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INTEGRATION OF DATA FROM DIFFERENT RAPID-E DEVICES SUPPORTS POLLEN CLASSIFICATION IN MORE LOCATIONS

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Introduction

The laser-sensing real-time bioaerosol detector Rapid-E (Plair SA) produces data prone to device-specific noise due to laser and detector sensibility, which is critical when transferring classification models between different devices (Matavulj *et al.* 2021). This study implements convolutional neural networks (CNNs) for pollen classification and tests how models trained with a combination of different datasets perform at two locations.

Materials and Methods

The study was conducted in San Michele all'Adige, Italy, and Novi Sad, Serbia. Taxonomically determined monospecific pollen samples were collected and injected into the devices to obtain reference datasets used for classification. A multi-modal CNN architecture was applied for pollen classification on one year of Rapid-E data, obtaining daily pollen concentrations which were then compared with the concentrations obtained by light microscopy analysis on Hirst-type volumetric pollen samples. CNNs were trained with different combinations of reference datasets to test if the models were transferable from one device to the other. All networks were additionally trained with the domain adaptation technique (Ganin and Lempinsky 2015) to exclude the device-specific noise.

Results and Discussion

Models lost performance when trained on data from one and tested on another device. We showed that data of the same pollen *taxon* from the two devices are more different than data of distinct pollen *taxa* from one device. Combining all available reference data in a single model enabled the classification of a higher number of pollen *taxa* in both study locations. The domain adaptation technique improved the performance of transferred models for several pollen *taxa*.

Conclusions

CNNs recognize significant differences in data from the two devices which can be solved by combining reference datasets from both locations. When a reference dataset is not available, the domain adaptation can improve the performance of models trained on data from other devices.

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