Reconstructing Motion in Parkinson's Disease Using Sparse Wearable Sensors

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INTRODUCTION

Parkinson’s Disease (PD) is a degenerative disorder which severely impacts motor functions, making accurate gait analysis essential for clinical evaluation and treatment optimization. We turn movement data from Parkinson's patients into 3D virtual body models. From these models, we generate virtual sensor readings to precisely analyze their walking.

Why does it matter: This approach enables objective gait analysis, superior to traditional clinical subjective observations.

AIM

Process Parkinson's patient motion capture data into 3D body models. From these, we generate virtual sensor data and analyze gait parameters to objectively assess disease progression and aid treatment

POTENTIAL IMPACT

- Earlier detection of mobility decline.
- Improve tracking of medication effects.
- Enhance personalised care.
- Home-based monitoring of Parkinson’s symptoms .

REFERENCES

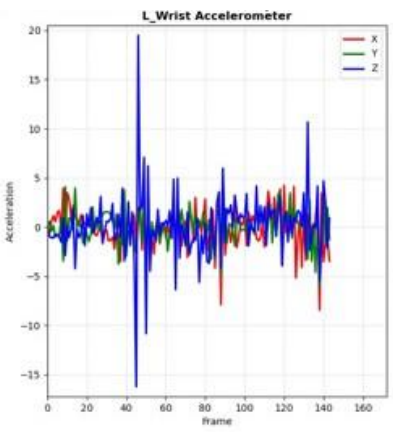
1. Huang Y, Kaufmann M, Aksan E, Black MJ, Hilliges O, Sigal L. Deep inertial poser: Learning to reconstruct human pose from sparse inertial measurements in real time. ACM Trans. Graph. (2018).
2. Malleson C, Doherty A, Clarkson P, Hollands K, Rochester L, Godfrey A. GaitPy: An open-source python package for gait analysis using an accelerometer on the lower back. J. Open Source Software (2020).Loper M, Mahmood N, Romero J, Pons-Moll G, Black MJ. SMPL: A skinned multi-person linear model. ACM Trans. Graph. (2015).

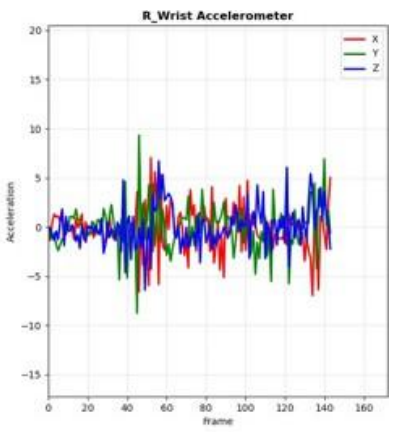
METHODOLOGY

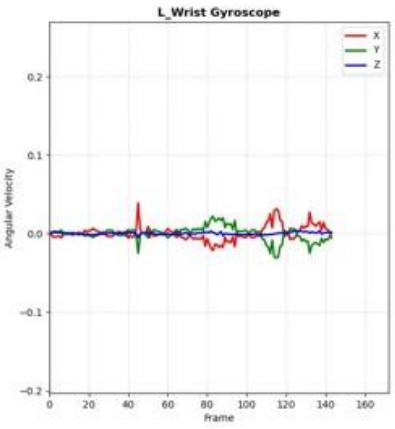
We studied Parkinson’s walking using camera recordings. We used computer programs like SMPL and Moshpp to build 3D virtual body models of the patients. Another program, Deep Inertial Poser (DIP), then created virtual sensor data (like from a smartwatch) from these models. We even used a custom Python script to clean and prepare data, improving on SOMA's smart system. Finally, a tool called GaitPy measured key walking patterns, helping us objectively understand movement.

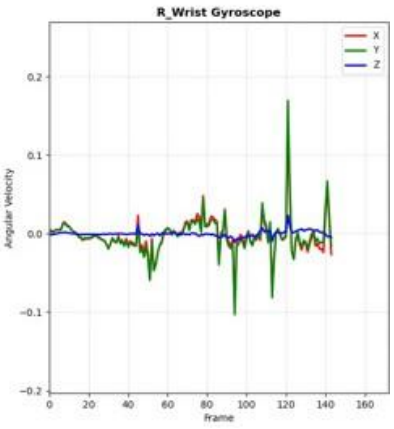
RESULTS

SENSOR DATA

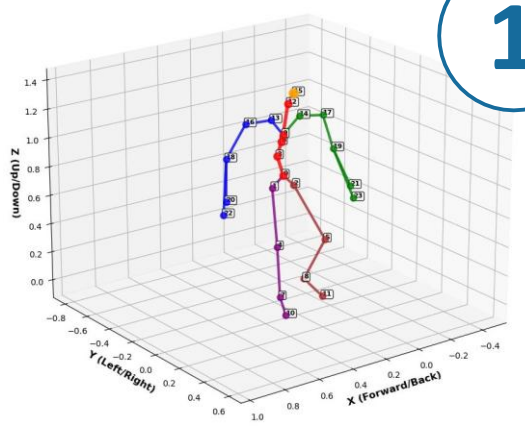


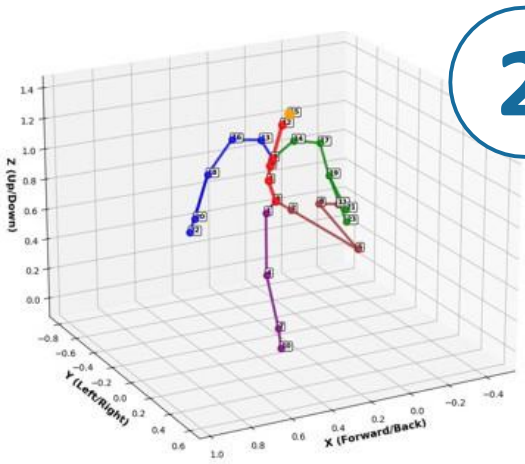


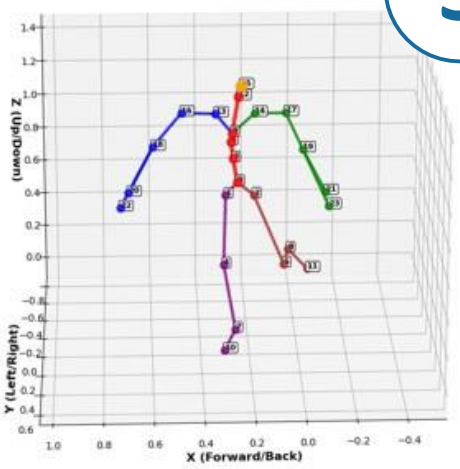




2D SKELETON MODEL*







*This 2D model is a Simple version of the 3D model that is currently in progress.

NEXT STEPS

Future work will refine sensor placement strategies and extend validation to larger, more diverse Parkinson’s populations. Incorporating real-world wearable data, beyond virtual IMUs, will strengthen clinical applicability. Collaborations with healthcare professionals will ensure the pipeline is practical, interpretable, and suitable for routine patient monitoring.

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Watch the full 2D motion reconstruction by scanning the QR code .