

# Nymeria-Gait: A Benchmark for Observer-Egocentric Real-World Gait Analysis

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## Introduction

**Goal:** Enable quantitative gait analysis during routine real-world observation.

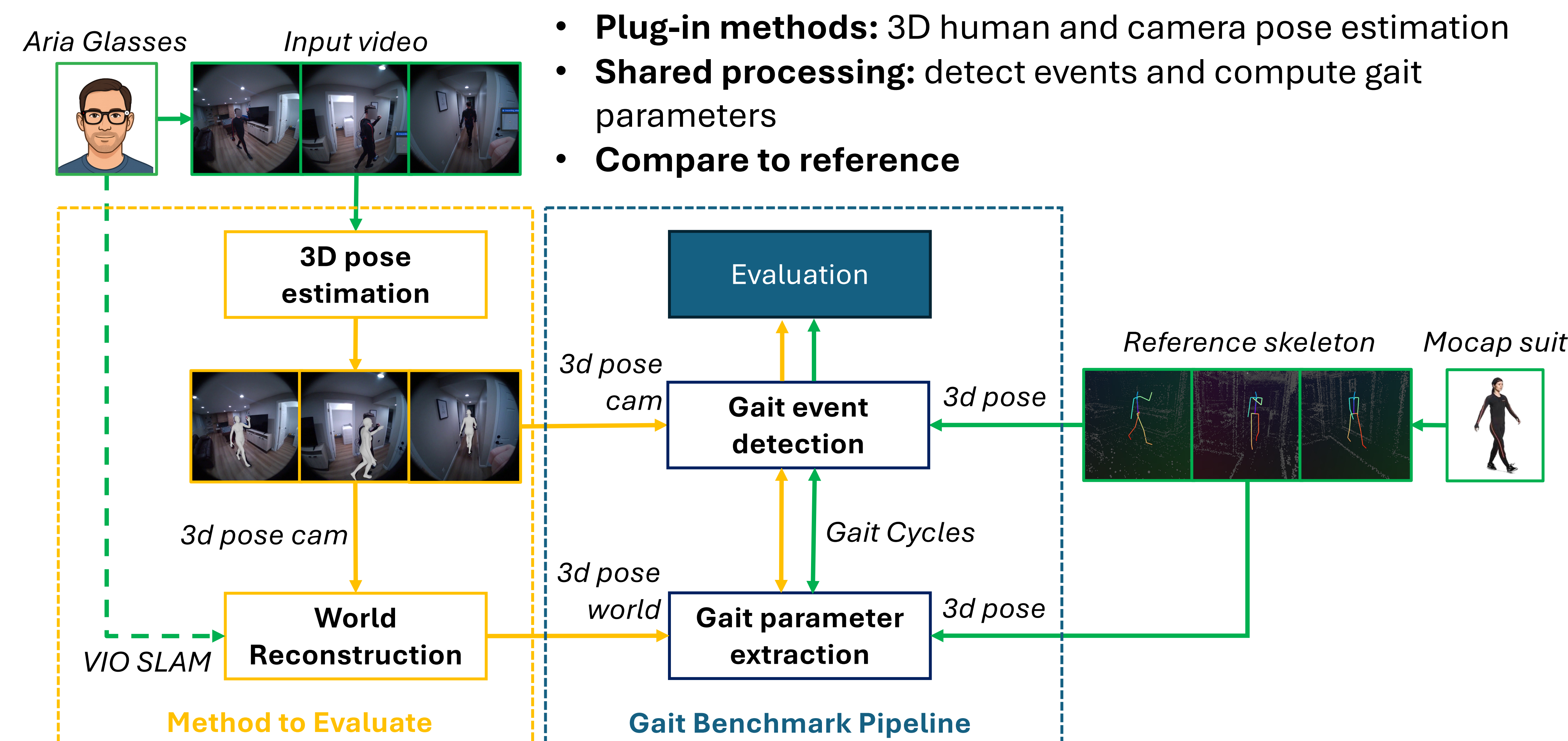
### Challenges:

- Existing gait datasets are mostly controlled environment, static-camera, or lack biomechanical reference
- Standard 3D pose evaluation metrics such as MPJPE may not reflect application-specific performance.

## Contributions

- Nymeria-Gait:** Real-world observer-egocentric gait dataset with biomechanical reference subset of Nymeria<sup>[1]</sup>
- Modular Benchmark pipeline:** Egocentric video → 3D motion → Gait parameters → Comparison to reference
- Evaluation of current methods**

## Modular Benchmark Pipeline

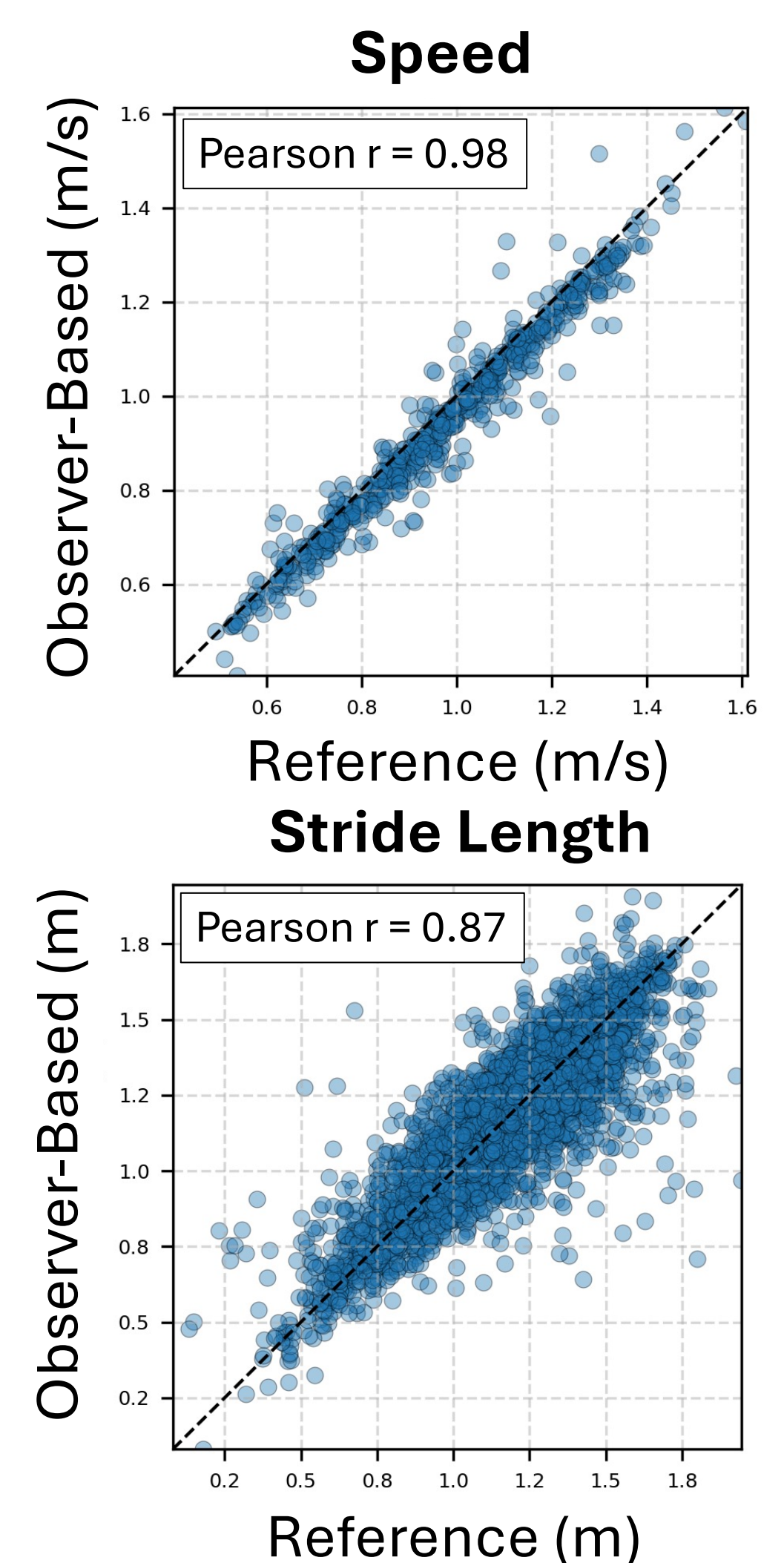


## Evaluation

**Best performing evaluated configuration:** WHAM<sup>[2]</sup> + Aria glasses VIO SLAM

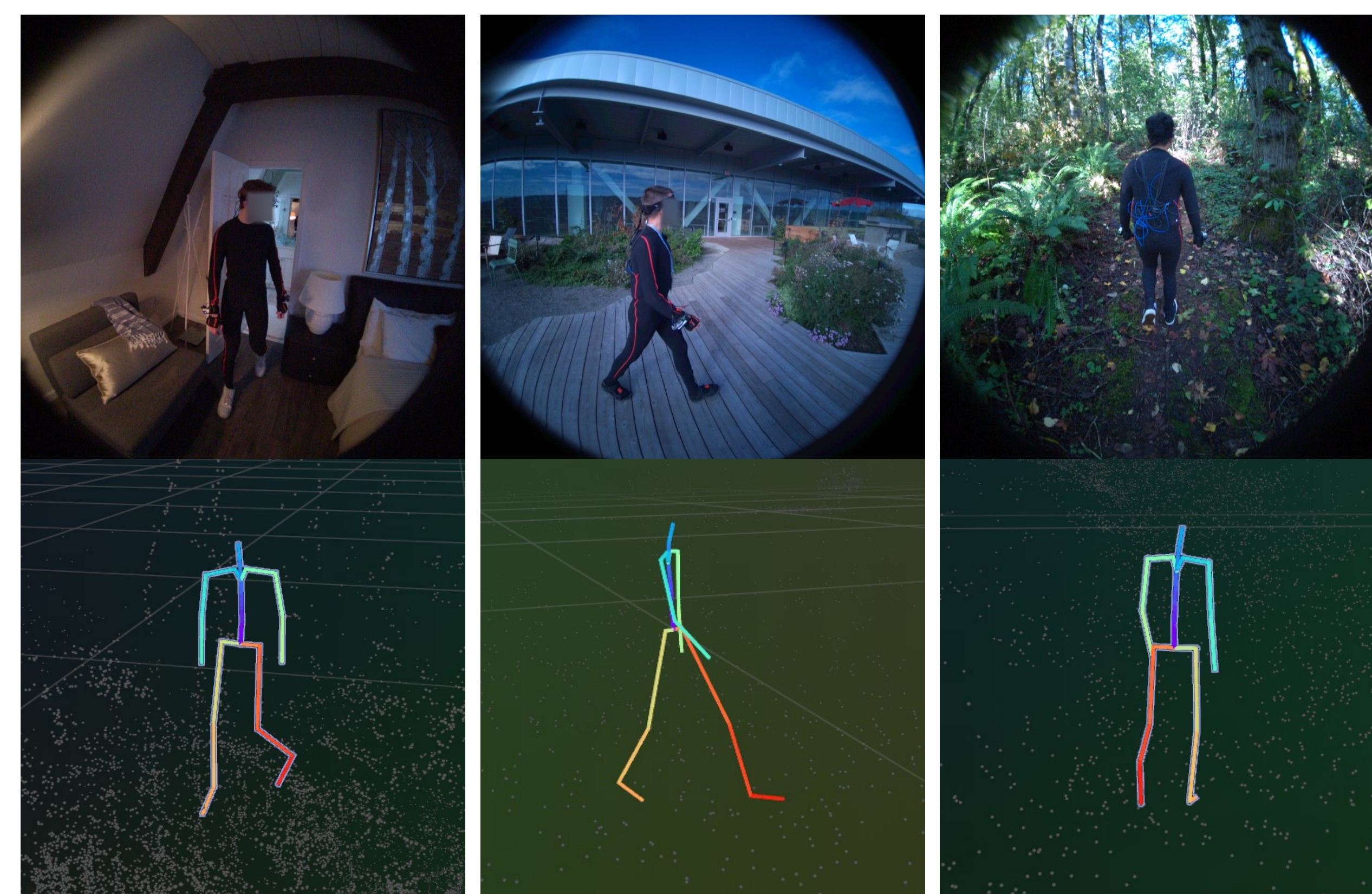
**Results:** 96.6% gait-event detection

| Parameter         | mean ± SD      |
|-------------------|----------------|
| Cycle time (ms)   | 0.2 ± 39.8     |
| Stance time (ms)  | -5.3 ± 45.1    |
| Swing time (ms)   | 5.5 ± 43.5     |
| Speed (m/s)       | -0.03 ± 0.04   |
| Distance (m)      | -0.18 ± 0.34   |
| Stride length (m) | -0.004 ± 0.116 |



- Strong temporal performance:** gait timing errors ≤ 5.7 ms, with precision ≤ 45.1 ms
- Open Challenge:** Stride length precision remains insufficient for clinical use

## Nymeria-Gait Dataset



|                           |                         |                                         |                                  |
|---------------------------|-------------------------|-----------------------------------------|----------------------------------|
| <b>54</b><br>participants | <b>908</b><br>sequences | <b>7.9 km</b><br>distance               | <b>142 min</b><br>recording      |
| <b>26,685</b><br>events   | <b>11,437</b><br>cycles | <b>2.4 / 5.5 km</b><br>indoor / outdoor | <b>Flat / Up / Down</b><br>slope |

| Dataset                               | Camera setting    | Gait-specific | Biomechanical reference | Indoor + outdoor | Gait pipeline |
|---------------------------------------|-------------------|---------------|-------------------------|------------------|---------------|
| TUM-GAID / CASIA / GAVD / PKU-HumanID | Static-cameras    | ✓             |                         | partial          |               |
| Human3.6M / MoVi / GPJATK             | Static-cameras    | partial       | ✓                       |                  |               |
| 3DPW / EMDB                           | Mobile monocular  |               | ✓                       | ✓                |               |
| EgoBody                               | Egocentric        |               | ✓                       | indoor           |               |
| <b>Nymeria-Gait</b>                   | <b>Egocentric</b> | <b>✓</b>      | <b>✓</b>                | <b>✓</b>         | <b>✓</b>      |

## Conclusion

- Encouraging results for real-world observer-egocentric gait analysis
- Nymeria-Gait exposes strengths and weaknesses of 3D pose methods through application-specific benchmarking



Dataset



Project

### Reference:

- [1] L. Ma et al., Nymeria: A Massive Collection of Multimodal Egocentric Daily Motion in the Wild, ECCV, 2024.  
 [2] S. Shin et al., WHAM: Reconstructing World-Grounded Humans with Accurate 3D Motion, CVPR, 2024.