Contribution ID: **32** Type: **Contributed talk**

Multimodal Data Analysis by Artificial Intelligence for Synchrotron Radiation Experiments

Thursday 29 August 2024 17:15 (15 minutes)

Synchrotron radiation (SR) light sources provide precise and deep insights that have been driving cutting-edge scientific research. Facing to SR scientific big data challenge, it is urgent to develop artificial intelligence (AI) analysis methods to enhance research efficiency including novel material discovery[1]. In this talk, I will focus on AI analysis methods for multimodal SR data including image and diffraction data. First, regarding image data, we implement a novel localization quantitative analysis method based on deep learning to analyze X-ray nano-computed tomography (Nano-CT). We achieve localization three-dimensional quantitative Nano-CT imaging analysis of single-cell HfO2 nanoparticles and demonstrate the notable effect of the nanoparticles in tumor treatment[2]. Our approaches show the potential to explore the localization quantitative three-dimensional distribution information of specific molecules at the nanoscale level in Nano-CT. Second, regarding diffraction data, we develop two sets of data-driven and physics-knowledge-driven machine learning (ML) methods to analyze the X-ray diffraction and extract three-dimensional orientation information of nanofibers. The data-driven ML model achieves high accuracy and fast analysis of experimental data and is available to be applied in multi light sources and beamlines[3]. The physics-knowledge-driven ML method enables high-precision, self-supervised, interpretable analysis and lays the foundation for systematic knowledge-driven online scientific big data analysis. Overall, our work aims to analyze multimodal SR data accurately and quickly in real-time through AI algorithms, which support AI for SR-based Science strongly.

Reference:
[1] Qingmeng Li, Rongchang Xing, Linshan Li, Haodong Yao, Liyuan Wu, Lina Zhao. *Synchrotron radiation data-driven artificial intelligence approaches in materials discovery. Artificial Intelligence Chemistry, 2(1): 2949-7477, (2024).*
[2] Zuoxin Xi, Haodong Yao, Tingfeng Zhang, Zongyi Su, Bing Wang, Weiyue Feng, Qiumei Pu, Lina Zhao. *Quantitative Three-Dimensional Imaging Analysis of HfO2 NPs in Single Cells Via Deep Learning aided Nano-CT. ACS Nano, under revision, (2024).*
[3] Minghui Sun, Zheng Dong, Liyuan Wu, Haodong Yao, Wenchao Niu, Deting Xu, Ping Chen, Himadri S Gupta, Yi Zhang, Yuhui Dong, Chunying Chen, Lina Zhao*. Fast extraction of three-dimensional nanofiber orientation from WAXD patterns using machine learning, IUCrJ, 10, 3 (2023).

I plan to submit also conference proceedings

Yes

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Session Classification: Mikrosymposium 3/2: Data, Automation and the Use of AI

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