Forecasting Air Pollutant Concentrations Using Selected Neural Network Architectures

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Abstract. *Air pollution currently represents a significant environmental challenge with a direct impact on both public health and ecosystems. One of the aims of this paper is to predict the concentration of particulate matter PM_{10} and CO_2 in the air using machine learning methods, specifically by employing various types of neural networks, feedforward, convolutional, and recurrent. The aim is also to compare the performance of these architectures in processing univariate time series with different temporal resolutions (yearly, monthly, hourly). The study uses real data from the Slovak Hydrometeorological Institute (SHMÚ) and modelled emissions from the EDGAR database. The models were trained, optimized, and evaluated using the MAE metric. The results showed that the Conv1D model achieved the highest accuracy on hourly and monthly data, while the Dense model performed best on yearly data. The findings confirm the potential of artificial intelligence methods as a tool for environmental monitoring and decision support in air quality protection. The work also presents opportunities for extending the model with meteorological variables and applying it in real-time warning systems.*

Keywords. Neural networks, environment, prediction, particle matters, carbon dioxide

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