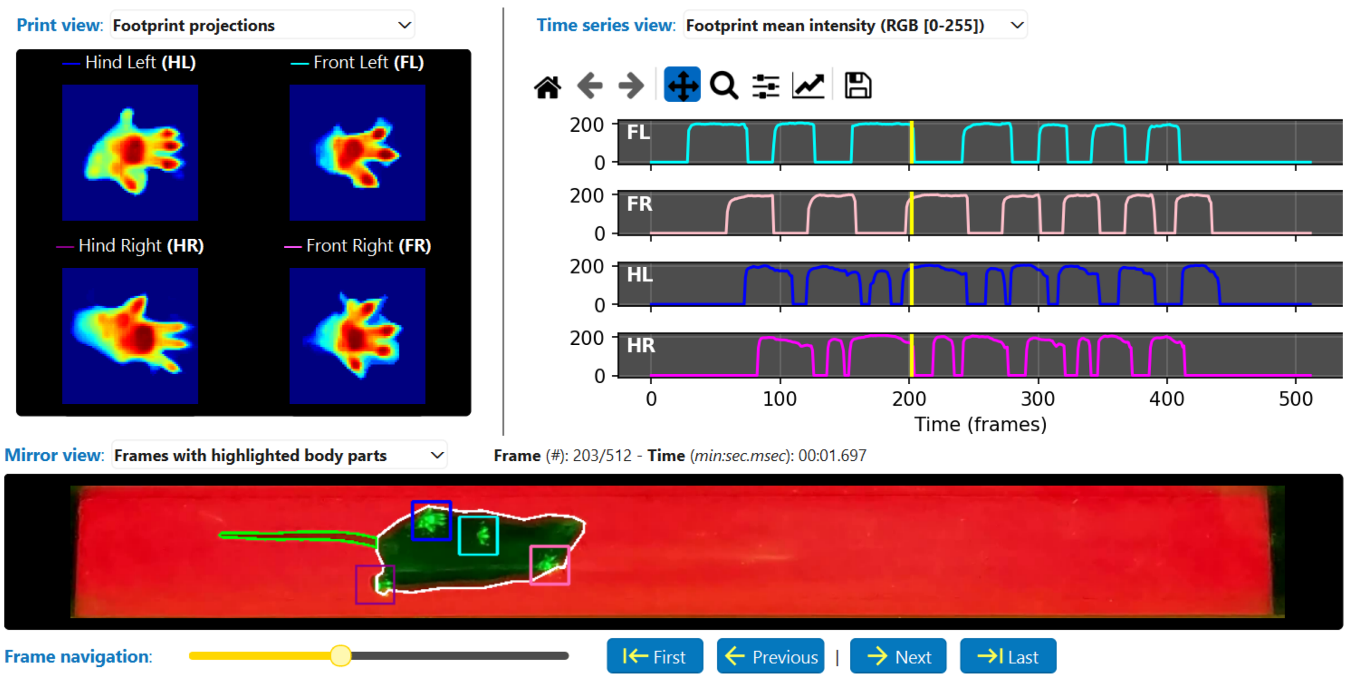
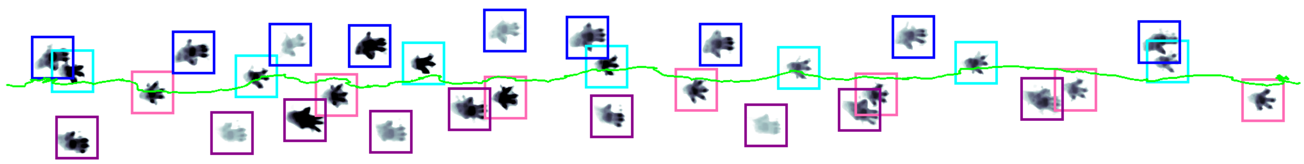
A.I. powered GA.I.T Analysis for mice

Paw identification accuracy



Fully automated gait parameters



Digital Ink for immediate gait visualization

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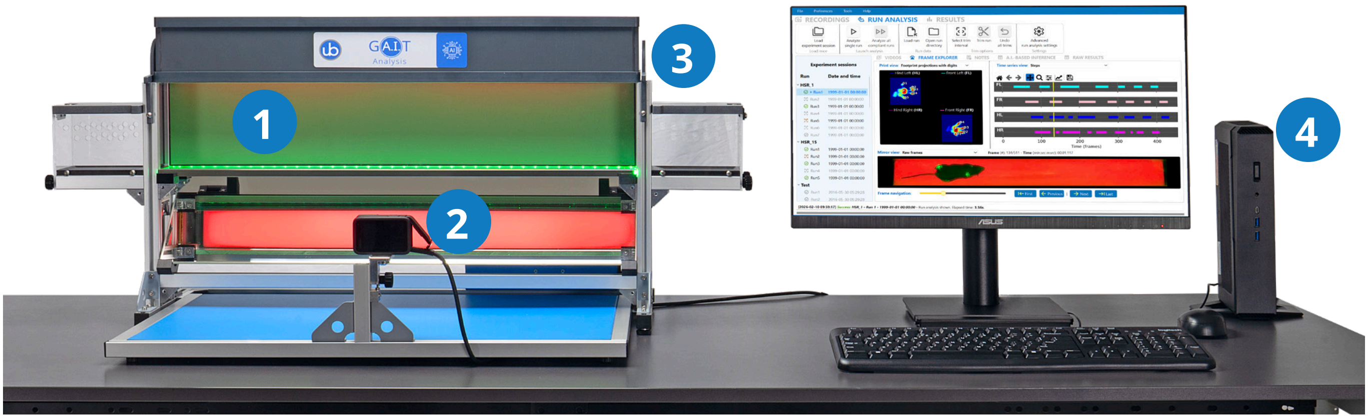
Gait analysis for mice made simple

A next-gen, table-top system combining A.I. precision and plug & play simplicity: ready to run, right out of the box.

The biggest challenge today in automated gait analysis is the correct identification of each paw in order to calculate all parameters automatically without the need for the scientist to manually check if the software has correctly identified each paw.

Since the Ugo Basile method is not based on classic video-tracking contrast, but on supervised A.I., paw identification is virtually mistake-free.



1. **Internal Reflection Illumination is coupled to 45° mirror and a frontal high-speed camera**
   Accurate identification of paws in ventral view (2) and simultaneous lateral view (1)

2. **Dedicated camera**
   Pre-calibrated camera ensures high-speed 4K recordings at 119 fps, with no setup required and automatic linear-view correction.

3. **Cages with individual sliding doors**
   Easily removable cages to enable smooth and stress-free animal handling. Moreover, the placement of these two cages changes the way the test is conducted compared to other systems. Valid runs are automatically detected without requiring intervention from the researcher.

4. **A.I. detection and analysis software**
   Image aquistion, comparable run selection and analysis of dozens of gait parameters are all accesible from an intuitive and largely preconigured user interface for the fastest learning curve and reliable result generation. Experiment recording fully automated. Post hoc analysis fast and intuitive, completed in just a few clicks within minutes.

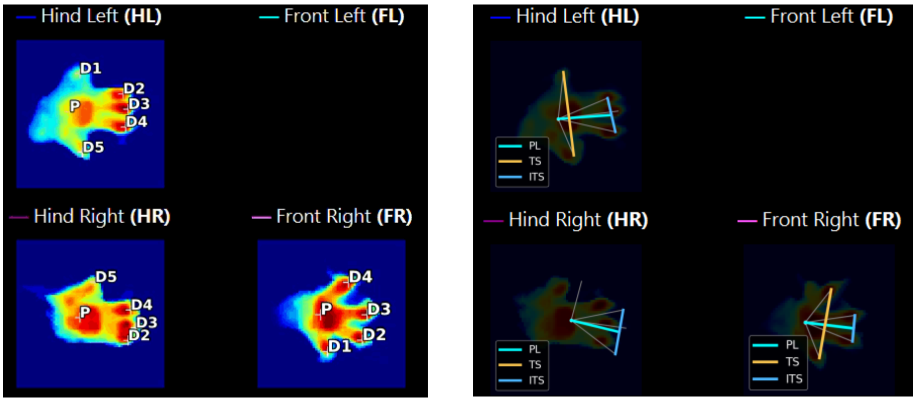
Gait Analysis Background

Locomotion is a complex behavior involving the integration of musculoskeletal, neurological and sensory systems to produce coordinated movement. Because of this, **gait is a sensitive marker of pain and motor dysfunction**, widely used in models of neurodegeneration, injury, arthritis and chronic pain (Clark et al., 2019; Sayed-Zahid et al., 2019).

Early approaches to rodent gait analysis, such as inked footprints on paper, provide only coarse information on stride length and paw placement. While still used for basic screening, these methods lack the resolution and objectivity required to detect subtle or early motor deficits. Rodents, as quadrupeds and prey animals, often mask signs of pain or impairment (Mogil, 2015). Their ability to shift weight between limbs (e.g., compensating for hindlimb injury by loading the forelimbs) can further obscure deficits detectable in bipedal species (Saunders et al., 2017).

To overcome these challenges, **automated gait analysis systems have become essential in neuroscience, pharmacology and toxicology**. These tools offer high-resolution, multi-parameter assessments, such as stance duration, stride variability, and interlimb coordination, captured in a naturalistic, unforced walking environment.

Single Digit Detection



Ugo Basile GA.I.T Analysis System **is unique as it simoltaneously images ventral and lateral views,** detecting not only paws but even **single digits** for **automated and reliable paw angle**, **paw spread** and **distances** from the palm and among the digits.

A range of parameters which most gait systems derive or calculate, are instead directly measured from the ventral images.

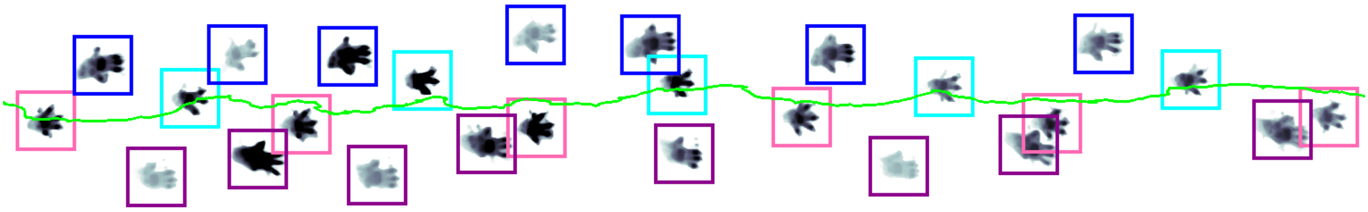
Pictures showing digit recognition and toe spreading analysis. Thanks to a tailored A.I. model for mouse footprints, GA.I.T automatically detects digit positions for each step. This allows the estimation of parameters such as palm length (PL), intermediate toe spreading (ITS), and toe spreading (TS), commonly evaluated in pain and motor research.

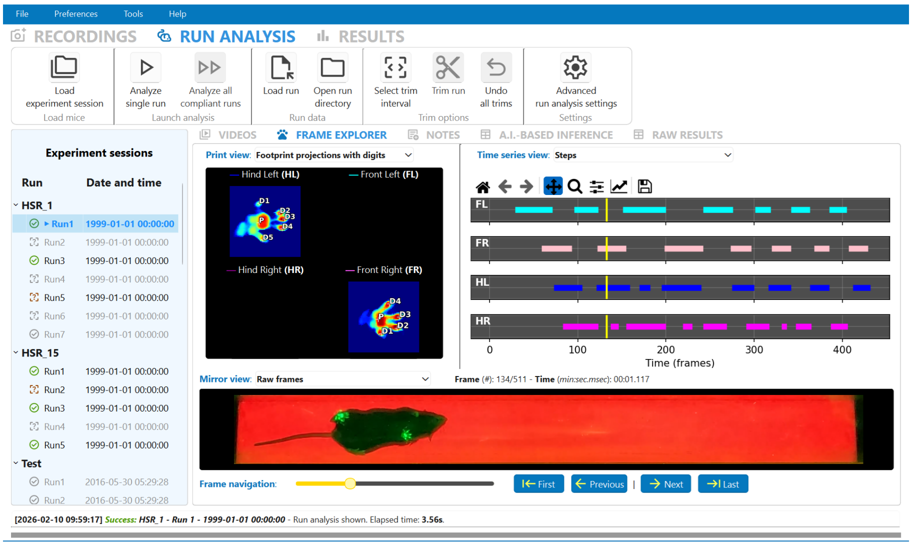
Product Description

The intuitive and interactive software interface uses a few tabs to access all features, like "Run Analysis" panel to load videos, raw footage and labeled paw tracking overlays.

The "Frame Explorer" menu shows detailed per-frame pose estimation of paw, body and tail. with related time series. Users can visualize intensity and contact area over time.

A **"digital ink" feature** recreates traditional ink-tracking effects.





Screenshot of the "Frame Explorer" menu showing detailed per-frame pose estimation of the paw, body and tail, with related time series.

The mouse is moving freely and its left-to-right and back runs are recorderd with high average run quality, thanks also to the **corridor dimensions** optimized for mice

Once the desidered number of comparable runs (*i.e.* similar speed) has been reached **the software will automatically calculate parameters** and prompt to the next animal.

The corridor floor is made of high-quality glass resistant to scratches and easy to clean. Green LEDs on the side of the corridor enhances shapes, contact surfaces and pressure, plus all the other temporal and spatial parameters scientists are interested to investigate.

The footprints appearing bright green regardless of the mouse fur color (Hamers et al. 2001) gives complete flexibility and enables step dynamics and semi-quantitative assessment of paw pressure (key in Pain Research and not only).

A **high frame rates** (100fps), **color** and **abberation self-correcting camera** (GoPro HERO 13 Black) is used for recording. The camera is controlled by the software, which handles background removal and detects valid runs automatically in real-time.

The system comes with a **preinstalled computer with dedicated GPU**, delivering **automatic detection and labelling of mouse paws** with **virtually 100% accuracy** (thanks to tailored A.I. training of thousands of frames).

The end result is an impressive **increase in paw detection accuracy (virtually 100%)**, **data quality** and **substantial time-saving**, given **no manual paw identification** and **no frame-by-frame manual revision is needed**. The results can be exportes in Excel format directly on the PC.

Main Parameters Analyzed

Motor research	Pain & inflammation	Aging research
Spatial and Temporal Parameters: • Stride Length • Stride Time (variability) • Swing/Stance Time • Paw Angle **Interlimb Coordination:** • Regularity Index • Phase Relationship **Body Parameters:** • Body axis deviation • Lateral body sway • Head-body alignment • Body rotation angle **Tail Parameters:** • Tail-body coordination • Tail movement amplitude	**Load and Support Parameters:** • Duty Cycle • Paw Print Area • Paw Intensity/Pressure • Paw Spread **Compensatory Parameters:** • Base of Support (Step Width)Weight shifting patterns • Body asymmetry index • Guarding posture **Tail Parameters:** • Tail position relative to body • Tail elevation angle • Tail rigidity	**Stability and Coordination Parameters:** • Stride Length • Stride Time variability • Base of Support • Regularity Index • Swing Time **Postural Parameters:** • Duty Cycle • Body stiffness index • Postural stability • Lateral body sway **Tail Parameters:** • Tail position relative to body • Tail movement amplitude

References

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Wertman, V. et al. (2020), "Low-Cost Gait Analysis for Behavioral Phenotyping of Mouse Models of Neuromuscular Disease", JoVE
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Clarke, K.A. et al., (2001) "Development and consistency of gait in the mouse"
DOI: https://doi.org/10.1016/S0031-9384(01)00444-9

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Specifications - Physical

Footprint	69 (w) x 56,5 (d) cm (does not include PC and 24" monitor)
Total dimensions	94 (w) x 56,5 (d) x 45 (h) cm
Ventral view corridor dimensions	66,5 (w) x 5,5 (d) cm
Lateral view glass dimensions	66,5 (w) x 12,5 (h) cm
Lateral cages internal dimensions	12 (w) x 8 (d) x 12,5 (h) cm

Ordering information

48203	GA.I.T Analysis system for mice. Based on AI, include PC and GoPro camera

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more than 50,000 citations in the main bibliographic search engines.

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