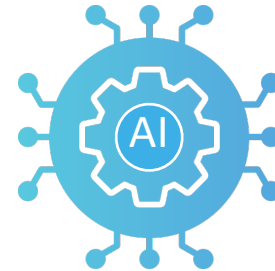# NUSHU

Creating the New Standard in Gait Analysis

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What are *NUSHU* smart shoes?

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The NUSHU smart shoes are a new neurological assessment standard to analyze gait. Using state-of-the-art technology and algorithms, the shoes are providing the most accurate gait parameters. ***NUSHU*** is being used by leading Swiss clinics on a daily basis.

No installation is needed to use ***NUSHU*** and it can be operated by any healthcare provider. The measurements and analysis require minimum time and effort. The calculated parameters are highlighted with specific range indications assisting the healthcare professionals. Automatic reports can be generated and exported to other health record platforms.
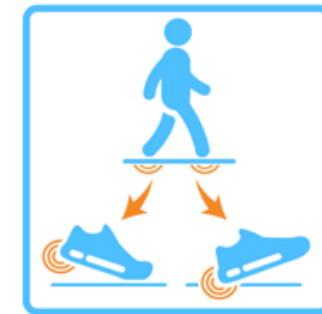
Our Solution: *NUSHU* – AI Powered Shoe

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NUSHU + Dashboard

- Standard gait tests

- To support decision making

- Real-world data collection outside the clinic

NUSHU + Biofeedback

- Real-time biofeedback by vibrations

- To improve gait and avoid freezing / falls

Product Offerings

✔ Quantitative assessment of multiple gait parameters

✔ Time and cost savings through objective assessments and immediate results

✔ Disease-specific and age-specific range indication of important parameters

✔ No installation or special room required

✔ Therapy monitoring, before/after comparison, assessment of **fatigue** and **fatigability**

✔ Assessment of therapy response (medication, physiotherapy, fitness)

✔ Precise assessment of normal pressure hydrocephalus (measurements before and after lumbar puncture)

✔ Assessment of cognitive reserve - **dual task tests**

✔ Posturography test

Use-cases

Inpatient Assessments	Monitoring @ Home
Outpatient Assessments	Research & Clinical Studies

Pipeline

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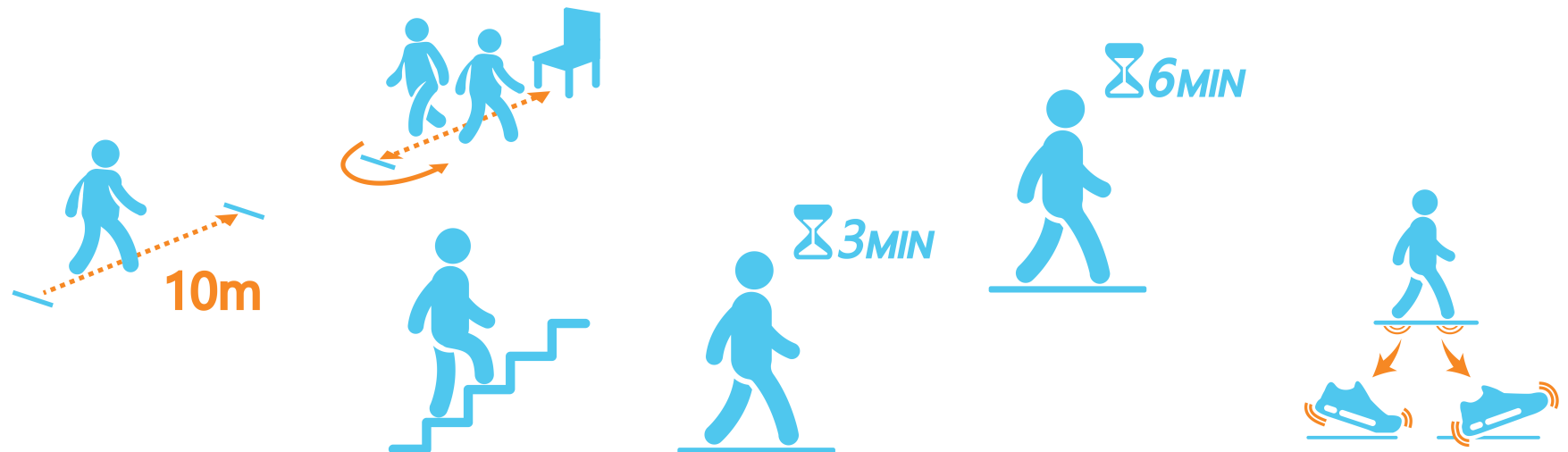| Assess neurological conditions	Measure risk of falling	Assess movement disorders in children	Diabetes	Pharma
• Parkinson's • Alzheimer's • Multiple Sclerosis • Mild cognitive decline • Neuropathy • Other	• Patients / Elderly • Measure risk of falling and warn the user via bio-feedback • Fall prevention	• Cerebral palsy • Spina bifida • Muscular dystrophy • Developmental dysplasia of the hip	• Diabetic neuropathy • Biofeedback while walking • Reduce risk of ulcers	• Use NUSHU in clinical trials • Roche, Novartis, Pfizer, Biogen, other

Measurement Types

Assessments

✔ Static 4m Test

✔ Dynamic 4m Test

✔ Dual Task 4m Test

✔ Static 10m Test

✔ Dynamic 10m Test

✔ Dual Task 10m Test

✔ TUG Test

✔ iTUG Test

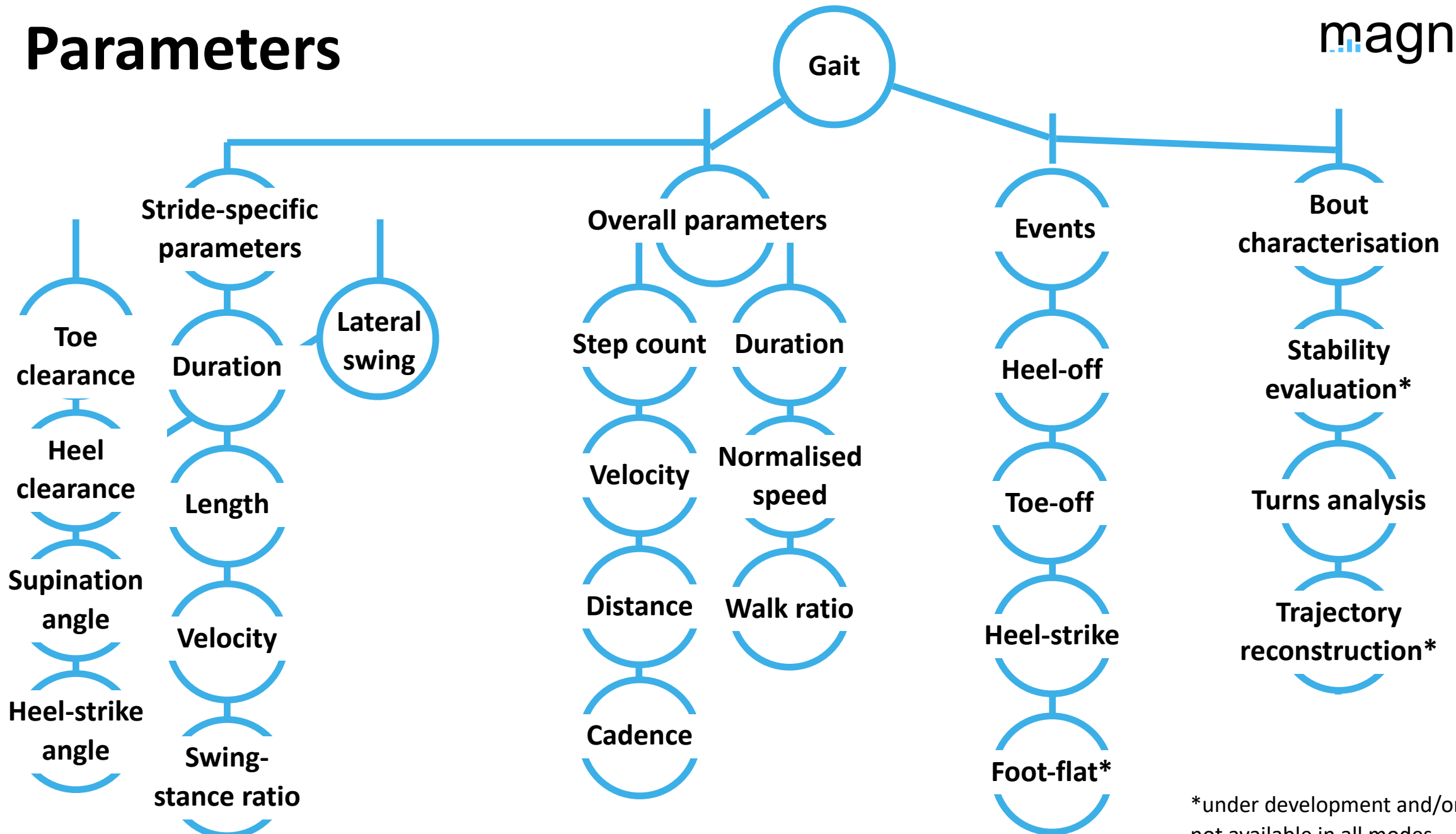✔ 3min

✔ 6min

✔ Stairs

✔ Timed 25 foot walk

Monitoring

✔ Generic outdoor

✔ Generic Indoor

Feedback Modes

✔ Metronome

✔ HS-HO Feedback

✔ Ground Feedback

✔ Swing Feedback

10m

6MIN

3MIN

Parameters

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Gait

Stride-specific parameters
- Toe clearance
- Heel clearance
- Supination angle
- Heel-strike angle

Duration
- Length
- Velocity
- Swing-stance ratio

Lateral swing

Overall parameters

Step count
- Velocity
- Distance
- Cadence

Duration
- Normalised speed
- Walk ratio

Events
- Heel-off
- Toe-off
- Heel-strike
- Foot-flat*

Bout characterisation
- Stability evaluation*
- Turns analysis
- Trajectory reconstruction*

*under development and/or not available in all modes

Additional Feature:
Interact with Patients via Vibrotactile Feedback

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The shoes can provide real-time vibrotactile stimulation.

✔ Immediate biofeedback

✔ Risk of fall warning

✔ High fatigue warning

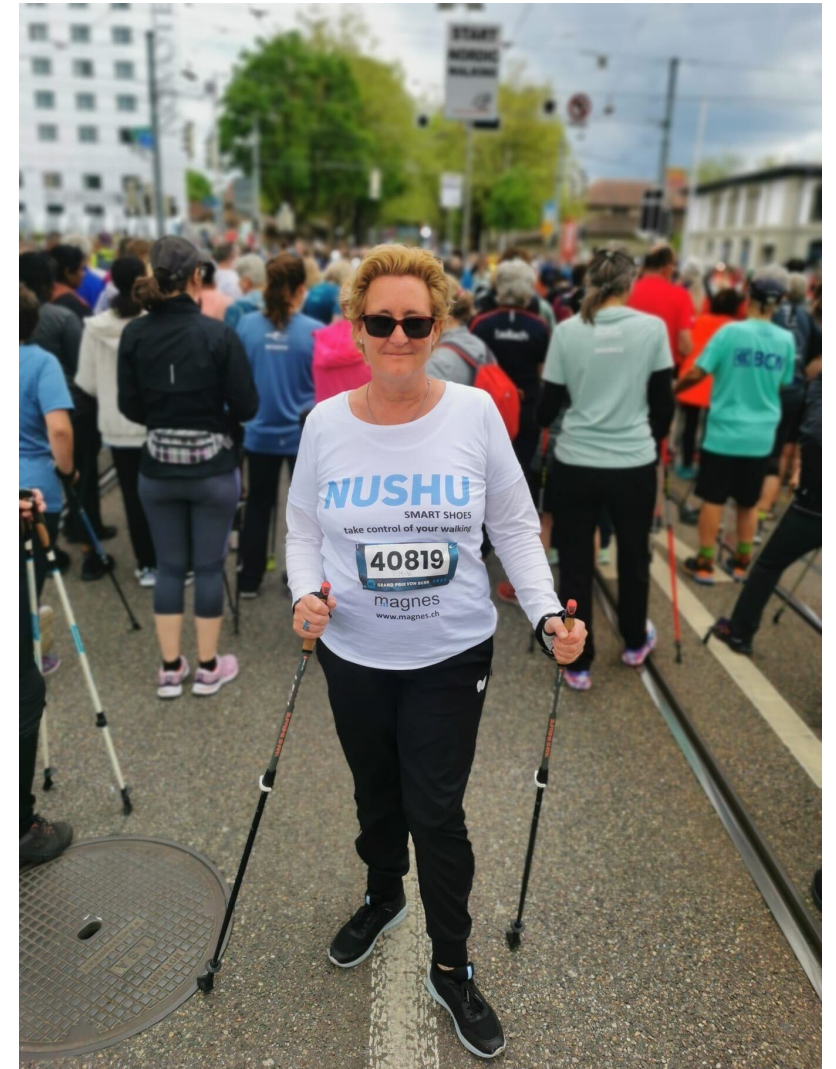✔ Overcoming Freezing of Gait

✔ Weight bearing feedback

Vibrotactile Feedback

Emma, 48 years old, Parkinson's patient

- Diagnosed at age 43

- Had Deep Brain Stimulation

- Difficulties in walking

- Nushu made a strong impact on her gait

- Uses the **vibrotactile feedback** while walking

- Finished Bern Grand Prix 4.7km Nordic Walking in May 2023

" *Walking is one of the most important things in life. Especially for me. I've got new shoes and a new life!* "
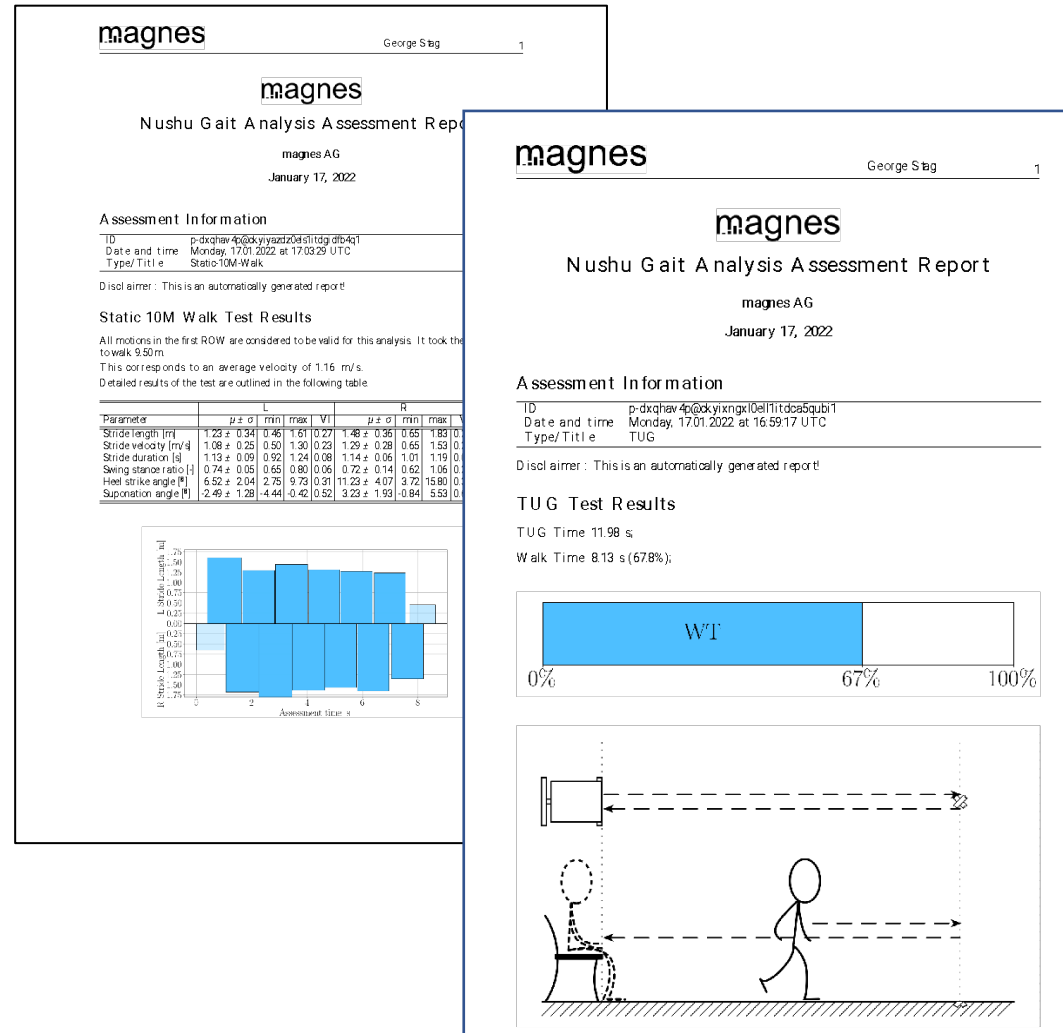
Analytics Platform

✔ Simple overview

✔ Detailed trend summary

✔ Green-Grey-Red color indication for patient parameters

✔ 35+ Gait parameters including variability, symmetry and range indication

Analytics Platform

✔ Comparison before and after a treatment

✔ Automated report generation

Traction

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Certifications

- ✔ CE Mark
- ✔ Reimbursed in Switzerland
- ✔ Recurring revenue
- ✔ **FDA**

Customers - Clinics

USZ Universitäts Spital Zürich

INSELSPITAL
UNIVERSITÄTSSPITAL BERN
HÔPITAL UNIVERSITAIRE DE BERNE

HIRSLANDEN

schulthess klinik

neurobaden
Praxis für Neurologie

NeuroRestore

cereneo
CENTER FOR NEUROLOGY & REHABILITATION

CHUV Centre hospitalier universitaire vaudois

Queensland Government

Achievements

Innosuisse

DAYONE

eurostars™

EUREKA
innovation across borders

ATTRACT

CERN

VENTURE KICK

Roche

SWISS Ai AWARD
2nd place 22

Spinoff ETHzürich

MSRL

Customers – Patients

- ✔ Happy patients
- ✔ Enabled patients to walk and be more independent

Use Cases

Neurological Assessments (out-patients)

- Standard tests

- Comparison before/after, monitor progression/therapy

Rehabilitation (in-patients)

- Exercise with vibrotactile feedback

- Data collection during rehabilitation

Remote Monitoring

- Perform assessments / exercise at home or outside

- Share the data with HCP

- Monitor your patients remotely and arrange visits if necessary

How accurate is *NUSHU* ?

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- ✔ Validation studies performed with gold standard gait analysis systems:

    - Camera based: Qualysis, Vicon

    - Pressure sensitive walkway: GaitRite

- ✔ Comparison of manual labeling of walking data from motion capture systems

- ✔ Accuracy obtained exceeds human labeling capabilities:

    📬 Average length error of 6mm

    📬 Average stride duration error of 1ms

Gait event results: Grey - Human precision, Blue - *Nushu* results
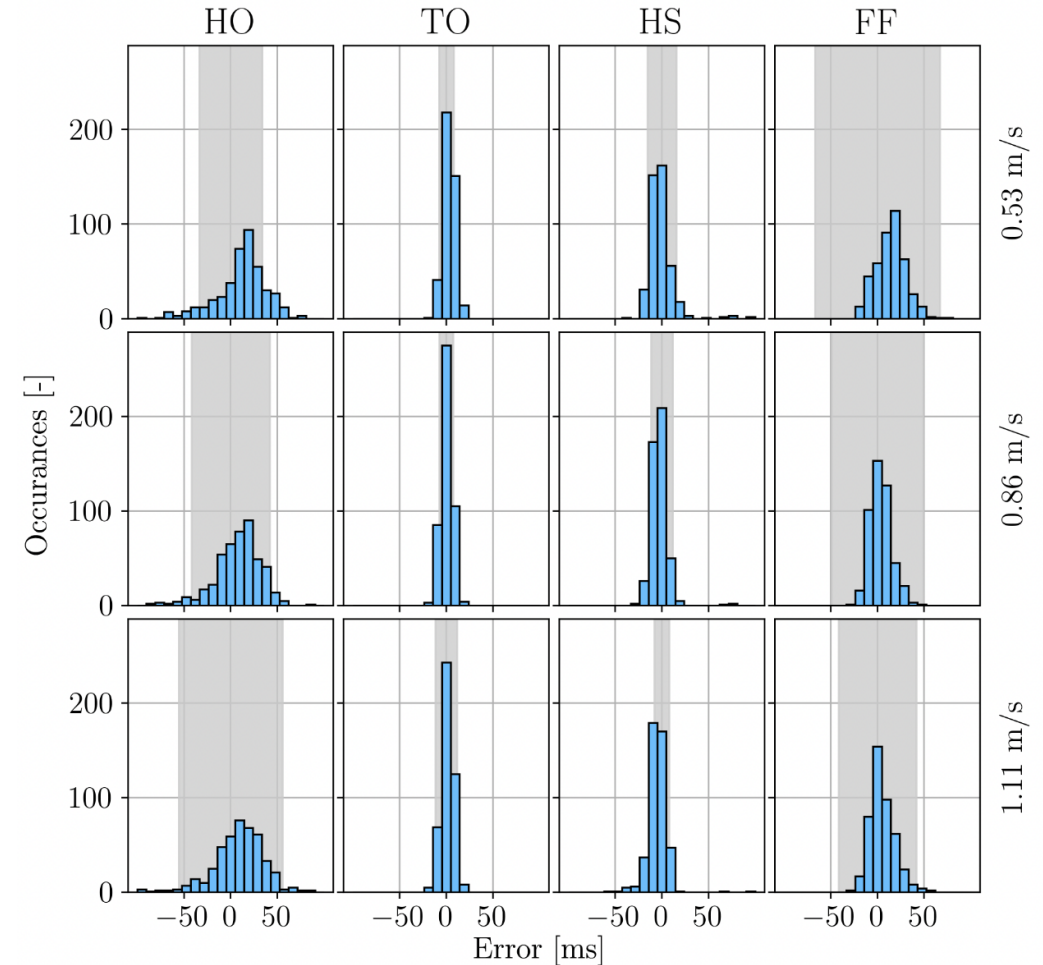
[1] Wu, Jiaen, et al. "Human Gait-labeling Uncertainty and a Hybrid Model for Gait Segmentation." Front. Neurosci., 2022.

[2] Wu, Jiaen, et al. "An intelligent in-shoe system for gait monitoring and analysis with optimized sampling and real-time visualization capabilities." *Sensors* 21.8 (2021): 2869.

[3] Wu, Jiaen, et al. "Real-Time Gait Phase Detection on Wearable Devices for Unsupervised Gait." IEEE Journal of Biomedical and Health Informatics, 2022.

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Thank you

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