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Enhancing Quantitative Analysis efficiency with Deep Learning Neural Network Coupled Laser-Induced Breakdown Spectroscopy

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Laser-Induced Breakdown Spectroscopy (LIBS) is an analytical method rooted in Atomic Emission Spectroscopy (AES). The traditional approach to quantitative analysis in LIBS, involving calibration curves, can be quite cumbersome [1]. However, in recent years, there has been significant growth in the integration of machine learning algorithms with LIBS for quantitative analysis [2]. Spectral quantitative analysis in conjunction with conventional supervised machine learning techniques such as linear regression, support vector regression (SVR) and so on, has showcased impressive capabilities in efficiently identifying the composition of elements present in samples [3]. Among the conventional machine learning algorithms, Deep Learning Neural Network (DNN) coupled LIBS is a promising analytical tool developed for the efficient compositional analysis [4]. In this work, we have proposed a deep learning neural network (DNN) model for the efficient quantitative analysis of Bronze (Cu-Sn) and Brass (Cu-Zn) alloys and has worked on improving the quantitative results by increasing the number of simulated spectra used for training. The simulation method allows obtaining synthetic spectra for training the model for different concentration of elements for a range of electron temperature and density [5]. This study suggests that employing DNN-supported LIBS is a promising analytical tool for multi-elemental compositional analysis.

References

[1] Ciucci, A., Corsi, M., Palleschi, V., Rastelli, S., Salvetti, A., Tognoni, E., Appl Spectrosc. **53**, 960–964 (1999).
[2] Ruan, F., Qi, J., Yan, C., Tang, H., Zhang, T., Li, H., J. Anal. At. Spectrom. **32**, 2194–2199 (2017).
[3] Sun, C., Tian, Y., Gao, L., Niu, Y., Zhang, T., Li, H., Zhang, Y., Yue, Z., Sci Rep. **9**, 1–18 (2019).
[4] Van Den Eynde, S., Diaz-Romero, D.J., Zaplana, I., Peeters, J., SSRN Journal. (2022).
[5] Sivadas, M.S.S., John, L.M., Anoop, K.K., IOP Conf. Ser.: Mater. Sci. Eng. **1221**, 012027 (2022).