

1. Introduction

Scarcity of databases of locomotion with access to raw information.

Winter [1], is the seminal reference of motion capture data.

Ambulation modes: ascending and descending stairs and ramps [5], [6].

Other sources provide insight about the power and torque contribution to locomotion at the joint level [2], [3], [4].

Hu et al. (2019) [7]: first benchmark database of simultaneous kinematic and EMG from healthy subjects. Limited to single staircase and ramp.

Our dataset extends the report of kinematics results by including the **kinematics, kinetics and joint power data** in conjunction with the data from multiple sources of **wearable sensors, including EMG, goniometer, accelerometer and gyroscope signals.**

This dataset will aid the development of better locomotion assistance techniques and can be used in applications of machine learning to human locomotion.

2. Methods

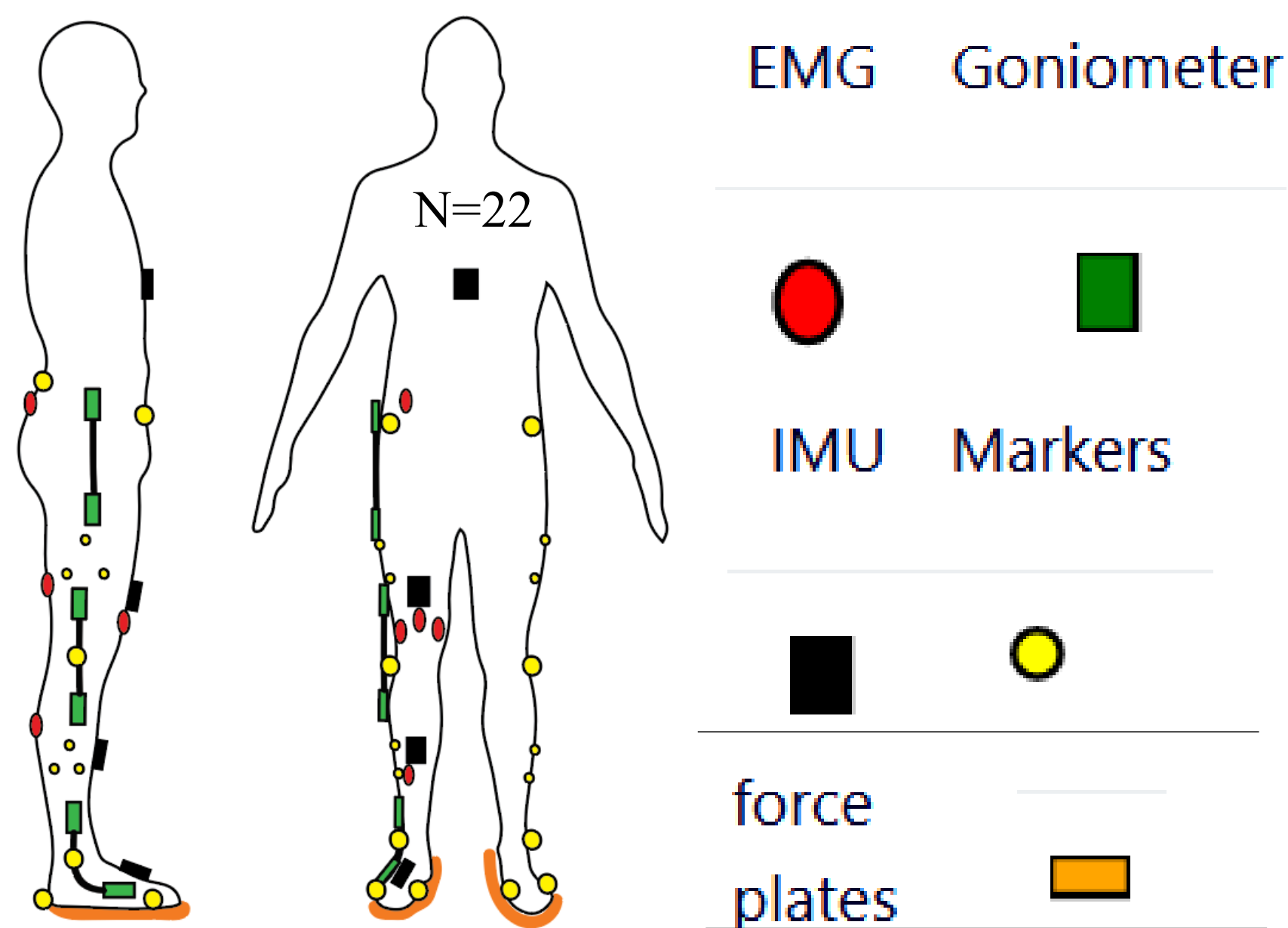
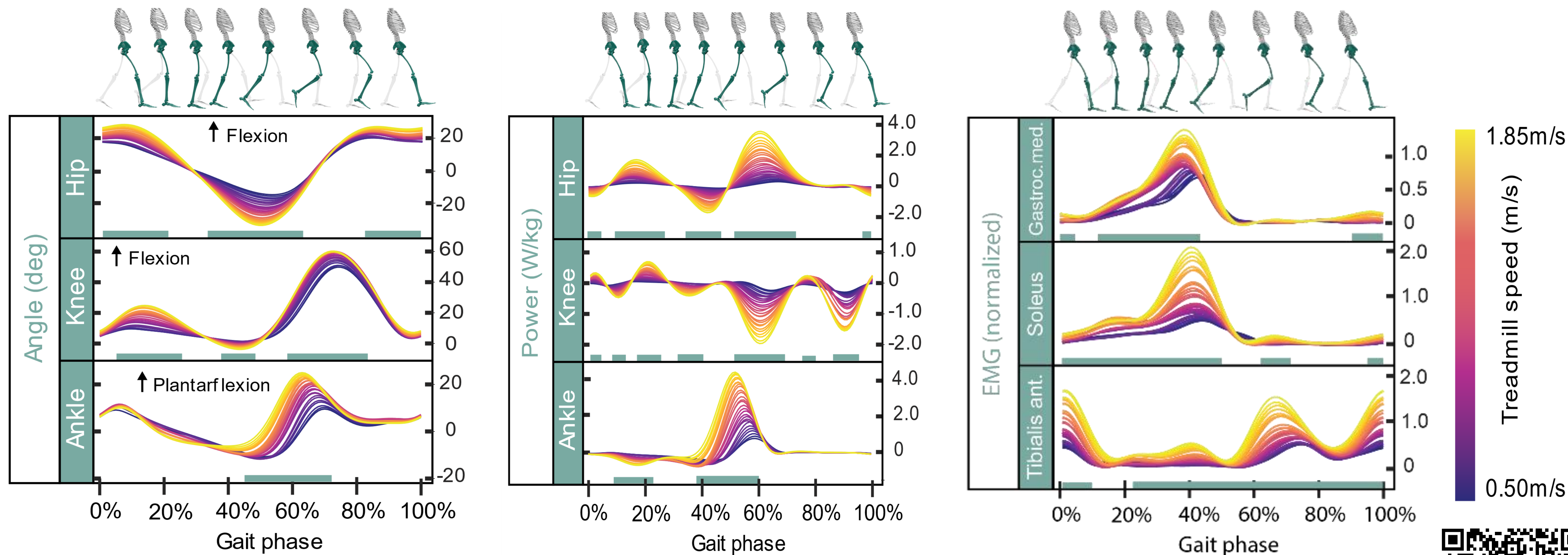


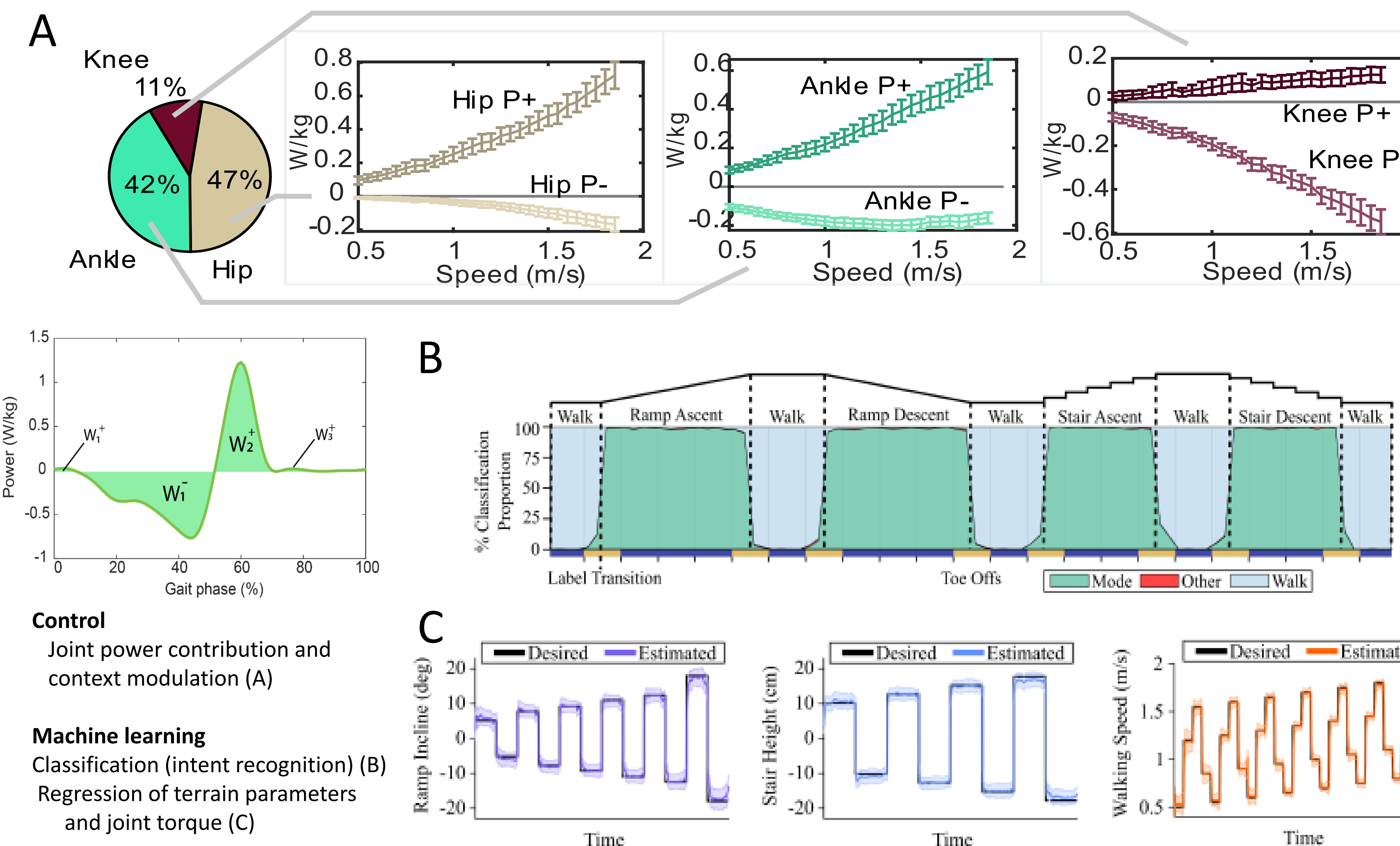
Figure 1. Instrumentation

	Mode	Conditions
	Treadmill	0.5 to 1.85m/s (28 different speeds)
	Levelground	Self selected: slow, normal and fast.
	Ramp ascent and descent	5.2°, 7.8°, 9.2°, 11°, 12.4° and 18°
	Stair ascent and descent	10.2cm (4in), 12.7cm (5in), 15.2cm (6in), 17.8cm (7in).

3. Results



4. Applications



Data access

<http://www.epic.gatech.edu/biomechanics-dataset-camargo-et-al/>



Acknowledgements

Thank you to:
Sensor fusion team at the Exoskeleton and Prosthetic Intelligent Control Lab (EPIC) at GeorgiaTech.
Funding: Fulbright Fellowship

References

- [1] D. A. Winter, "Biomechanical motor patterns in normal walking." *J. Mot. Behav.*, vol. 15, no. 4, pp. 302-330, 1983, doi: 10.1080/00222895.1983.10735302.
- [2] G. W. Lange, et al., "Electromyographic and kinematic analysis of graded treadmill walking and the implications for knee rehabilitation." *J. Orthop. Sports Phys. Ther.*, vol. 23, no. 5, pp. 294-301, 1996.
- [3] M. M. Ankarali, et al., "Walking dynamics are symmetric (enough)." *J. R. Soc. Interface*, vol. 12, no. 108, 2015, doi: 10.1098/rsif.2015.0209.
- [4] D. J. Farris and G. S. Sawicki, "The mechanics and energetics of human walking and running: a joint level perspective" no. May 2011, pp. 110-118, 2012, doi: 10.1098/rsif.2011.0182.
- [5] M. S. Redfern and J. DiPasquale, "Biomechanics of descending ramps." *Gait Posture*, vol. 6, no. 2, pp. 119-125, 1997.
- [6] R. Rienecker et al., "Stair Ascent and Descent at Different Inclinations", *Gait Posture* vol. 15, pp. 32-44, 2002.
- [7] B. Hu, et al., "Benchmark datasets for Bilateral Lower-limb neuromechanical signals from wearable sensors during unassisted locomotion in able-bodied individuals," *Front. Robot. AI*, vol. 5, no. FEB, pp. 1-5, 2018.