STRIDE

Structuring Gait Asymmetry Using Unsupervised Learning

Toward Rehabilitation Monitoring and Recovery using the Re-Kinesis Platform

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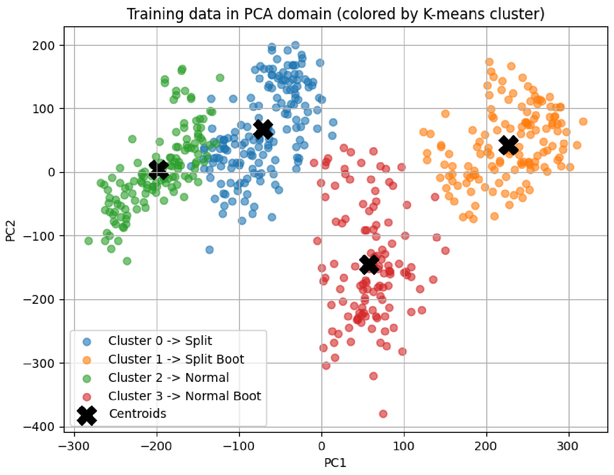
Gait Patterns Separate Naturally....Without Labels!



Introduction

Gait abnormalities are key indicators of neurological injury and recovery, particularly after stroke. Yet current assessment methods rely on simplified metrics and brief clinical observation.

These approaches reduce complex movement into a few predefined measures and often miss subtle changes in gait. As a result, clinicians lack continuous, objective insight into how patients move in real-world settings.

At the same time, modern plantar pressure insoles capture rich, high-resolution data from every step, most of which remains unused.

This raises a critical question:

Can we move beyond predefined metrics and instead discover meaningful gait patterns directly from the data itself?

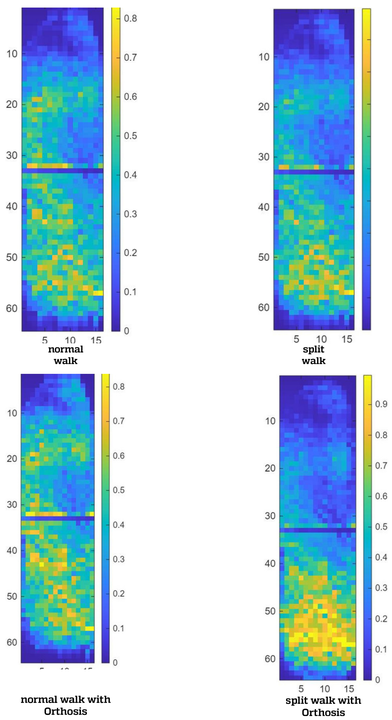
Our Goal

Develop a data-driven framework for detecting pathological gait patterns without relying on predefined clinical metrics, by enabling the model to learn latent representations directly from raw gait signals. This approach aims to reduce bias introduced by handcrafted features and enhance the model's ability to generalize across varying gait abnormalities and subject-specific variations.

What We Found

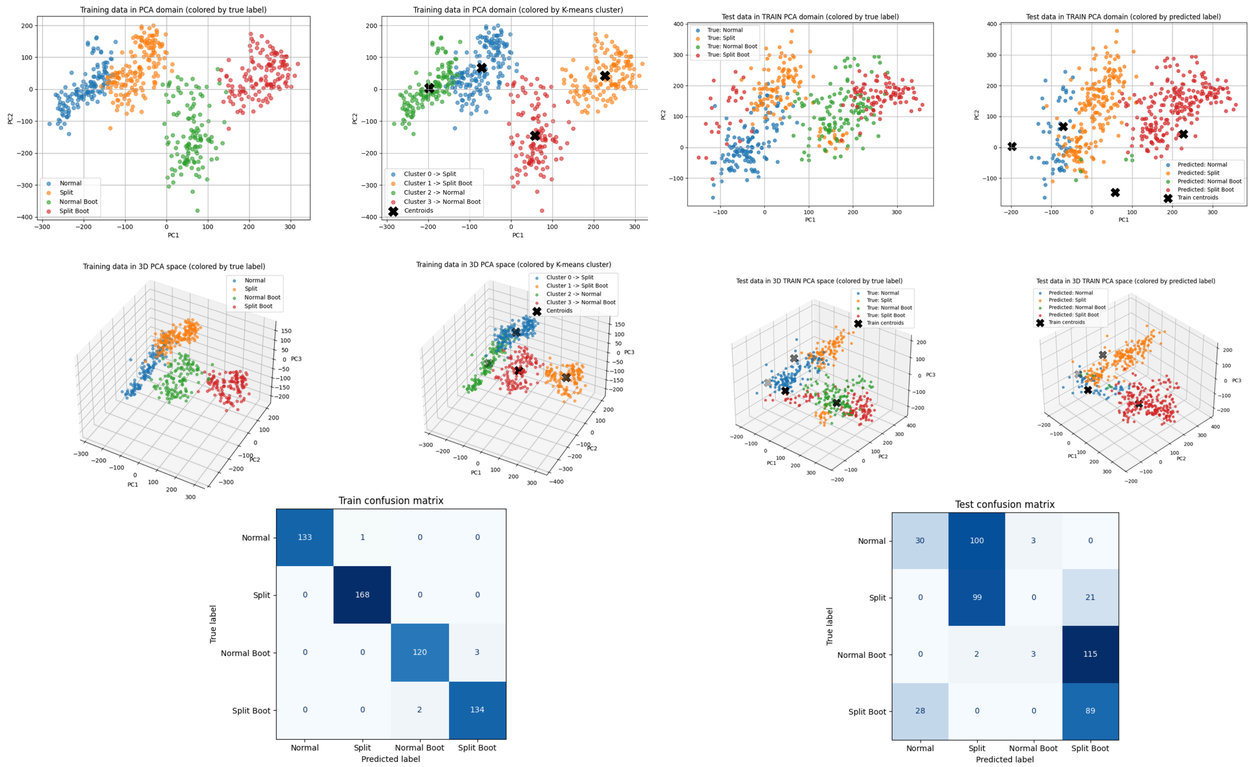
1 **Distinct Gait Patterns Emerge**

- **Clear differences appear between gait with difference features**
- **Pressure distributions shift as asymmetry increases**



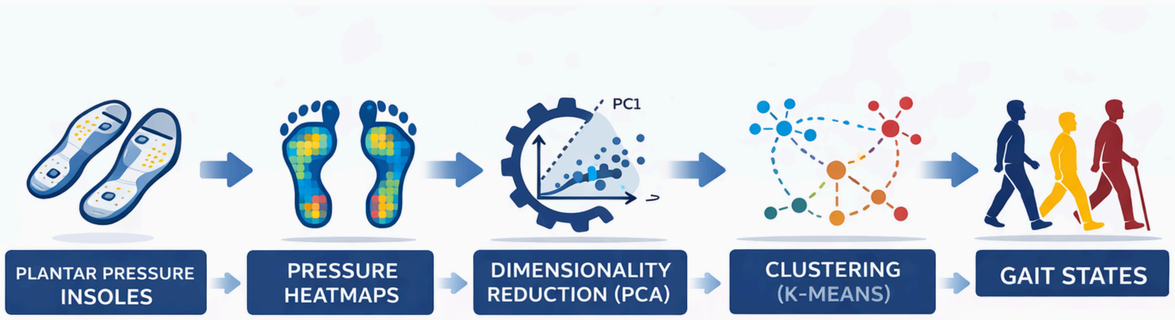
2 **Patterns Form Without Labels**

- **The model groups walking patterns automatically**
- **No predefined metrics or labels were used**



3 **New Samples Are Mapped to Learned Clusters**

How It Works



Why This Matters

High-resolution plantar pressure data contains meaningful structure that can be uncovered without predefined biomechanical metrics.

- Gait patterns emerge directly from raw data, rather than being manually defined
- Differences between normal and asymmetric gait are captured clearly and consistently
- Subtle changes in gait can be detected without relying on simplified summary measures

This approach enables objective, data-driven gait assessment that can extend beyond the clinic into real-world monitoring.

Conclusion + Future Work

Unsupervised learning applied to high-resolution plantar pressure data can reveal meaningful gait patterns without predefined biomechanical metrics.

What This Enables

- Objective detection of gait abnormalities
- Continuous monitoring of gait over time
- A data-driven foundation for rehabilitation tracking

Future Direction

- Validate on clinical populations (e.g., stroke patients)
- Expand dataset and improve model robustness

Toward scalable, real-world gait intelligence for clinical decision-making and recovery monitoring.