Minimization of air pollution monitoring cost in the urban area

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The air pollution is monitored in the urban area by installation of air pollution monitoring stations. The high initial capital, operation and maintenance costs of air pollution monitoring stations has limited to install a dense monitoring network. In addition, there is a direct relation between the accuracy of monitoring and the density of network. Although there are a limited number of stations in Berlin (13 real stations), but it is possible to generate dense monitoring network by simulation of some virtual stations in Berlin. The studied pollutant in this study is hourly PM10. Sometimes the PM10 concentration in outdoor air in Berlin exceeds from EU-Limit value, hence PM10 should be monitored with better monitoring network. Firstly, we must perform or collect some hourly PM10 data in the positions of virtual stations concurrent with real station measurements. Then, the appropriate real stations for the simulation of each virtual station are determined using a feature selection algorithm. Next, the PM10 concentration of appropriate stations are utilized as the input variables for an artificial neural network (ANN) and the PM10 concentration in the virtual stations are utilized as output of ANN. Finally about 33 virtual stations were simulated by ANN for PM10 monitoring in Berlin. In other words, a high density network with minimum cost was developed for hourly PM10 monitoring in Berlin. The results demonstrated that it is possible to simulate the virtual stations with high accuracy (mean absolute percentage error about 25%). Using the idea of this study, it is possible to develop a dense air pollution monitoring network for the urban areas with minimum cost. Consequently, it is possible to calculate the hourly spatial variations of pollutants with high accuracy using the developed dense monitoring network in the urban area.