

Wenbo Mo

Minjie Zhou, Shuang Ni, Daojian Qi, Xinming Wang, Feng Tang, Jiaxing Wen, Yue Yang, Zongqing Zhao

Laser Fusion Research Center, China Academy of Engineering Physics, 621900 Mianyang, China

mwb19@tsinghua.org.cn

Raman rapid diagnosis of tumor pathology based on spectral-image fusion intelligent method

Abstract

Advanced physics detection technologies represented by laser technology are renowned for their high speed and high precision. If applied to the biomedical field, they are expected to break through the technical bottlenecks of traditional biological or chemical-based biological detection methods regarding speed, sensitivity, and operational convenience. Among them, Surface-enhanced Raman Spectroscopy (SERS) technology based on the principle of laser plasma can provide molecular fingerprint information, offering advantages of label-free and high sensitivity. It is expected to develop into a highly promising new method for biodetection. However, it faces some challenges in clinical transformation. This project proposes a "Raman Spectral-image Fusion" method, aiming to address key issues such as the difficulty in obtaining the standard spectrum of biological macromolecules, insufficient spectral analysis capability for multiple markers, and difficulties in imaging resolution and morphological information fusion. We propose a scientific calculation method of "intelligent segmentation and highly parallel" Raman full spectrum of biological macromolecules, develop high-accuracy and interpretable deep learning spectral analysis algorithms, and multi-source data fusion and diagnostic assistance algorithms. Clinical application verification will be carried out in the scenario of breast cancer pathological subtyping diagnosis. This project is expected to break through the bottlenecks of SERS biodetection applications, promote its clinical translation in the field of medical diagnosis, and promote the cross-integration and development of multiple disciplines such as physics and biomedicine.

References

- [1] Mo W, Ni S, Zhou M, et al. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2024, 314: 124155.
- [2] Mo W, Ke Q, Yang Q, et al. Analytical Chemistry, 2024, 96(33): 13410-13420.
- [3] Mo W, Ke Q, Zhou M, et al. Analytical Chemistry, 2023, 95(5): 3019-3027.

Figures

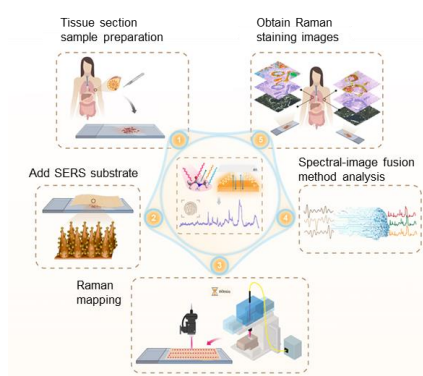


Figure 1: Flow chart of Raman spectral-image fusion method applied to histopathological diagnosis of breast cancer.