ATOM-HP: Analytical Technologies to Objectively Measure Human Performance

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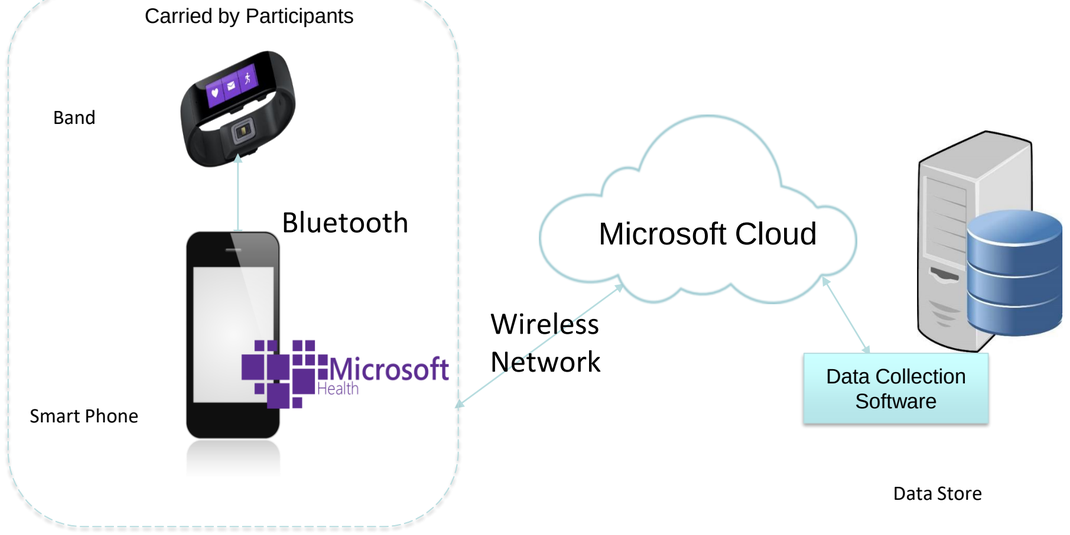
Introduction

- **Cancer patients undergoing treatment**
- The successful mission completion/survival of warfighters
- Technology to measure Performance Status (PS)
- Current PS evaluation might be subjective[1], and patient-physician disagreement is associated with an increase in the risk of death.
- **Exceptional development of sensors**
- 3D Camera sensor (Depth, Infrared, RGB,…)
- Daily activity data from Wearable sensor [2]

- **Multivariate Time Series (MTS) data analysis**
- High-dimensional MTS data visualization [3]
- Skeletal Data – Human Motion data analysis [4]

System

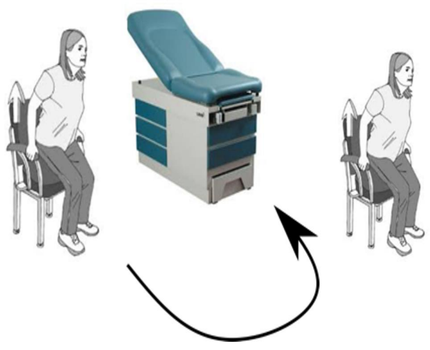
Home Remote Monitoring

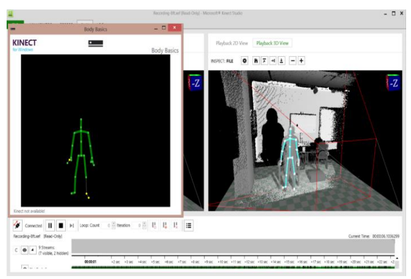


In the Clinic / Site

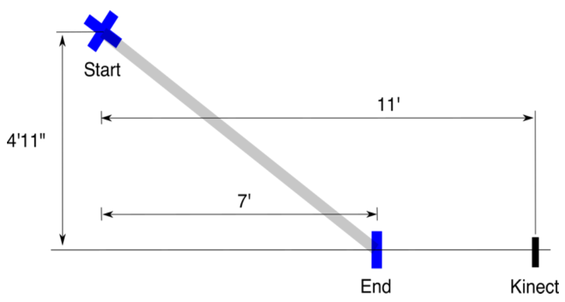
Chair to Exam-Table

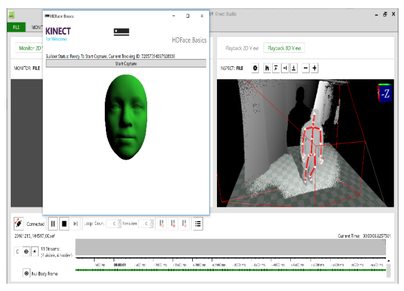
Get-Up and Go





walk and talk

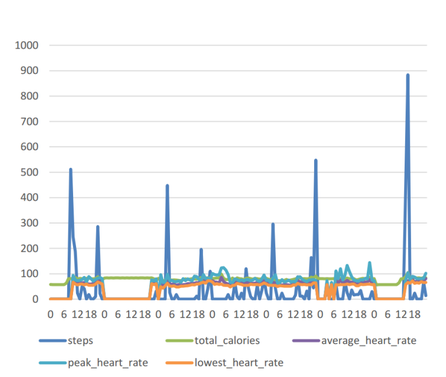


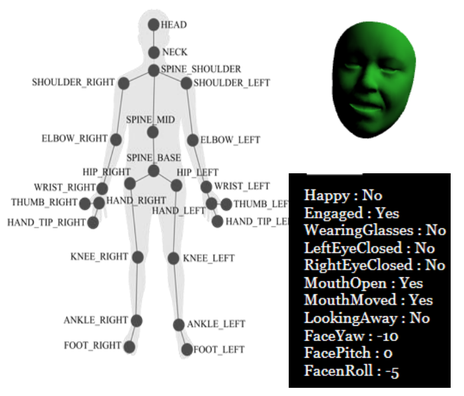


Data Analysis & Visualization

Collected Data

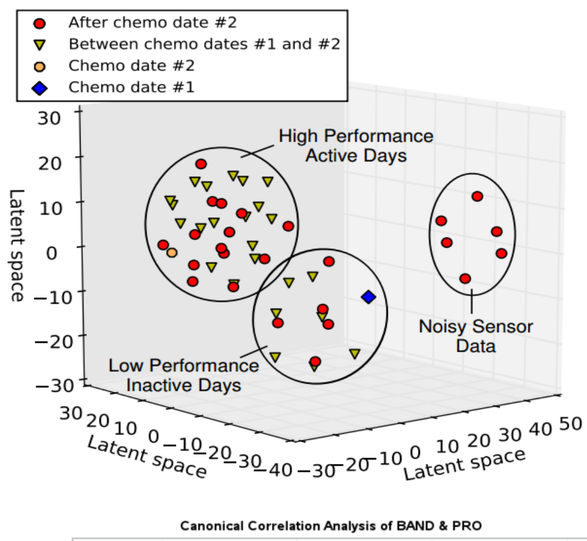
- Band monitoring data
- Human motion skeletal data
- Self- report Outcomes



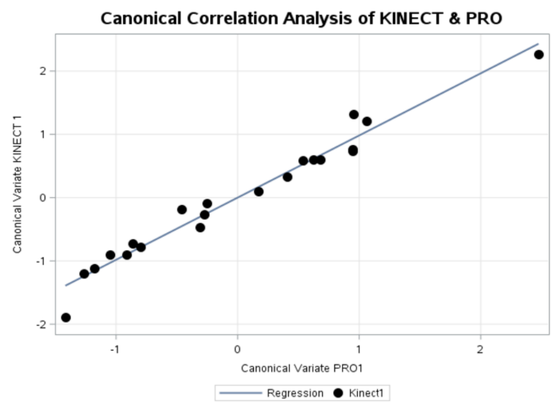


- m-TSNE Visualization framework:

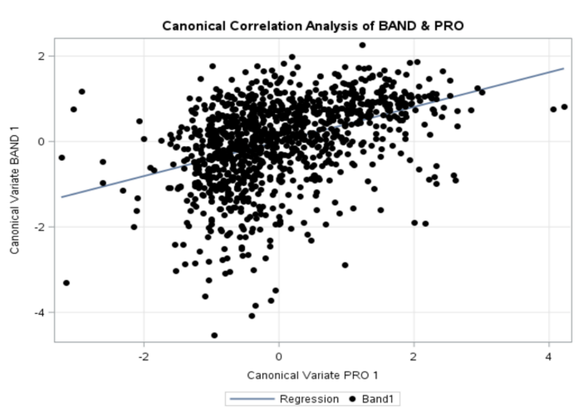
Visual result:
Clusters of active dates,
inactive dates
noisy data



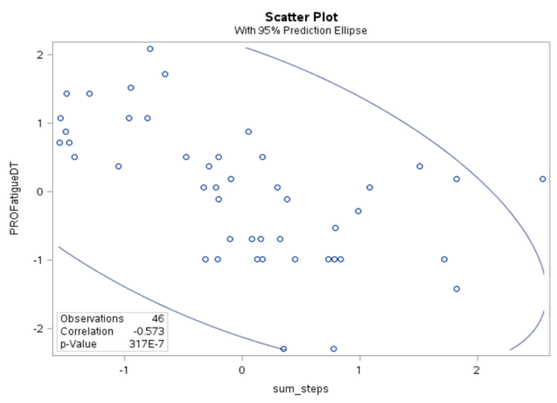
- Correlation



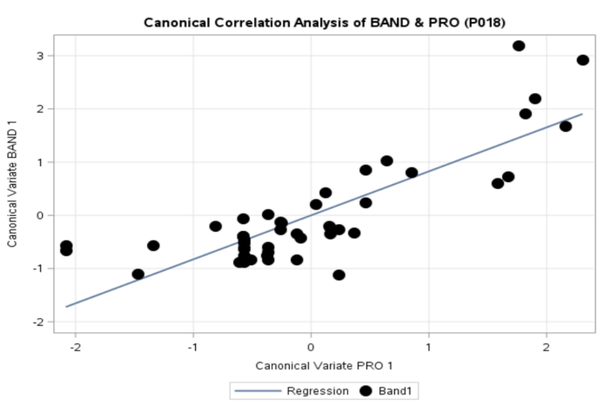
Correlation between the canonical variate pair Kinect 1 & PRO1: **0.983**



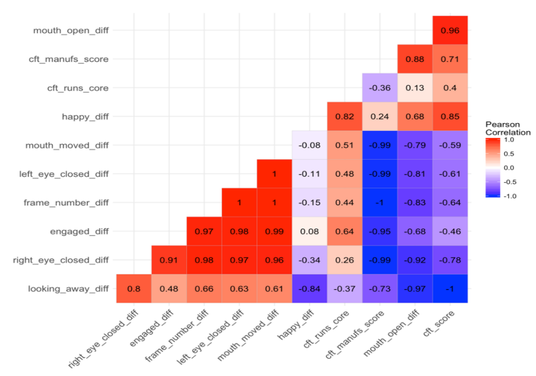
Moderate Correlation between the canonical variate pair Band 1 & PRO1: **0.405**



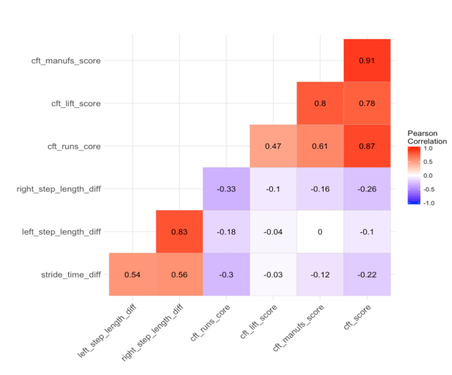
Pearson correlation for Band & Pro (per subject)



Canonical correlation for Band & Pro (per subject)



Pearson correlation between face parameters & cft scores



Pearson correlation between skeleton data & cft scores

Reference

[1] M. M. Oken, et al. "Toxicity and response criteria of the Eastern Cooperative Oncology Group." *American journal of clinical oncology* 5.6 (1982): 649-656.
[2] M. Nguyen, et al. “Activity Recognition Using Wrist-Worn Sensors for Human Performance Evaluation”, IEEE International Conference on Data Mining (ICDMW 2015), Nov.15, 2015.
[3] M. Nguyen , et al. “m-TSNE: A Framework for Visualizing High-Dimensional Multivariate Time Series”, VAHC in conjunction with AMIA 2016, Nov.12, 2016
[4] J. Kao, et al, “Validation of Automated Mobility Assessment using a Single 3D Sensor”, ACVR in conjunction with ECCV2016, Oct. 9, 2016

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ATOM-HP: Quantifying Human Performance P5OC-0081
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