# Impact of Meteorological Conditions on Air Quality Prediction using Deep Learning

**Fahmina Taranum[1] and Sumera Sultana[2]**

(Osmania University)

*Muffakham Jah College Of Engg. And Tech.* Hyderabad, India

ftaranum@gmail.com[1] , sumerakhan0921@gmail.com [2]

## ABSTRACT

Meteorological conditions have a strong influence on air quality and can play an important role in air quality prediction. However, due to the ‘‘black-box’’ nature of deep learning, it is difficult to obtain trustworthy deep learning models when considering meteorological conditions in air quality prediction. To address the above problem, we reveal the influence of meteorological conditions on air quality prediction by utilizing deep learning. In this proposal, (1) the source data from air pollutant datasets, including PM2.5, PM10, SO2, CO, NO2, O3 hourly concentration, and the meteorological condition datasets measuring the temperature and atmospheric pressure are obtained; (2) the Artificial Neural Network (ANN) model are established for air quality prediction in 3 conditions

We find that the prediction accuracy is not improved by considering only PM2.5. However, when combining meteorological conditions with PM2.5 the prediction accuracy is higher than considering only PM2.5 . The prediction accuracy is the highest when considering all the factors. The prediction accuracy obtained for PM2.5 is0.899,0.950 when combining PM2.5 with meteorological conditions and 0.982 respectively when considering all the factors. The reason for the different accuracies of the prediction may because of the interaction between meteorological conditions and other air pollutants. The investigated results can help improve the prediction accuracy of air quality and achieve trusted air quality predictions.

**Keywords:** Deep learning, Artificial Neural Network(ANN), air quality prediction, meteorological conditions, PM2.5, air pollutants.

## 1. INTRODUCTION

Environmental issues have been brought about by the ongoing acceleration of global growth in industrialization and urbanization. Air quality is just one of the major environmental issues brought on by the growth of urbanization and industrialisation. Both energy generation and consumption activities, such as power plants, manufacturing facilities, and automotive exhaust emissions, have eventually contributed to the ongoing worsening of global air pollution due to the necessities of shipping, production, and life. Air pollution poses a severe threat in the well-being of individuals because it can result in cancer and other respiratory conditions. PM2.5, PM10, SO2, and other air pollutants are among the primary ones. PM2.5, one of them, is a tiny particle with a diameter of under 2.5 microns. PM2.5 particles are much more effective as larger microscopic pollutants, which allows them to travel quicker and easier through the air as well as stay in the atmosphere for a longer period of time. Of the biggest and most significant sources of air pollution

0.5043, 0.6715, and 0.3945. The lowest accuracy occurs when only PM2.5 is taken into account for the prediction, with errors as follows: 0.5264, 0.6845, and 0.4148 for MSE, RMSE, and MAE respectively. (ii) When PM2.5 and meteorological conditions are taken into consideration, the errors obtained are as follows: 0.5175 as MSE, 0.6712 as RMSE, and MAE as 0.4025. 93% accuracy was attained.

In the future, we intend to develop models based on deep learning for environmental quality prediction that are more accurate and reliable and can be used to provide predictions of realistic air quality levels.

## REFERENCES

[1] Rishanti Murugan et al.and Naveen Palanichamy," Smart City Air Quality Prediction using Machine Learning", 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), May,2021

[2] Yuan Huang,Yuxing Xiang, Ruixiao Zhao;,Zhe Cheng," Air Quality Prediction Using Improved PSO-BP Neural Network", IEEE Access ( Volume: 8), May,2020

[3] Usha Mahalingam, Kirthiga Elangovan, Himanshu Dobhal, Chocko Valliappa, Sindhu Shrestha, and Giriprasad Kedam," A Machine Learning Model for Air Quality Prediction for Smart Cities", 2019 International Conference on Wireless Communications Signal Processing and Networking (WiSPNET), March,2019.

[4] Timothy M. Amado, Jennifer C. Dela Cruz,"Development of Machine Learning-based Predictive Models for Air Quality Monitoring and Characterization", TENCON 2018 - 2018 IEEE Region 10 Conference, October,2018

[5] Wang Zhenghua, Tian Zhihui ," Prediction of air quality index based on improved neural network", 2017 International Conference on Computer Systems, Electronics and Control (ICCSEC), December 2017

[6] [6]R. J. Kuo, B. Prasetyo, and B. S. Wibowo, ''Deep learning-based approach for air quality forecasting by using recurrent neural network with Gaussian process in Taiwan,'' in Proc. IEEE 6th Int. Conf. Ind. Eng. Appl. (ICIEA), Apr. 2019.

[7] H. Li, J. Wang, R. Li, and H. Lu, ''Novel analysis-forecast system based on multi objective optimization for air quality index,'' J. Cleaner Prod., vol. 208, pp. 1365–1383, Jan. 2019.

[8] Y. Qi, Q. Li, H. Karimian, and D. Liu, ''A hybrid model for spatiotemporal forecasting of PM2.5 based on graph convolutional neural network and long short-term memory,'' Sci. Total Environ., vol. 664, pp. 1–10, May 2019.

[9] C. Wen, S. Liu, X. Yao, L. Peng, X. Li, Y. Hu, and T. Chi, ''A novel spatiotemporal convolutional long short-term neural network for air pollution prediction,'' Sci. Total Environ., vol. 654, pp. 1091–1099, Mar. 2019.

[10] R. J. Kuo, B. Prasetyo, and B. S. Wibowo, ''Deep learning-based approach for air quality forecasting by using recurrent neural network with Gaussian process in Taiwan,'' in Proc. IEEE 6th Int. Conf. Ind. Eng. Appl. (ICIEA), Apr. 2019