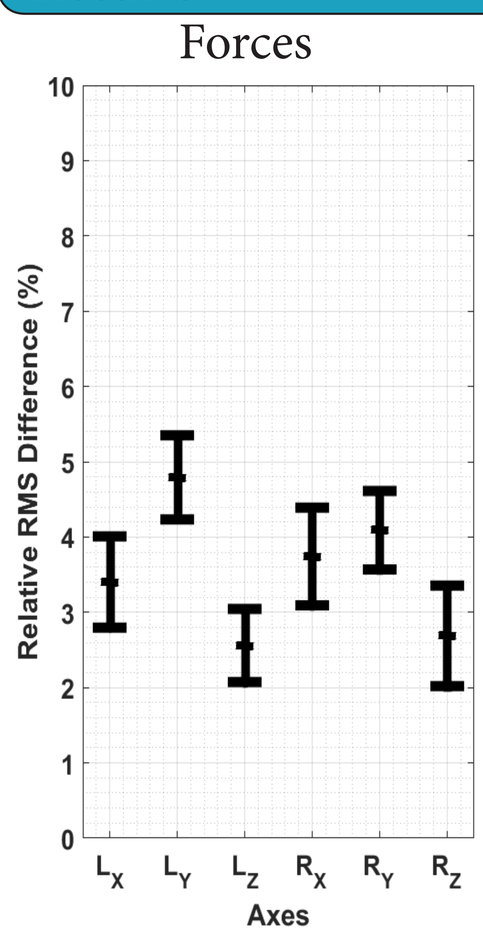


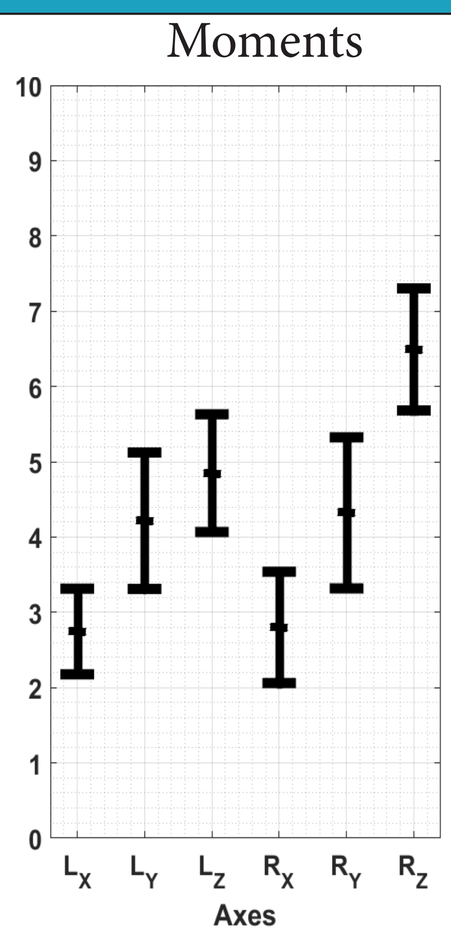
Machine Learning

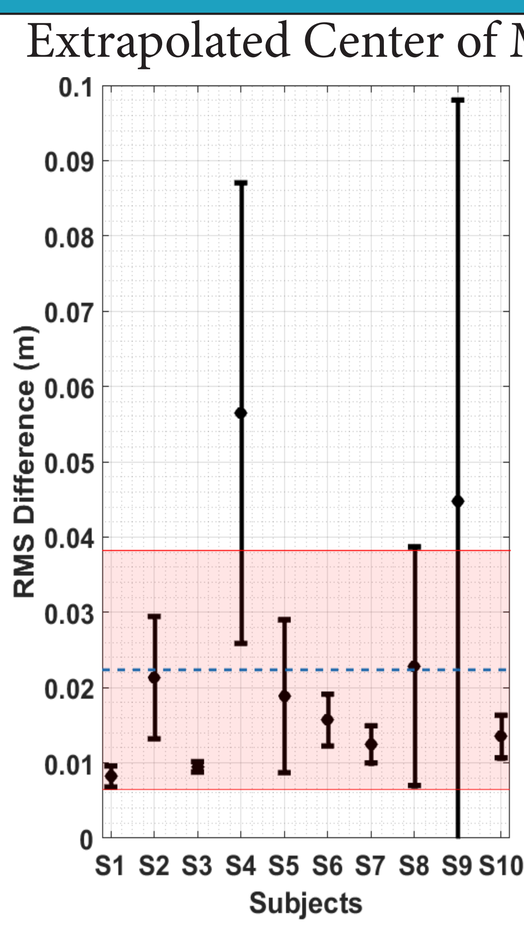
Appended Walking Trials

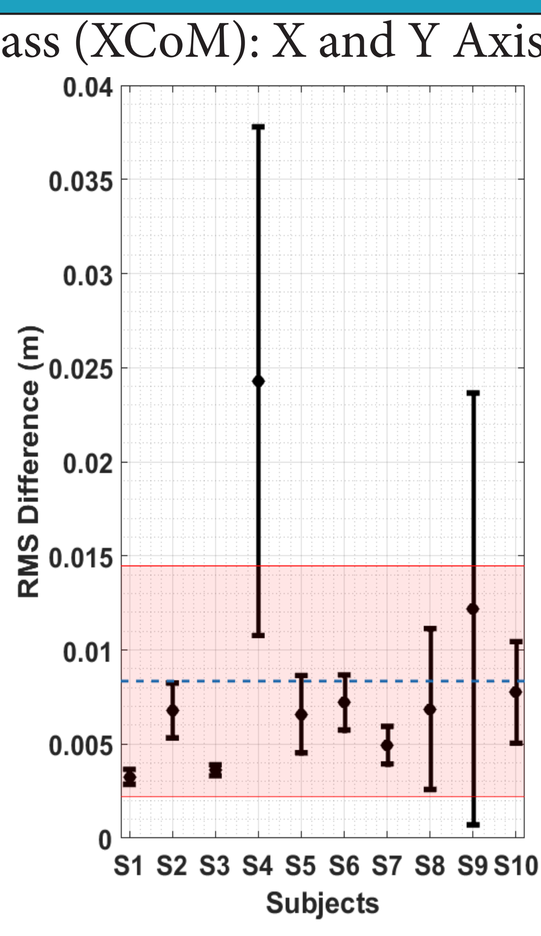


Results









Classifying dynamic stability: Any good?

Estimation Accuracy: 98.4%

Whats next?

Pressure Insoles can be an alternative for gait and balance estimation

- Testing for different walking speeds, preferably slower
- Estimation accuracy during initial & final step?
- Is low frequency information sufficient for CoM estimation?
- Effect of reducing number of pressure sensors on estimation accuracy?

REFERENCES

[1] Veltink et al, *IEEE Trans. Neural Syst. Rehabil. Eng.*, 2005
[2] Schepers et al, *IEEE Trans. Biomed. Eng.*, 2009
[3] Rouhani et al, *Gait & Posture*, 2010

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