Analysis of laser induced plasma plume in atmosphere: artificial neural network approach

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Time resolved analysis of spectra of laser initiated electric discharge spark in atmosphere is presented here. Spectral images of optical emission of atmospheric plasma are obtained by a streak camera.

Various machine learning (ML) techniques are used more and more for analysis of LIBS data. The combination of the popular machine learning algorithms (PCA and LDA, unsupervised and supervised techniques, respectively) with LIBS are used to complete rapid and precise classification of different samples (Bellou et al. 2020, Diaz et al. 2019, Pořízka et al. 2018, Yang et al. 2020, Zhang et al. 2020). An artificial neural network (ANN) algorithm is also used for the determination of electron temperature and electron number density in LIBS (Borges et al. 2014, D'Andrea 2015). The advantage of ANNs is in the possibility of reproducing nonlinear relations between the inputs and the output(s).

In our recent work we have combined several machine learning techniques, such as K-nearest neighbors classification together with clustering algorithms in supervised manner which is possible in SOLO software, in order to estimate plasma temperature (Rabasovic et al. 2022). Now, we have advanced research through the ANN and deep learning technique. Namely, large set of measured spectra are used to train the artificial neural network to obtain the estimation of plasma temperature. For machine learning approach to data analysis we use Solo+Mia software package (Version 9.0, Eigenvector Research Inc, USA) (Wise et al. 2006).

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