Docket #: S25-301

Multi-modal AI Laboratory Intelligence Platform for Experiment Capture, Analysis, And Automation

Researchers at Stanford have developed a laboratory intelligence platform that integrates multimodal artificial intelligence, extended reality (XR), computer vision, and robotic systems to support scientific research workflows from experimental design through laboratory execution.

Current artificial intelligence systems have significantly advanced computational tasks such as data analysis, hypothesis generation, and experimental planning. However, laboratory research often relies on manual training, fragmented documentation, and tacit operational knowledge that can be difficult to transfer, reproduce, or scale. Existing digital laboratory tools typically capture only limited experimental information and provide minimal contextual understanding of laboratory procedures, reducing their ability to support real-time guidance, quality control, and workflow automation.

This technology combines AI agents, laboratory-specific vision-language models, XR-enabled interfaces, and multimodal sensing to capture and interpret laboratory activities in real time. The platform can provide context-aware guidance, identify workflow deviations, generate automated experimental documentation, and support robotic execution of laboratory procedures. By linking digital scientific reasoning with physical laboratory workflows, the system enables knowledge capture, workflow standardization, laboratory training, and scientific automation within a unified framework.

Potential applications include research training, laboratory operations, scientific workflow management, digital laboratory environments, and laboratory automation.

Stage of Development
Lab Prototype

Applications

- Laboratory training and skill transfer
- Automated documentation and compliance
- Laboratory automation and robotics
- Digital laboratory twins and workflow analytics

Advantages

- Multi-modal laboratory perception
- Real-time workflow guidance
- Automated documentation and record generation
- Human-AI-robot collaboration
- Unified platform for laboratory intelligence and automation

Publications

- Cong, L., Smerkous, D., Wang, X., Yin, D., Zhang, Z., Jin, R., et al.LabOS: The AI-XR Co-Scientist That Sees and Works With Humans. bioRxiv, 2025.

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