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Advancing cage-side welfare assessment: Automated monitoring technologies in laboratory animal research

RSPCA Animal Welfare Seminar 2026

A/Prof. Alex Whittaker

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We respectfully acknowledge the Kaurna, Boandik, and Barngarla First Nations Peoples and their Elders past and present, who are the Traditional Owners of the lands that are home to our campuses across Adelaide and South Australia.

Why Cage-Side Welfare Assessment Matters

Ethical Research Foundations

Cage-side welfare assessment supports ethical principles and the Australian Code

3Rs Principle - Refinement

This practice refines research by minimising animal distress and promoting optimal care during studies.

Importance of Circadian Monitoring

Monitoring animals during their active periods improves welfare assessment accuracy for nocturnal species.

Improved Research Outcomes

Better welfare assessments lead to reliable data and uphold a culture of care in research institutions.

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Limitations of Traditional Practices

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Subjectivity in Observations

Manual welfare checks depend on human interpretation, leading to variability between observers and potential inconsistency in data.

Intermittent and Labor-Intensive

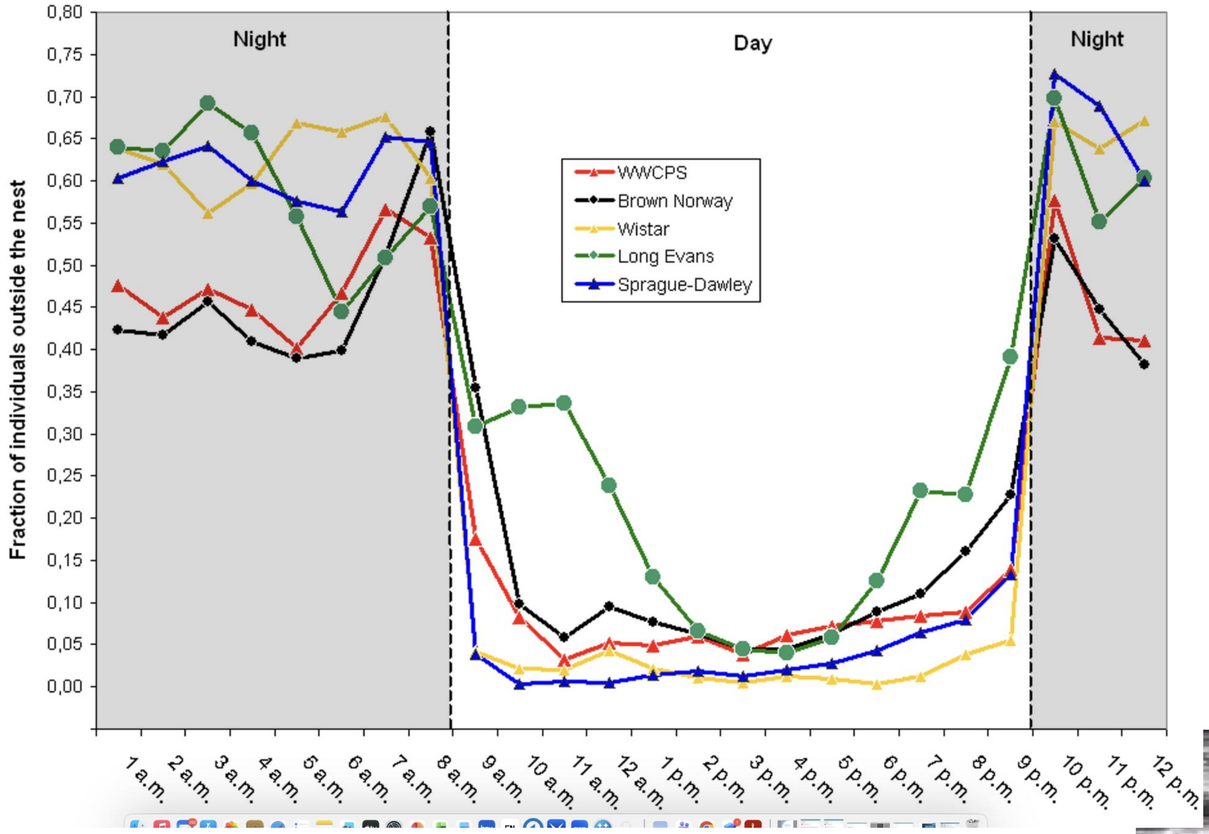
Manual checks provide only snapshot data and require significant time and effort, overlooking subtle behavioral changes.

Missed Nocturnal Behaviors

Daytime-focussed checks miss nocturnal behaviors, leading to gaps in monitoring animal welfare effectively.

Limitations of Manual Scoring

Manual scoring systems like grimace scales require extensive training and can suffer from variability, affecting reliability.



Stryjek et al 2013

Sensor-Based Systems and Smart Cages

Animal Tracking Technologies

RFID tags and accelerometers monitor animal presence, movement patterns, and activity levels to detect abnormalities.

Thermal Imaging for Health

Thermal imaging detects changes in body temperature, identifying potential pain or illness in animals promptly.

Environmental Monitoring

Sensors measure temperature, humidity, ammonia, noise, and light to maintain optimal cage conditions for welfare.

Integrated Smart Cage Systems

Smart cages combine sensors and cameras, feeding data to dashboards for real-time welfare alerts and interventions.

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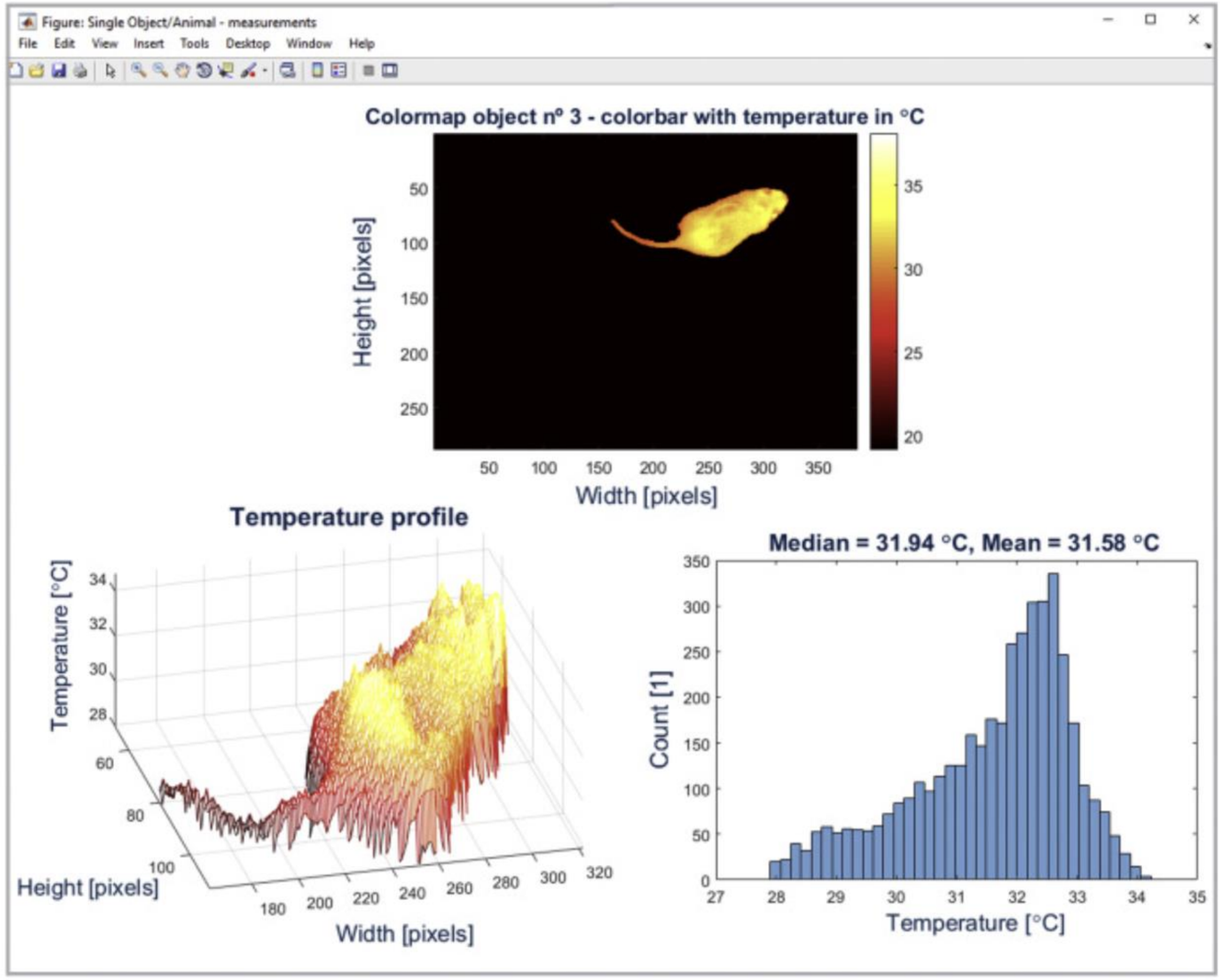


ELSEVIER

Physiology & Behavior

Volume 207, 1 August 2019, Pages 113-121

ThermoLabAnimal – A high-throughput analysis software for non-invasive thermal assessment of laboratory mice

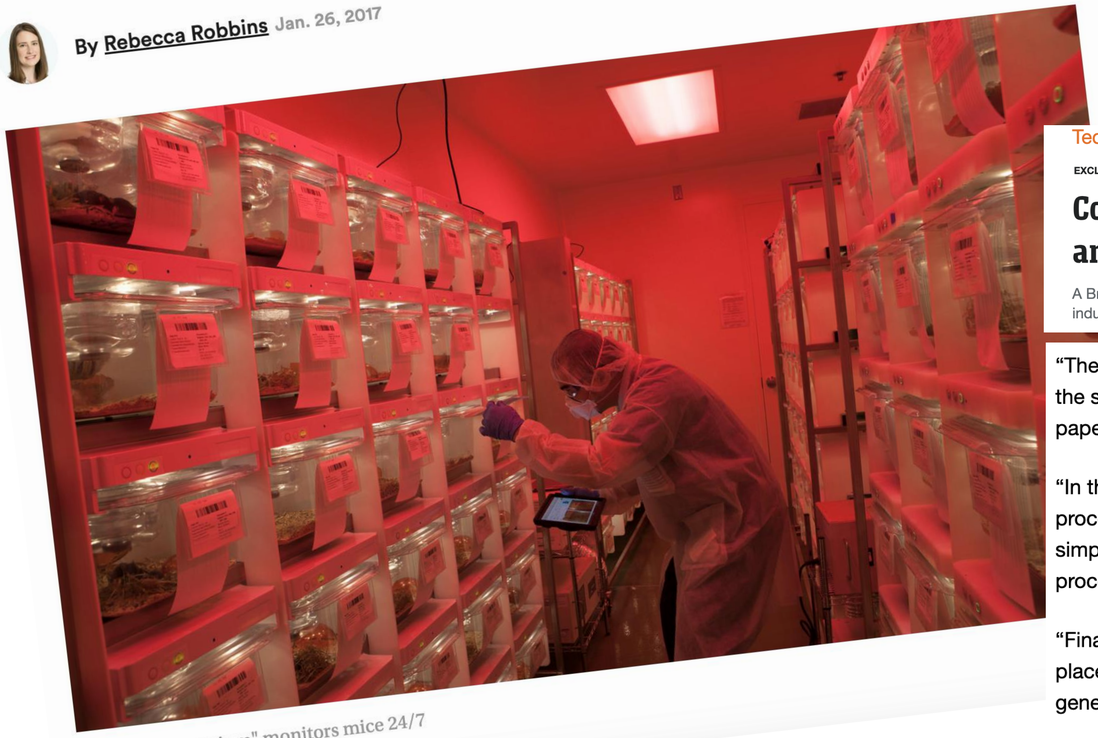
Nuno Henrique Franco [a b 1], Ana Gerós [b c d 1], Liliana Oliveira [a b], I. Anna S. Olsson [a b], Paulo Aguiar [b c]


DVC
DIGITAL VENTILATED CAGE

A whole new way to monitor lab rats — by tracking their every breath

Reprints

By Rebecca Robbins Jan. 26, 2017



The "digital vivarium" monitors mice 24/7

COURTESY VIUM

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FEATURE

AI-Powered Tech Enables Continuous Lab Animal Monitoring

Scientists are using AI-powered, 24/7 home-cage monitoring to accelerate discovery, enhance reproducibility, and improve animal well-being.

Technology > Innovation

EXCLUSIVE

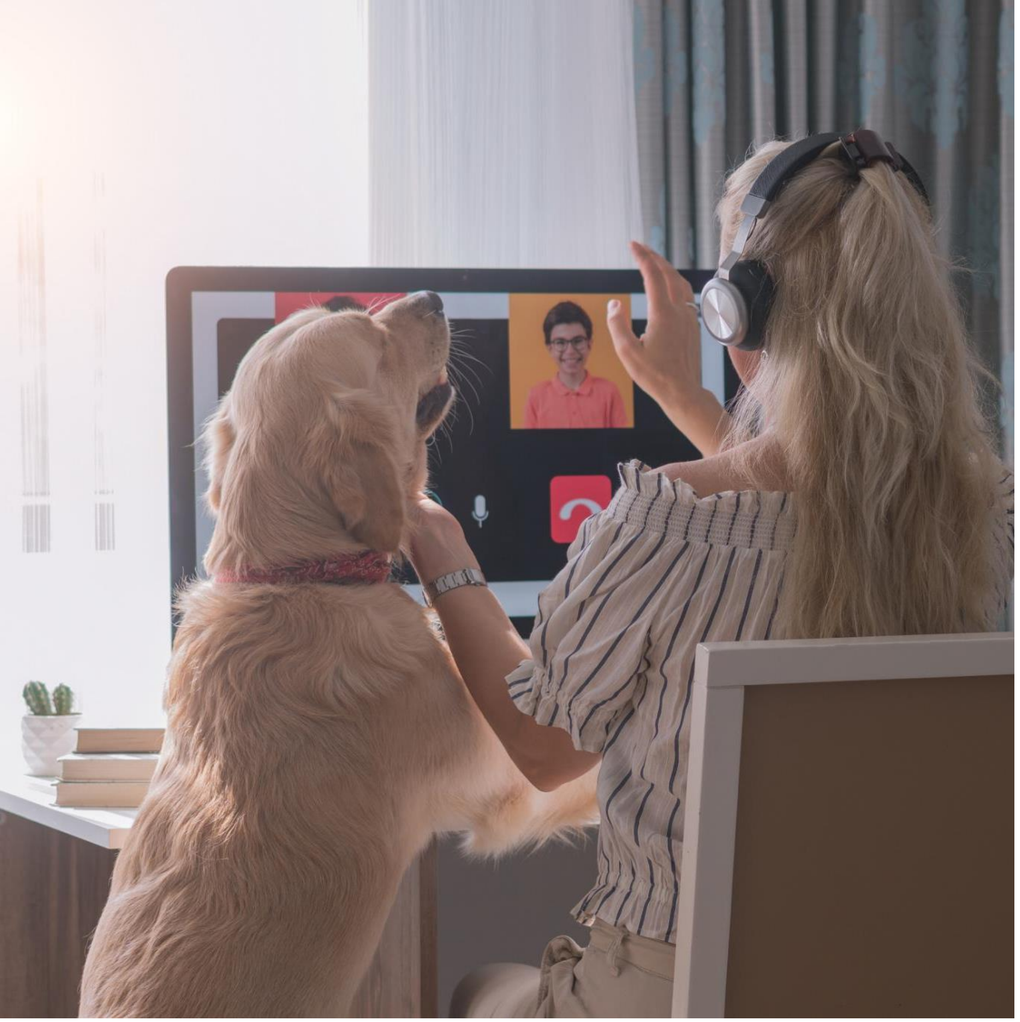
Could this Aussie AI start-up phase out lab testing on animals?

A Brisbane company has partnered with tech giant Google to solve a dark secret plaguing the drug development industry.

“The platform does this instantly for you. A researcher can simply enter a question and the system automatically summarises the latest scientific literature. Our operating papers give insights to the scientists before designing their experiments.

“In the design and execution module, the module guides the user through its entire process from tissue selection all the way to the parameter optimisation. The user can simply select the tissue type they want to grow, and our platform will optimise all the processing parameters for them in the background.

“Finally, their analytics module here, the experimental data can be analysed all in one place. Researchers can simply select the analysis they want to run, and the system generates clean visual insights for them.



Video-based AI systems

Behavior Recognition and Classification

Computer vision AI algorithms identify and classify animal behaviors such as locomotion, grooming, rearing, and posture changes continuously.

- Manual v automatic

Anomaly Detection

AI detects abnormal behaviors like immobility or stereotypic actions that may indicate animal distress or welfare issues.

24/7 Monitoring with Edge Computing

Systems operate continuously, processing data near the source to reduce latency and enhance privacy by minimising raw video storage.

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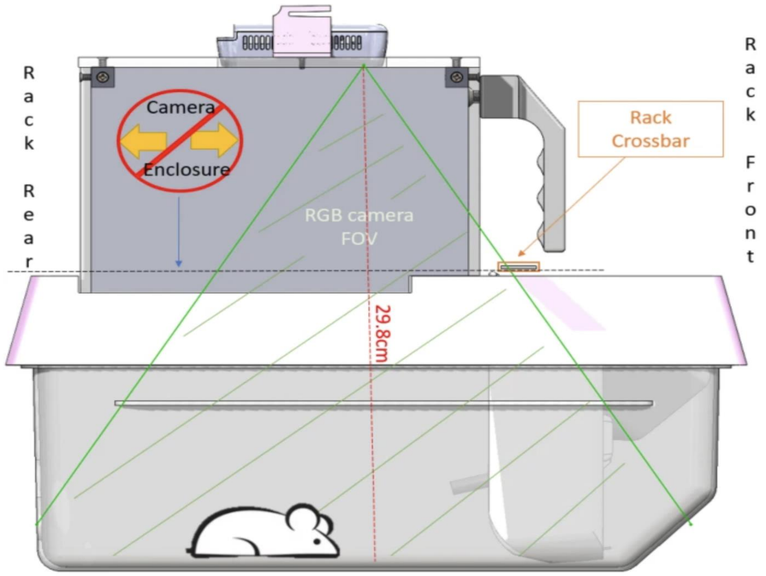
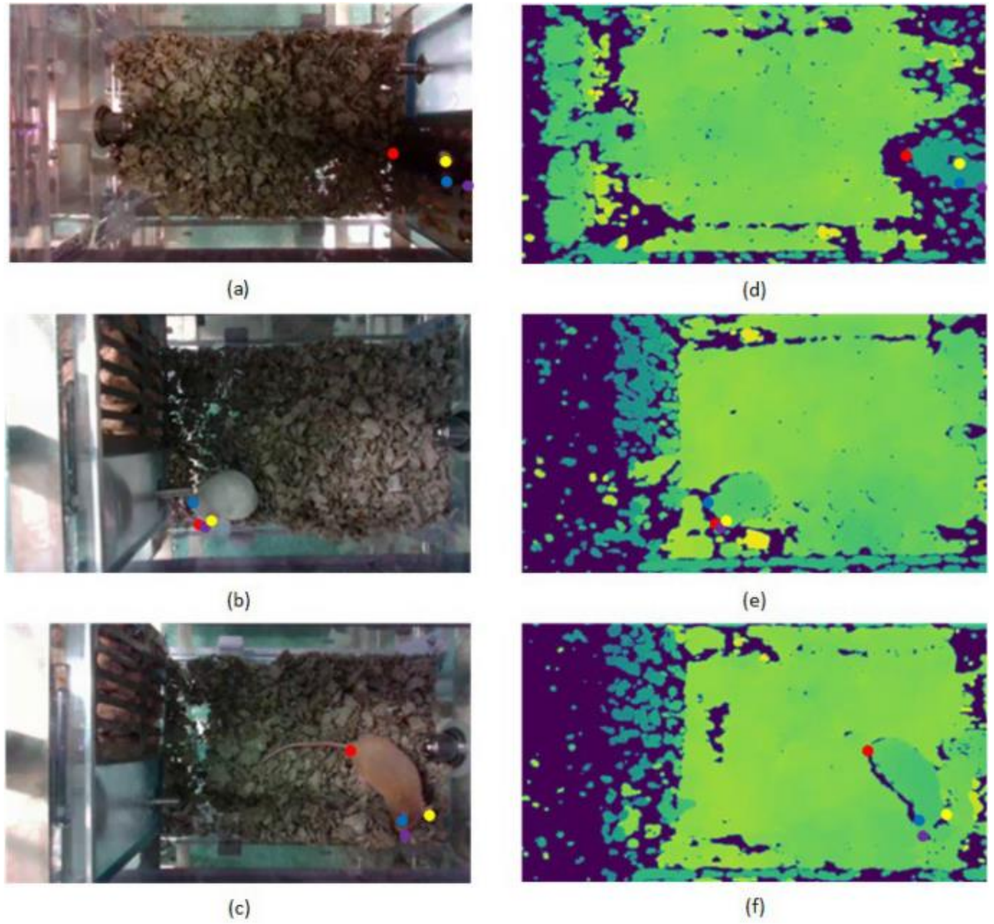
Article | Open access | Published: 01 February 2024

MouseVUER: video based open-source system for laboratory mouse home-cage monitoring

Ghadi Salem, Niall Cope, Marcial Garmendia, Alex Pu, Abhishek Somenhalli, Jonathan Krynitsky, Noah Cubert, Thomas Jones, George Dold, Anthony Fletcher, Alexxai Kravitz, Thomas Pohida & John Dennis

Scientific Reports **14**, Article number: 2662 (2024) | Cite this article





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Automation of Grimace Scoring

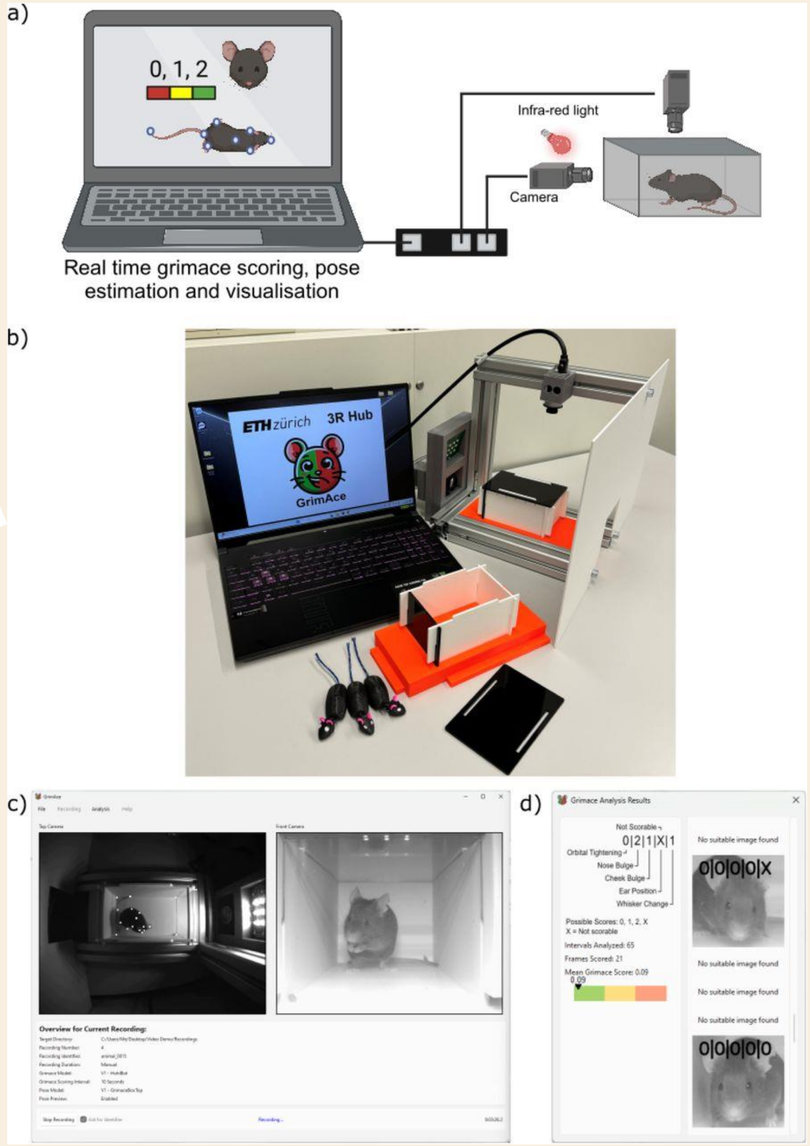
New Results

Follow this preprint

GrimACE: Automated, multimodal cage-side assessment of pain and well-being in mice

Oliver Sturman, Marcel Schmutz, Tom Lorimer, Runzhong Zhang, Mattia Privitera, Fabienne K Roessler, Justine Leonardi, Rebecca Waag, Alina-Mariuca Marinescu, Clara Bekemeier, Katharina Hohlbaum, Johannes Bohacek

doi: https://doi.org/10.1101/2025.03.07.642046



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Semi-automated systems

Ethical and Practical Considerations

Data Privacy and Security

Implement strict data privacy protocols and access controls to ensure compliance with institutional policies.

Bias Avoidance and Validation

- Validate systems to prevent bias across species, strain, or sex for accurate welfare assessments.
- Proprietary algorithms

Staff Training and Response

Train staff to interpret automated data and respond appropriately to ensure successful system integration.

Complementing Human Oversight

Automation should enhance, not replace, human oversight to support a culture of care and avoid surveillance fears.

Scalability

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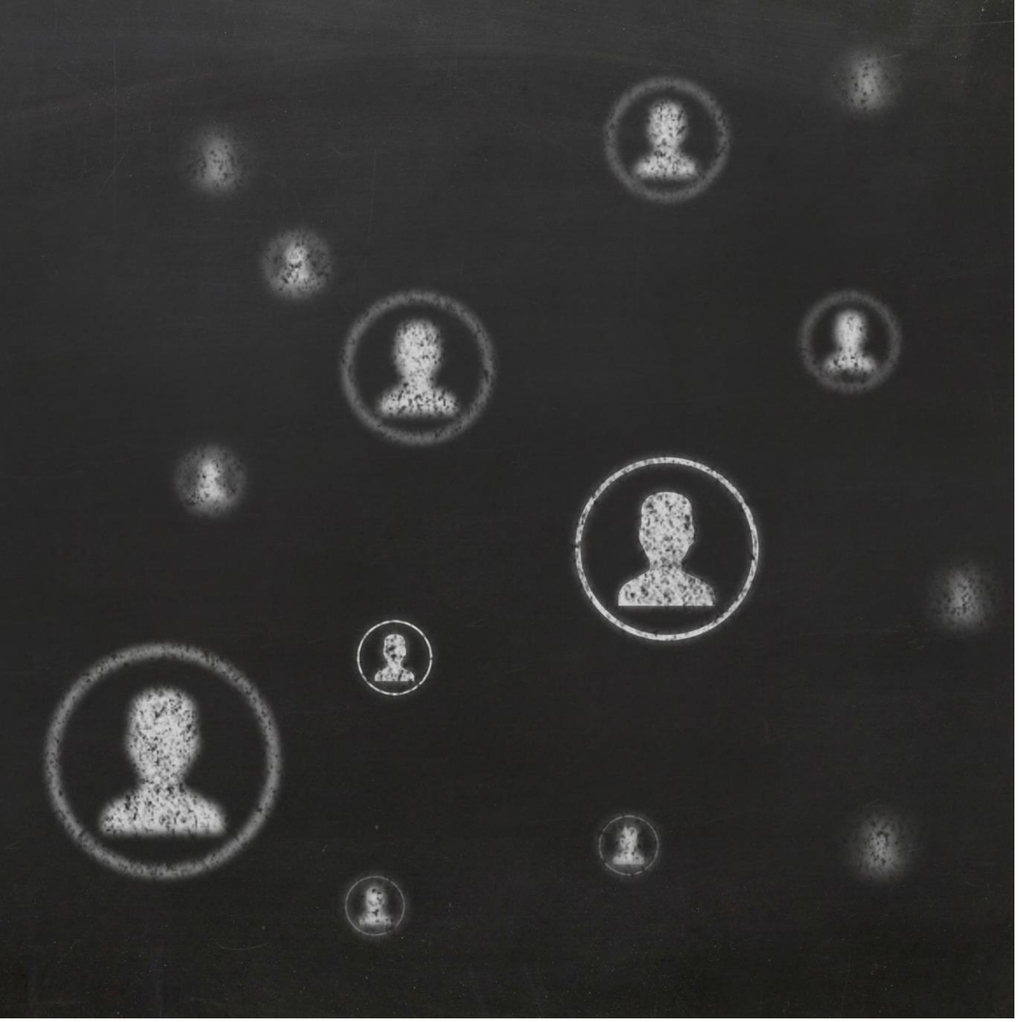

Advancing Welfare Through Predictive Analytics

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Predictive Welfare Assessment

Predictive analytics anticipates welfare risks by analysing longitudinal data from automated monitoring systems.

Closed-Loop Refinement

Alerts trigger predefined responses such as environmental adjustments or veterinary checks to address welfare issues proactively.

Collaboration and Standards

Collaboration among academia, industry, and regulators develops best practices and open standards for ethical governance.

Circadian-Aware Monitoring

Integrating automated, circadian-aware monitoring into routine care improves welfare standards and research quality.

Call to Action

Pilot Implementation

Start with small-scale pilot projects to validate automated monitoring technologies against expert assessments.

Staff Training and Adoption

Invest in comprehensive staff training to ensure successful adoption and integration of new monitoring tools.

Collaboration and Knowledge Sharing

Promote collaboration and knowledge sharing to accelerate adoption and improvement of monitoring systems.

Ethical Integration

Integrate technology thoughtfully to uphold ethical standards and enhance animal welfare in research.

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Better data. Better care

- Continuous, objective monitoring = better welfare
- Tech complements human care
- Start small, validate, scale