



Predicting Lifting Postures with Force Plates

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Background

Back injury is among the leading cause of absenteeism in the workplace in the United States. Billions of dollars per year are spent for medical costs due to injuries and disabilities which occur at the workplace. A major cause of back pain is poor lifting posture in the workplace. Poor posture can increase the forces experienced by the spine, eventually leading to low back injury.

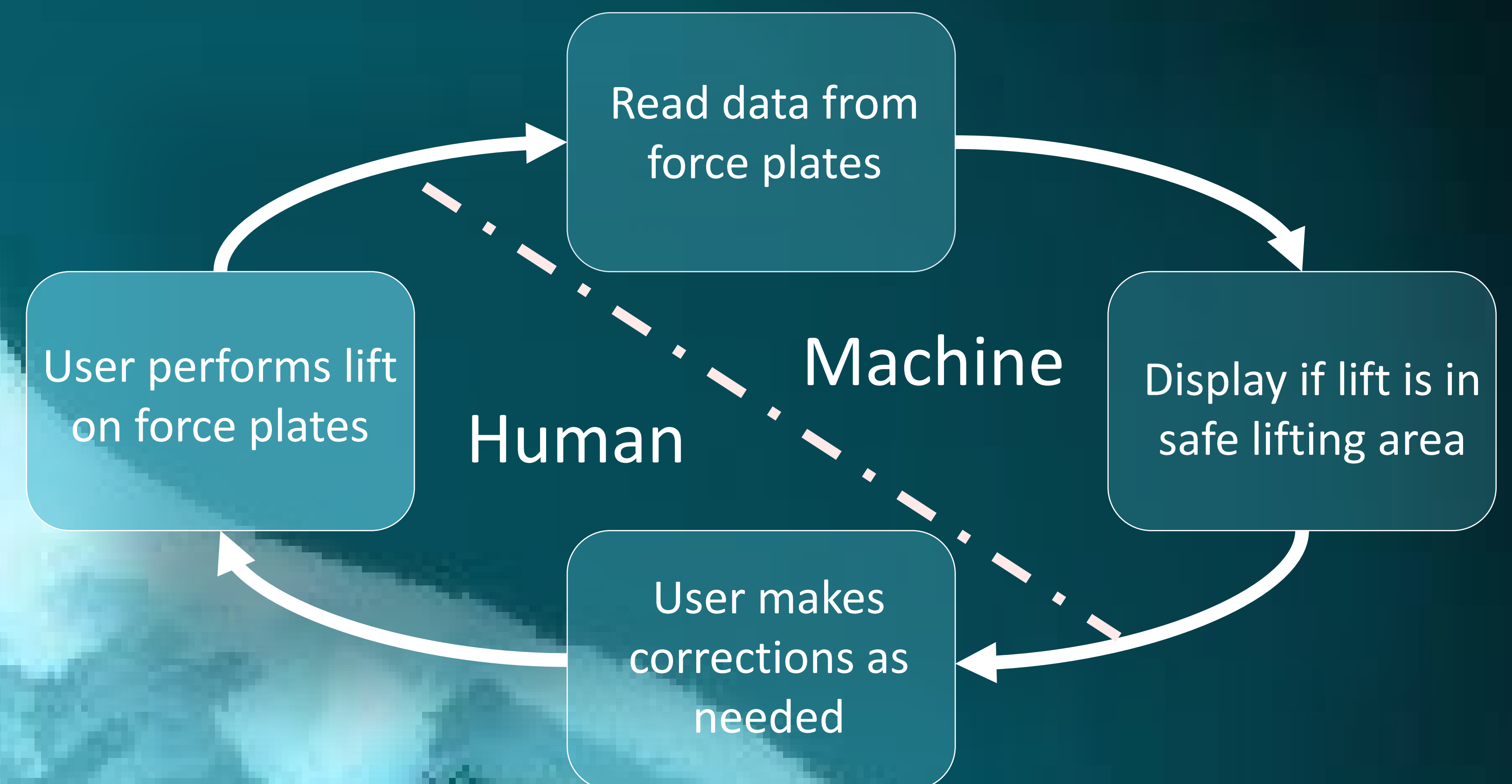
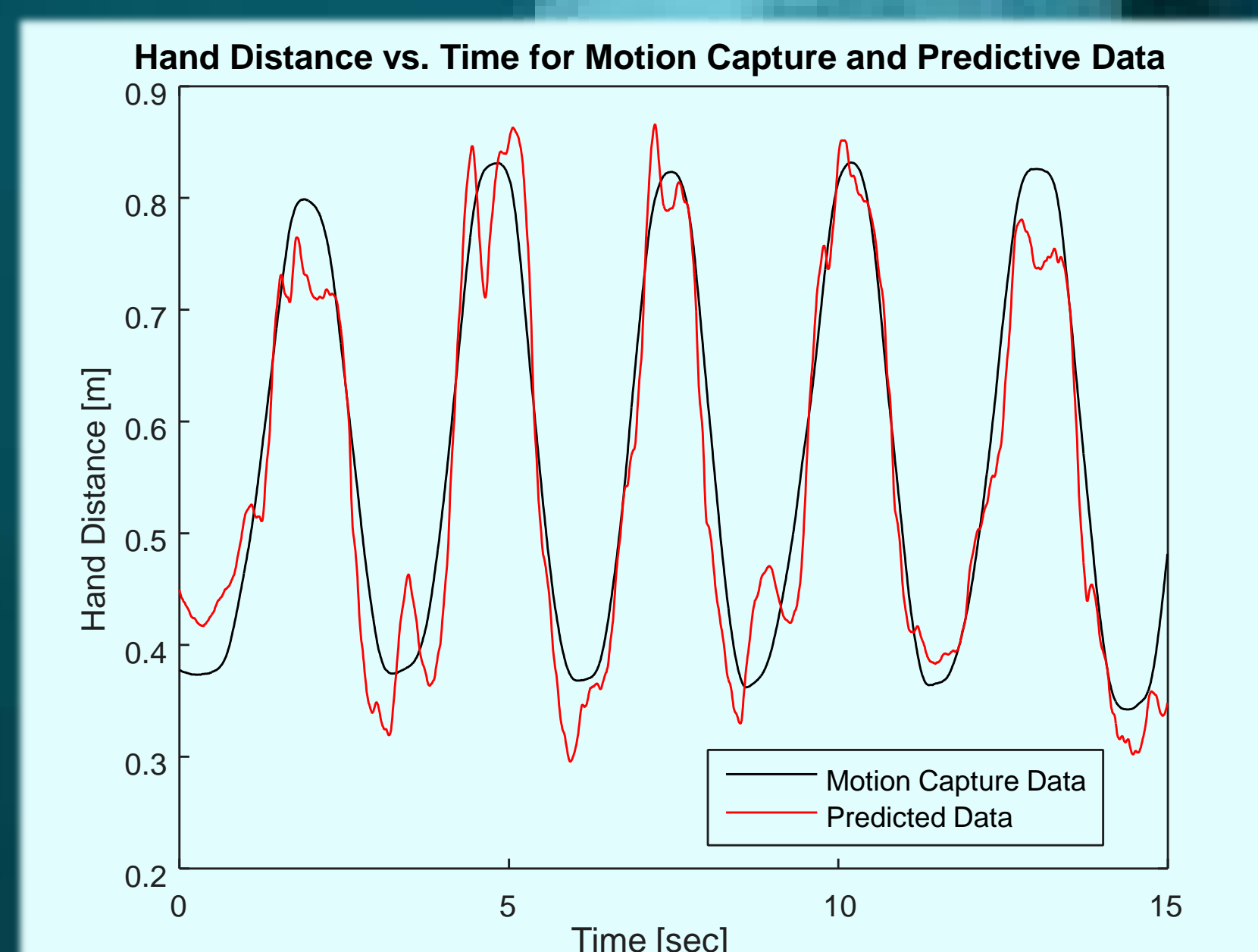
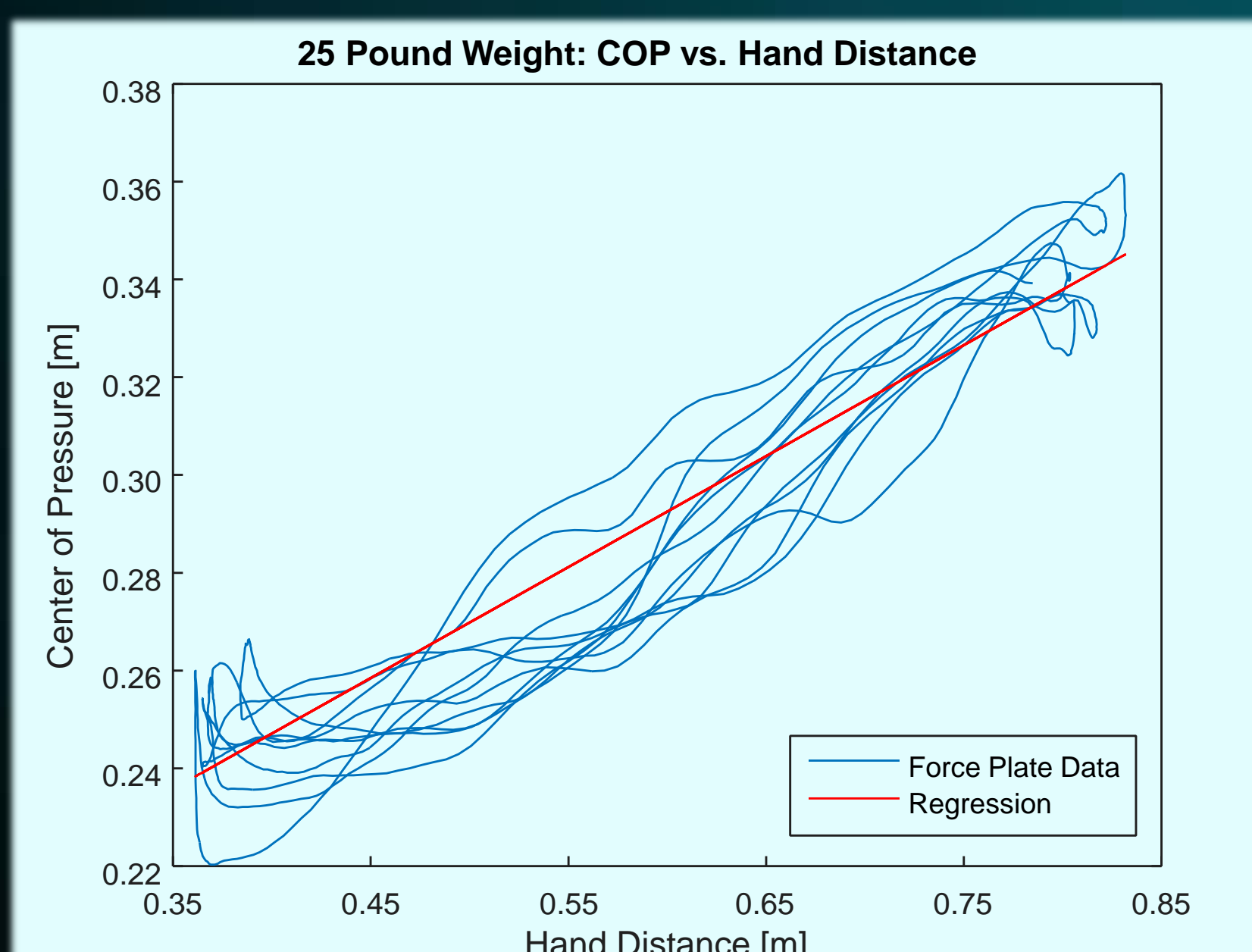
Proposed Solution

Develop a proof of concept monitoring system to identify characteristics of unsafe lifting postures by:

- Predict posture metrics through changes in Center of Pressure (COP) by using force plates
- Develop a lifting safety envelope of allowed movement which is dependent on weight of object
- Correctly identify posture and signal when the lifting safety envelope is breached

Results

COP accurately predicts the position of the hands relative to the lower back (Hand Distance). Correlation between COP and Hand Distance is 0.954 for a 25 pound weight [$R^2 = 0.909$, $F(2,1498) = 15000$, $p < .001$]



Conclusion

Force plates are a viable way to predict major lifting behaviors and can be used to accurately estimate posture while performing lifts. The correlations between COP and hand data suggest strong correlation between the two.

Future Work

Future work includes displaying the user's body position on a screen to let them view their posture in real time.

The ultimate goal of this project is to provide a mobile system in which the user can have feedback on the job. The system can be converted from force plates into shoe insoles. Mobile shoe insoles could travel with the worker and inform them of lifting technique through audio or tactile feedback.