Docket #: S24-163

3D-Opto-SEQ: An AI-assisted label-free optical platform to characterize nano and micro-vesicles and biological tissues

Researchers at Stanford University have demonstrated rapid and accurate identification of extracellular vesicles (EVs) from different cell lines using an AI-assisted optical platform.

EVs are lipid bilayer structures that facilitate cell-to-cell communication by transporting encased cellular cargo, such as proteins, lipids, and nucleic acids. They vary widely in size, origin, and function. Identifying and characterizing EVs and their content is crucial for gaining insights into various biological processes, disease mechanisms, and their roles in diagnostics and therapeutics. However, current methods for optical localization and characterization of EVs are labor-intensive and have limited capabilities, such as reliance on labeling techniques, difficulty analyzing heterogeneous mixtures, and low sensitivity.

To overcome these limitations, Stanford researchers have developed a novel AI-assisted imaging solution for EV profiling. Their multimodal imaging platform combines interferometric imaging and super-resolution Raman microscopy to enable simultaneous label-free chemical and physical analysis of EVs. A pre-trained artificial neural network algorithm is used on the collected data to profile EV types, even from heterogeneous EV mixtures. This innovative approach offers a powerful tool for fast and precise EV characterization.

Stage of Development
Prototype

Applications

- Diagnostics
- Infectious diseases
- Cardiovascular diseases
- Cancer
- Vaccine delivery
- Drug delivery

Advantages

- Noninvasive
- Cost-effective
- High-throughput
- Label-free
- High sensitivity

Publications

- Parlatan, U., Ozen, M. O., Kecoglu, I., Koyuncu, B., Torun, H., Khalafkhany, D., Loc, I., Ogut, M. G., Inci, F., Akin, D., Solaroglu, I., Ozoren, N., Unlu, M. B., & Demirci, U. (2023). Label-Free Identification of Exosomes using Raman Spectroscopy and Machine Learning. *Small (Weinheim an der Bergstrasse, Germany), 19*(9), e2205519.

Patents

- Published Application: WO2025235538

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