
6 References

- [1] Li, Xinwei, Zhang, X., Zhang, Z., Han, L., Gong, D., Li, J., Wang, T., Wang, Y., Gao, S., Duan, H., & Kong, F. (2019). (D. J. Schroeder (1999). *Astronomical optics* (2nd ed.). Academic Press. p. 278. ISBN 978-0-12-629810-9., p.278). Air pollution exposure and immunological and systemic inflammatory alterations among schoolchildren in China. *Science of The Total Environment*, 657, 1304–1310. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2018.12.153>
- [2] Chen, Z., Cui, L., Cui, X., Li, X., Yu, K., Yue, K., Dai, Z., Zhou, J., Jia, G., & Zhang, J. (2019). The association between high ambient air pollution exposure and respiratory health of young children: A cross sectional study in Jinan, China. *Science of The Total Environment*, 656, 740–749. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2018.11.368>
- [3] Ravindra, K. (2019). Emission of black carbon from rural households kitchens and assessment of lifetime excess cancer risk in villages of North India. *Environment International*, 122, 201–212. <https://doi.org/https://doi.org/10.1016/j.envint.2018.11.008>
- [4] Ravindra, K., Singh, T., Pandey, V., & Mor, S. (2020). Air pollution trend in Chandigarh city situated in Indo-Gangetic Plains: Understanding seasonality and impact of mitigation strategies. *Science of The Total Environment*, 729, 138717. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2020.138717>
- [5] Organization, W. H. (n.d.). *Ambient air pollution: a global assessment of exposure and burden of disease*. World Health Organization. <https://apps.who.int/iris/handle/10665/250141>
- [6] Bodor, Z., Bodor, K., Keresztesi, Á., & Szép, R. (2020). Major air pollutants seasonal variation analysis and long-range transport of PM10 in an urban environment with specific climate condition in Transylvania (Romania). *Environmental Science and Pollution Research*, 27(30), 38181–38199. <https://doi.org/10.1007/s11356-020-09838-2>
- [7] IPCC, 2023: Summary for Policymakers. In: *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing

-
- Team, H. Lee and J. Romero (eds.)).IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001
- [8] Shindell, D., Kuylensstierna, J. C., Vignati, E., van Dingenen, R., Amann, M., Klimont, Z., ... & Fowler, D. (2012). Simultaneously mitigating near-term climate change and improving human health and food security. *Science*, 335(6065), 183-189.
- [9] Jacobson, M. Z., Delucchi, M. A., Cameron, M. A., & Frew, B. A. (2015). Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes. *Proceedings of the National Academy of Sciences*, 112(49), 15060-15065.
- [10] Markandya, A., Sampedro, J., Smith, S. J., van Dingenen, R., Pizarro-Irizar, C., Arto, I., & González-Eguino, M. (2018). Health co-benefits from air pollution and mitigation costs of the Paris Agreement: a modelling study. *The Lancet Planetary Health*, 2(3), e126-e133.
- [11] Smith, P., Bustamante, M., Ahammad, H., Clark, H., Dong, H., Elsiddig, E. A., ... & Tubiello, F. N. (2014). Agriculture, forestry and other land use (AFOLU). In *Climate Change 2014: Mitigation of Climate Change* (pp. 811-922). Cambridge University Press.
- [12] Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kazmierczak, A., Niemela, J., & James, P. (2007). Promoting ecosystem and human health in urban areas using green infrastructure: A literature review. *Landscape and Urban Planning*, 81(3), 167-178.
- [13] Thompson, T. M., Rausch, S., Saari, R. K., & Selin, N. E. (2014). A systems approach to evaluating the air quality co-benefits of US carbon policies. *Nature Climate Change*, 4(10), 917-923.
- [14] Creutzig, F., Agoston, P., Goldschmidt, J. C., Luderer, G., Nemet, G. F., & Pietzcker, R. C. (2016). The underestimated potential of solar energy to mitigate climate change. *Nature Energy*, 1(6), 16068.
- [15] Pollitt, M. G., Neuhoff, K., Lin, K., & Hobbs, B. F. (2015). Market reforms and energy efficiency. *The Energy Journal*, 36, 3-28.
- [16] Coats, C. J. J., & Coats C J [MCNC Environmental Programs, Research Triangle Park, NC (United States)], J. (1996). High Performance Algorithms In The Sparse Matrix Operator Kernel Emissions (smoke) Modeling System.

- Proc. Ninth AMS Joint Conference on Applications of
<https://www.osti.gov/biblio/422986>
- [17] Olatinwo, R. O., Prabha, T., Paz, J. O., Riley, D. G., & Hoogenboom, G. (2010). The Weather Research and Forecasting (WRF) model: Application in prediction of TSWV-vectors populations. *Journal of Applied Entomology*, 135(1-2), 81–90. <https://doi.org/10.1111/j.1439-0418.2010.01539.x>
- [18] Vautard, R., Builtjes, P. J. H., Thunis, P., Cuvelier, C., Bedogni, M., Bessagnet, B., Honore, C., Moussiopoulos, N., Pirovano, G., Schaap, M., Stern, R., Tarrason, L., & Wind, P. (2007). Evaluation and intercomparison of Ozone and PM10 simulations by several chemistry transport models over four European cities within the CityDelta project. *Atmospheric Environment*, 41, 173–188. <https://doi.org/10.1016/j.atmosenv.2006.07.039>
- [19] Stern, R., Builtjes, P. J. H., Schaap, M., Timmermans, R., Vautard, R., Hodzic, A., Memmesheimer, M., Feldmann, H., Renner, E., Wolke, R., Kerschbaumer, A., Liu, B. C., Binaykia, A., Chang, P. C., Tiwari, M. K., Tsao, C. C., Srivastava, N., Mansimov, E., Salakhutdinov, R., ... Bui, T. (2017). A model inter-comparison study focussing on episodes with elevated PM10 concentrations. *Atmospheric Environment*, 42(19), 4567–4588. <https://doi.org/10.1016/j.neucom.2018.06.049>
- [20] Saide, P. E., Carmichael, G. R., Spak, S. N., Gallardo, L., Osses, A. E., Mena-Carrasco, M. A., & Pagowski, M. (2011). Forecasting urban PM10 and PM2.5 pollution episodes in very stable nocturnal conditions and complex terrain using WRF–Chem CO tracer model. *Atmospheric Environment*, 45(16), 2769–2780.
<https://doi.org/https://doi.org/10.1016/j.atmosenv.2011.02.001>
- [21] Goyal, P., Chan, A. T., & Jaiswal, N. (2006). Statistical models for the prediction of respirable suspended particulate matter in urban cities. *Atmospheric Environment*, 40(11), 2068–2077. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2005.11.041>
- [22] Díaz-Robles, L. A., Ortega, J. C., Fu, J. S., Reed, G. D., Chow, J. C., Watson, J. G., & Moncada-Herrera, J. A. (2008). A hybrid ARIMA and artificial neural networks model to forecast particulate matter in urban areas: The case of Temuco, Chile. *Atmospheric Environment*, 42(35), 8331–8340. <https://doi.org/10.1016/j.atmosenv.2008.07.020>

- [23] Chen, Y., Shi, R., Shu, S., & Gao, W. (2013). Ensemble and enhanced PM10 concentration forecast model based on stepwise regression and wavelet analysis. *Atmospheric Environment*, 74, 346–359. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2013.04.002>
- [24] Alimissis, A., Philippopoulos, K., Tzanis, C. G., & Deligiorgi, D. (2018). Spatial estimation of urban air pollution with the use of artificial neural network models. *Atmospheric Environment*, 191, 205–213. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2018.07.058>
- [25] Yang, Z., & Wang, J. (2017). A new air quality monitoring and early warning system: Air quality assessment and air pollutant concentration prediction. *Environmental Research*, 158, 105–117. <https://doi.org/https://doi.org/10.1016/j.envres.2017.06.002>
- [26] Antanasijević, D. Z., Pocajt, V. V, Povrenović, D. S., Ristić, M. Đ., & Perić-Grujić, A. A. (2013). PM10 emission forecasting using artificial neural networks and genetic algorithm input variable optimization. *Science of The Total Environment*, 443, 511–519. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2012.10.110>
- [27] Mishra, D., & Goyal, P. (2016). Neuro-fuzzy approach to forecast NO2 pollutants addressed to air quality dispersion model over Delhi, India. *Aerosol and Air Quality Research*, 16(1), 166–174. <https://doi.org/10.4209/aaqr.2015.04.0249>
- [28] Paschalidou, A., Karakitsios, S., Kleanthous, S., & Kassomenos, P. (2011). Forecasting hourly PM10 concentration in Cyprus through artificial neural networks and multiple regression models: Implications to local environmental management. *Environmental Science and Pollution Research International*, 18, 316–327. <https://doi.org/10.1007/s11356-010-0375-2>
- [29] Kolehmainen, M., Martikainen, H., & Ruuskanen, J. (2001). Neural Networks and Periodic Components Used in Air Quality Forecasting. *Atmospheric Environment*, 35, 815–825. [https://doi.org/10.1016/S1352-2310\(00\)00385-X](https://doi.org/10.1016/S1352-2310(00)00385-X)
- [30] Kang, Z., Qu, Z., Kim, M. H., Kim, Y. S., Lim, J., Kim, J. T., Sung, S. W., & Yoo, C. (2017). Data-driven prediction model of indoor air quality in an underground space. 2017 2nd IEEE International Conference on Computational Intelligence and Applications (ICCI), 27(6), 1675–1680. <https://doi.org/10.1007/s11814-010-0313-5>

- [31] Feng, Y., Zhang, W., Sun, D., & Zhang, L. (2011). Ozone concentration forecast method based on genetic algorithm optimized back propagation neural networks and support vector machine data classification. *Atmospheric Environment*, 45(11), 1979–1985. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2011.01.022>
- [32] Prakash, A., Kumar, U., Kumar, K., & Jain, V. (2011). A Wavelet-based Neural Network Model to Predict Ambient Air Pollutants' Concentration. *Environmental Modeling & Assessment*, 16, 503–517. <https://doi.org/10.1007/s10666-011-9270-6>
- [33] Li, Xiang, Peng, L., Yao, X., Cui, S., Hu, Y., You, C., & Chi, T. (2017). Long short-term memory neural network for air pollutant concentration predictions: Method development and evaluation. *Environmental Pollution*, 231(December), 997–1004. <https://doi.org/10.1016/j.envpol.2017.08.114>
- [34] Reddy, V., Yedavalli, P., Mohanty, S., & Nakhat, U. (2017). Deep Air: Forecasting Air Pollution in Beijing, China.
- [35] K ok, İ., Şimşek, M. U., &  zdemir, S. (2017). A deep learning model for air quality prediction in smart cities. *2017 IEEE International Conference on Big Data (Big Data)*, 1983–1990. <https://doi.org/10.1109/BigData.2017.8258144>
- [36] Liu, B., Yan, S., Li, J., Qu, G., Li, Y., Lang, J., & Gu, R. (2019). A Sequence-to-Sequence Air Quality Predictor Based on the n-Step Recurrent Prediction. *IEEE Access*, 7, 43331–43345. <https://doi.org/10.1109/ACCESS.2019.2908081>
- [37] Soh, P. W., Chang, J. W., & Huang, J. W. (2018). Adaptive Deep Learning-Based Air Quality Prediction Model Using the Most Relevant Spatial-Temporal Relations. *IEEE Access*, 6, 38186–38199. <https://doi.org/10.1109/ACCESS.2018.2849820>
- [38] Qi, Y., Li, Q., Karimian, H., Liu, D., Gong, Y., Liu, L., Yang, M., Bourdev, L., Soh, P., Chang, J., Huang, J., Stojov, V., Koteli, N., & Lameski, P. (2019). A hybrid model for spatiotemporal forecasting of PM2.5 based on graph convolutional neural network and long short-term memory. *Science of The Total Environment*, 664(2014), 1–10. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.01.333>
- [39] Fan, J., Li, Q., Hou, J., Feng, X., Karimian, H., & Lin, S. (2013). A spatiotemporal prediction framework for air pollution based on deep RNN.

- ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 4(4W2), 15–22. <https://doi.org/10.5194/isprs-annals-IV-4-W2-15-2017>
- [40] Zhang, C., Yan, J., Li, C., Rui, X., Liu, L., & Bie, R. (2016). On estimating air pollution from photos using convolutional neural network. *MM 2016 - Proceedings of the 2016 ACM Multimedia Conference*, 297–301. <https://doi.org/10.1145/2964284.2967230>
- [41] Li, Xiang, Peng, L., Hu, Y., Shao, J., & Chi, T. (2016). Deep learning architecture for air quality predictions. *Environmental Science and Pollution Research*, 23(22), 22408–22417. <https://doi.org/10.1007/s11356-016-7812-9>
- [42] Bui, T., Le, V.-D., & Cha, S.-K. (2018). A Deep Learning Approach for Forecasting Air Pollution in South Korea Using LSTM. <http://arxiv.org/abs/1804.07891>
- [43] Zhao, X., Zhang, R., Wu, J. L., & Chang, P. C. (2018). A deep recurrent neural network for air quality classification. *Journal of Information Hiding and Multimedia Signal Processing*, 9(2), 346–354.
- [44] Wang, J., & Song, G. (2018). A Deep Spatial-Temporal Ensemble Model for Air Quality Prediction. *Neurocomputing*, 314, 198–206. <https://doi.org/10.1016/j.neucom.2018.06.049>
- [45] Lee, S., & Shin, J. (2019). Hybrid Model of Convolutional LSTM and CNN to Predict Particulate Matter. *International Journal of Information and Electronics Engineering*, 9(1), 34–38. <https://doi.org/10.18178/ijiee.2019.9.1.701>
- [46] Pak, U., Ma, J., Ryu, U., Ryom, K., Juhyok, U., Pak, K., & Pak, C. (2020). Deep learning-based PM_{2.5} prediction considering the spatiotemporal correlations: A case study of Beijing, China. *Science of The Total Environment*, 699, 133561. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.07.367>
- [47] Ma, J., Cheng, J. C. P. P., Lin, C., Tan, Y., & Zhang, J. (2019). Improving air quality prediction accuracy at larger temporal resolutions using deep learning and transfer learning techniques. *Atmospheric Environment*, 214(July), 116885.

- [48] Singh, K. P., Gupta, S., Kumar, A., & Shukla, S. P. (2012). Linear and nonlinear modeling approaches for urban air quality prediction. *Science of The Total Environment*, 426, 244–255. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2012.03.076>
- [49] Kwok, L. K., Lam, Y. F., & Tam, C.-Y. (2017). Developing a statistical based approach for predicting local air quality in complex terrain area. *Atmospheric Pollution Research*, 8(1), 114–126. <https://doi.org/https://doi.org/10.1016/j.apr.2016.08.001>
- [50] Coats, C. J. J., & Coats C J [MCNC Environmental Programs, Research Triangle Park, NC (United States)], J. (1996). High Performance Algorithms In The Sparse Matrix Operator Kernel Emissions (smoke) Modeling System. Proc. Ninth AMS Joint Conference on Applications of <https://www.osti.gov/biblio/422986>
- [51] Olatinwo, R. O., Prabha, T., Paz, J. O., Riley, D. G., & Hoogenboom, G. (2010). The Weather Research and Forecasting (WRF) model: Application in prediction of TSWV-vectors populations. *Journal of Applied Entomology*, 135(1-2), 81–90. <https://doi.org/10.1111/j.1439-0418.2010.01539.x>
- [52] Byun, D. W., & Ching, J. K. S. (1999). Science Algorithms of the EPA Models-3 Community Multiscale Air Quality (CMAQ) modeling system. *United States Environmental Protection Agency*, 44(6), 1765–1778.
- [53] Grell, G. A., Peckham, S. E., Schmitz, R., McKeen, S. A., Frost, G., Skamarock, W. C., & Eder, B. (2005). Fully coupled “online” chemistry within the WRF model. *Atmospheric Environment*, 39(37), 6957–6975. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2005.04.027>
- [54] Saide, P. E., Carmichael, G. R., Spak, S. N., Gallardo, L., Osses, A. E., Mena-Carrasco, M. A., & Pagowski, M. (2011). Forecasting urban PM10 and PM2.5 pollution episodes in very stable nocturnal conditions and complex terrain using WRF–Chem CO tracer model. *Atmospheric Environment*, 45(16), 2769–2780. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2011.02.001>
- [55] Vautard, R., Builtjes, P. J. H., Thunis, P., Cuvelier, C., Bedogni, M., Bessagnet, B., Honore, C., Moussiopoulos, N., Pirovano, G., Schaap, M., Stern, R., Tarrason, L., & Wind, P. (2007). Evaluation and intercomparison of Ozone and PM10 simulations by several chemistry transport models over four

- European cities within the CityDelta project. *Atmospheric Environment*, 41, 173–188. <https://doi.org/10.1016/j.atmosenv.2006.07.039>
- [56] Wang, Z., Maeda, T., Hayashi, M., Hsiao, L.-F., & Liu, K.-Y. (2001). A Nested Air Quality Prediction Modeling System for Urban and Regional Scales: Application for High-Ozone Episode in Taiwan. *Water, Air, and Soil Pollution*, 130(1), 391–396. <https://doi.org/10.1023/A:1013833217916>
- [57] Stern, R., Builtjes, P., Schaap, M., Timmermans, R., Vautard, R., Hodzic, A., ... Kerschbaumer, A. (2008). A model inter-comparison study focussing on episodes with elevated PM10 concentrations. *Atmospheric Environment*, 42(19), 4567–4588. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2008.01.068>
- [58] Suleiman, A., Tight, M. R., & Quinn, A. D. (2019). Applying machine learning methods in managing urban concentrations of traffic-related particulate matter (PM10 and PM2.5). *Atmospheric Pollution Research*, 10(1), 134–144. <https://doi.org/https://doi.org/10.1016/j.apr.2018.07.001>
- [59] Catalano, M., & Galatioto, F. (2017). Enhanced transport-related air pollution prediction through a novel metamodel approach. *Transportation Research Part D: Transport and Environment*, 55, 262–276. <https://doi.org/https://doi.org/10.1016/j.trd.2017.07.009>
- [60] Li, C., Hsu, N. C., & Tsay, S.-C. (2011). A study on the potential applications of satellite data in air quality monitoring and forecasting. *Atmospheric Environment*, 45(22), 3663–3675. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2011.04.032>
- [61] Jian, L., Zhao, Y., Zhu, Y.-P., Zhang, M.-B., & Bertolatti, D. (2012). An application of ARIMA model to predict submicron particle concentrations from meteorological factors at a busy roadside in Hangzhou, China. *Science of The Total Environment*, 426, 336–345. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2012.03.025>
- [62] Slini, T., Karatzas, K., & Moussiopoulos, N. (2002). Statistical analysis of environmental data as the basis of forecasting: an air quality application. *Science of The Total Environment*, 288(3), 227–237. [https://doi.org/https://doi.org/10.1016/S0048-9697\(01\)00991-3](https://doi.org/https://doi.org/10.1016/S0048-9697(01)00991-3)

- [63] Davis, J. M., & Speckman, P. (1999). A model for predicting maximum and 8h average ozone in Houston. *Atmospheric Environment*, 33(16), 2487–2500. [https://doi.org/https://doi.org/10.1016/S1352-2310\(98\)00320-3](https://doi.org/https://doi.org/10.1016/S1352-2310(98)00320-3)
- [64] Hu, X., Waller, L. A., Al-Hamdan, M. Z., Crosson, W. L., Estes, M. G., Estes, S. M., ... Liu, Y. (2013). Estimating ground-level PM2.5 concentrations in the southeastern U.S. using geographically weighted regression. *Environmental Research*, 121, 1–10. <https://doi.org/https://doi.org/10.1016/j.envres.2012.11.003>
- [65] Goyal, P., Chan, A. T., & Jaiswal, N. (2006). Statistical models for the prediction of respirable suspended particulate matter in urban cities. *Atmospheric Environment*, 40(11), 2068–2077. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2005.11.041>
- [66] Song, X.-Y., Gao, Y., Peng, Y., Huang, S., Liu, C., & Peng, Z.-R. (2021). A machine learning approach to modelling the spatial variations in the daily fine particulate matter (PM2.5) and nitrogen dioxide (NO2) of Shanghai, China. *Environment and Planning B: Urban Analytics and City Science*, 48(3), 467–483. <https://doi.org/10.1177/2399808320975031>
- [67] Cabaneros, S. M., Calautit, J. K., & Hughes, B. R. (2019). A review of artificial neural network models for ambient air pollution prediction. *Environmental Modelling & Software*, 119, 285–304. <https://doi.org/https://doi.org/10.1016/j.envsoft.2019.06.014>
- [68] Wang, R., Bei, N., Wu, J., Li, X., Liu, S., Yu, J., ... Li, G. (2022). Cropland nitrogen dioxide emissions and effects on the ozone pollution in the North China plain. *Environmental Pollution*, 294, 118617. <https://doi.org/https://doi.org/10.1016/j.envpol.2021.118617>
- [69] Lu, W. Z., Wang, W. J., Fan, H. Y., Leung, A. Y. T., Xu, Z. B., Lo, S. M., & Wong, J. C. K. (2002). Prediction of pollutant levels in Causeway Bay area of Hong Kong using an improved neural network model. *Journal of Environmental Engineering*, 128(12), 1146–1157. [https://doi.org/10.1061/\(ASCE\)0733-9372\(2002\)128:12\(1146\)](https://doi.org/10.1061/(ASCE)0733-9372(2002)128:12(1146))
- [70] Osowski, S., & Garanty, K. (2007). Forecasting of the daily meteorological pollution using wavelets and support vector machine. *Engineering Applications of Artificial Intelligence*, 20(6), 745–755. <https://doi.org/10.1016/j.engappai.2006.10.008>

- [71] García Nieto, P. J., Combarro, E. F., del Coz Díaz, J. J., Montañés, E., Garcia Nieto, P. J., Combarro, E. F., ... Montañés, E. (2013). A SVM-based regression model to study the air quality at local scale in Oviedo urban area (Northern Spain): A case study. *Applied Mathematics and Computation*, 219(17), 8923–8937. <https://doi.org/10.1016/j.amc.2013.03.018>
- [72] Sun, W., & Sun, J. (2017). Daily PM_{2.5} concentration prediction based on principal component analysis and LSSVM optimized by cuckoo search algorithm. *Journal of Environmental Management*, 188, 144–152. <https://doi.org/https://doi.org/10.1016/j.jenvman.2016.12.011>
- [73] Qi, Z., Wang, T., Song, G., Hu, W., Li, X., Zhongfei, & Zhang. (2017). Deep Air Learning: Interpolation, Prediction, and Feature Analysis of Fine-grained Air Quality. *IEEE Transactions on Knowledge and Data Engineering*, PP. <https://doi.org/10.1109/TKDE.2018.2823740>
- [74] Hooyberghs, J., Mensink, C., Dumont, G., Fierens, F., & Brasseur, O. (2005). A neural network forecast for daily average PM₁₀ concentrations in Belgium. *Atmospheric Environment*, 39(18), 3279–3289. <https://doi.org/10.1016/j.atmosenv.2005.01.050>
- [75] Díaz-Robles, L. A., Ortega, J. C., Fu, J. S., Reed, G. D., Chow, J. C., Watson, J. G., & Moncada-Herrera, J. A. (2008). A hybrid ARIMA and artificial neural networks model to forecast particulate matter in urban areas: The case of Temuco, Chile. *Atmospheric Environment*, 42(35), 8331–8340. <https://doi.org/10.1016/j.atmosenv.2008.07.020>
- [76] Chen, Y., Shi, R., Shu, S., & Gao, W. (2013). Ensemble and enhanced PM₁₀ concentration forecast model based on stepwise regression and wavelet analysis. *Atmospheric Environment*, 74, 346–359. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2013.04.002>
- [77] Alimissis, A., Philippopoulos, K., Tzani, C. G., & Deligiorgi, D. (2018). Spatial estimation of urban air pollution with the use of artificial neural network models. *Atmospheric Environment*, 191, 205–213. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2018.07.058>
- [78] Yang, Z., & Wang, J. (2017). A new air quality monitoring and early warning system: Air quality assessment and air pollutant concentration prediction. *Environmental Research*, 158, 105–117. <https://doi.org/https://doi.org/10.1016/j.envres.2017.06.002>

- [79] Lu, W. Z., Wang, W. J., Fan, H. Y., Leung, A. Y. T., Xu, Z. B., Lo, S. M., & Wong, J. C. K. (2002). Prediction of pollutant levels in Causeway Bay area of Hong Kong using an improved neural network model. *Journal of Environmental Engineering*, 128(12), 1146–1157. [https://doi.org/10.1061/\(ASCE\)0733-9372\(2002\)128:12\(1146\)](https://doi.org/10.1061/(ASCE)0733-9372(2002)128:12(1146))
- [80] Paschalidou, A., Karakitsios, S., Kleanthous, S., & Kassomenos, P. (2011). Forecasting hourly PM10 concentration in Cyprus through artificial neural networks and multiple regression models: Implications to local environmental management. *Environmental Science and Pollution Research International*, 18, 316–327. <https://doi.org/10.1007/s11356-010-0375-2>
- [81] Kolehmainen, M., Martikainen, H., & Ruuskanen, J. (2001). Neural Networks and Periodic Components Used in Air Quality Forecasting. *Atmospheric Environment*, 35, 815–825. [https://doi.org/10.1016/S1352-2310\(00\)00385-X](https://doi.org/10.1016/S1352-2310(00)00385-X)
- [82] Kang, Z., Qu, Z., Kim, M. H., Kim, Y. S., Lim, J., Kim, J. T., Sung, S. W., & Yoo, C. (2017). Data-driven prediction model of indoor air quality in an underground space. 2017 2nd IEEE International Conference on Computational Intelligence and Applications (ICCI), 27(6), 1675–1680. <https://doi.org/10.1007/s11814-010-0313-5>
- [83] Feng, Y., Zhang, W., Sun, D., & Zhang, L. (2011). Ozone concentration forecast method based on genetic algorithm optimized back propagation neural networks and support vector machine data classification. *Atmospheric Environment*, 45(11), 1979–1985. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2011.01.022>
- [84] Antanasijević, D. Z., Pocajt, V. V, Povrenović, D. S., Ristić, M. Đ., & Perić-Grujić, A. A. (2013). PM10 emission forecasting using artificial neural networks and genetic algorithm input variable optimization. *Science of The Total Environment*, 443, 511–519. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2012.10.110>
- [85] Mishra, D., & Goyal, P. (2016). Neuro-fuzzy approach to forecast NO2 pollutants addressed to air quality dispersion model over Delhi, India. *Aerosol and Air Quality Research*, 16(1), 166–174. <https://doi.org/10.4209/aaqr.2015.04.0249>

-
- [86] Rubal, & Kumar, D. (2018). Evolving Differential evolution method with random forest for prediction of Air Pollution. *Procedia Computer Science*, 132, 824–833. <https://doi.org/https://doi.org/10.1016/j.procs.2018.05.094>
- [87] Lin, Y., & Cobourn, W. G. (2007). Fuzzy system models combined with nonlinear regression for daily ground-level ozone predictions. *Atmospheric Environment*, 41(16), 3502–3513. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2006.11.060>
- [88] Neagu, C.-D., Avouris, N., Kalapanidas, E., & Palade, V. (2002). Neural and Neuro-Fuzzy Integration in a Knowledge-Based System for Air Quality Prediction. *Applied Intelligence*, 17(2), 141–169. <https://doi.org/10.1023/A:1016108730534>
- [89] Kim, T.-H., Park, D.-C., Woo, D.-M., Huh, W., Yoon, C.-H., Kim, H.-U., & Lee, Y. (2010). Sunspot series prediction using a Multiscale Recurrent Neural Network. *The 10th IEEE International Symposium on Signal Processing and Information Technology*, 399–403. <https://doi.org/10.1109/ISSPIT.2010.5711781>
- [90] Prakash, A., Kumar, U., Kumar, K., & Jain, V. (2011). A Wavelet-based Neural Network Model to Predict Ambient Air Pollutants' Concentration. *Environmental Modeling & Assessment*, 16, 503–517. <https://doi.org/10.1007/s10666-011-9270-6>
- [91] Ong, B. T., Sugiura, K., & Zettsu, K. (2016). Dynamically pre-trained deep recurrent neural networks using environmental monitoring data for predicting PM2.5. *Neural Computing and Applications*, 27(6), 1553–1566. <https://doi.org/10.1007/s00521-015-1955-3>
- [92] Schmidhuber, J. (2015). Deep learning in neural networks: An overview. *Neural Networks*, 61, 85–117. <https://doi.org/https://doi.org/10.1016/j.neunet.2014.09.003>
- [93] Itamar Arel, Derek C. Rose, T. P. K. (2010). Deep Machine Learning—A New Frontier .pdf. *Ieee*, (November), 13–18.
- [94] Hochreiter, S., & Schmidhuber, J. (1997). Long Short-Term Memory. *Neural Computation*, 9(8), 1735–1780. <https://doi.org/10.1162/neco.1997.9.8.1735>
- [95] Liu, B., Yan, S., Li, J., Qu, G., Li, Y., Lang, J., & Gu, R. (2019). A Sequence-to-Sequence Air Quality Predictor Based on the n-Step Recurrent Prediction.

- IEEE Access, 7, 43331–43345.
<https://doi.org/10.1109/ACCESS.2019.2908081>
- [96] K k,  .,  im sek, M. U., &  zdemir, S. (2017). A deep learning model for air quality prediction in smart cities. 2017 IEEE International Conference on Big Data (Big Data), 1983–1990. <https://doi.org/10.1109/BigData.2017.8258144>
- [97] Soh, P. W., Chang, J. W., & Huang, J. W. (2018). Adaptive Deep Learning-Based Air Quality Prediction Model Using the Most Relevant Spatial-Temporal Relations. IEEE Access, 6, 38186–38199. <https://doi.org/10.1109/ACCESS.2018.2849820>
- [98] Qi, Y., Li, Q., Karimian, H., Liu, D., Gong, Y., Liu, L., Yang, M., Bourdev, L., Soh, P., Chang, J., Huang, J., Stojov, V., Koteli, N., & Lameski, P. (2019). A hybrid model for spatiotemporal forecasting of PM2.5 based on graph convolutional neural network and long short-term memory. *Science of The Total Environment*, 664(2014), 1–10. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.01.333>
- [99] Fan, J., Li, Q., Hou, J., Feng, X., Karimian, H., & Lin, S. (2013). A spatiotemporal prediction framework for air pollution based on deep RNN. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 4(4W2), 15–22. <https://doi.org/10.5194/isprs-annals-IV-4-W2-15-2017>
- [100] Zhang, C., Yan, J., Li, C., Rui, X., Liu, L., & Bie, R. (2016). On estimating air pollution from photos using convolutional neural network. *MM 2016 - Proceedings of the 2016 ACM Multimedia Conference*, 297–301. <https://doi.org/10.1145/2964284.2967230>
- [101] Li, Xiang, Peng, L., Hu, Y., Shao, J., & Chi, T. (2016). Deep learning architecture for air quality predictions. *Environmental Science and Pollution Research*, 23(22), 22408–22417. <https://doi.org/10.1007/s11356-016-7812-9>
- [102] Li, Xiang, Peng, L., Yao, X., Cui, S., Hu, Y., You, C., & Chi, T. (2017). Long short-term memory neural network for air pollutant concentration predictions: Method development and evaluation. *Environmental Pollution*, 231(December), 997–1004. <https://doi.org/10.1016/j.envpol.2017.08.114>
- [103] Wang, J., & Song, G. (2018). A Deep Spatial-Temporal Ensemble Model for Air Quality Prediction. *Neurocomputing*, 314, 198–206. <https://doi.org/10.1016/j.neucom.2018.06.049>

-
- [104] Bui, T., Le, V.-D., & Cha, S.-K. (2018). A Deep Learning Approach for Forecasting Air Pollution in South Korea Using LSTM. <http://arxiv.org/abs/1804.07891>
- [105] Zhao, X., Zhang, R., Wu, J. L., & Chang, P. C. (2018). A deep recurrent neural network for air quality classification. *Journal of Information Hiding and Multimedia Signal Processing*, 9(2), 346–354.
- [106] Lee, S., & Shin, J. (2019). Hybrid Model of Convolutional LSTM and CNN to Predict Particulate Matter. *International Journal of Information and Electronics Engineering*, 9(1), 34–38. <https://doi.org/10.18178/ijiee.2019.9.1.701>
- [107] Ma, J., Cheng, J. C. P. P., Lin, C., Tan, Y., & Zhang, J. (2019). Improving air quality prediction accuracy at larger temporal resolutions using deep learning and transfer learning techniques. *Atmospheric Environment*, 214(July), 116885.
- [108] Pak, U., Ma, J., Ryu, U., Ryom, K., Juhyok, U., Pak, K., & Pak, C. (2020). Deep learning-based PM_{2.5} prediction considering the spatiotemporal correlations: A case study of Beijing, China. *Science of The Total Environment*, 699, 133561. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.07.367>
- [109] Le, V., Bui, T., & Cha, S. (2020). Spatiotemporal Deep Learning Model for Citywide Air Pollution Interpolation and Prediction. 2020 IEEE International Conference on Big Data and Smart Computing (BigComp), 55–62. <https://doi.org/10.1109/BigComp48618.2020.00-99>
- [110] Cheng, X., Zhang, W., Wenzel, A., & Chen, J. (2022). Stacked ResNet-LSTM and CORAL model for multi-site air quality prediction. *Neural Computing and Applications*, 34(16), 13849–13866. <https://doi.org/10.1007/s00521-022-07175-8>
- [111] Zhang, B., Zou, G., Qin, D., Ni, Q., Mao, H., & Li, M. (2022). RCL-Learning: ResNet and convolutional long short-term memory-based spatiotemporal air pollutant concentration prediction model. *Expert Systems with Applications*, 207, 118017. <https://doi.org/https://doi.org/10.1016/j.eswa.2022.118017>
- [112] Zhang, B., Zou, G., Qin, D., Lu, Y., Jin, Y., & Wang, H. (2021). A novel Encoder-Decoder model based on read-first LSTM for air pollutant prediction.

-
- Science of The Total Environment, 765, 144507.
<https://doi.org/https://doi.org/10.1016/j.scitotenv.2020.144507>
- [113] Gao, X., & Li, W. (2021). A graph-based LSTM model for PM2.5 forecasting. *Atmospheric Pollution Research*, 12(9), 101150. <https://doi.org/https://doi.org/10.1016/j.apr.2021.101150>
- [114] Gnauck, A. (2004). Interpolation and approximation of water quality time series and process identification. *Analytical and Bioanalytical Chemistry*, 380(3), 484–492. <https://doi.org/10.1007/s00216-004-2799-3>
- [115] Kalchbrenner, N., & Blunsom, P. (2013). Recurrent Continuous Translation Models. *Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing*, 1700–1709. Retrieved from <https://www.aclweb.org/anthology/D13-1176>
- [116] Sutskever, I., Vinyals, O., & Le, Q. V. (2014). Sequence to sequence learning with neural networks. *Advances in Neural Information Processing Systems*, 4(January), 3104–3112.
- [117] Liu, B., Yan, S., Li, J., Qu, G., Li, Y., Lang, J., & Gu, R. (2019). A Sequence-to-Sequence Air Quality Predictor Based on the n-Step Recurrent Prediction. *IEEE Access*, 7, 43331–43345. <https://doi.org/10.1109/ACCESS.2019.2908081>
- [118] Lipton, Z. C., Berkowitz, J., & Elkan, C. (2015). A Critical Review of Recurrent Neural Networks for Sequence Learning. Retrieved from <http://arxiv.org/abs/1506.00019>
- [119] Hochreiter, S., & Schmidhuber, J. (1997). Long Short-Term Memory. *Neural Computation*, 9(8), 1735–1780. <https://doi.org/10.1162/neco.1997.9.8.1735>
- [120] Sutskever, I., Vinyals, O., & Le, Q. V. (2014). Sequence to sequence learning with neural networks. *Advances in Neural Information Processing Systems*, 4(January), 3104–3112.
- [121] Graves, A., & Schmidhuber, J. (2005). Framewise phoneme classification with bidirectional LSTM and other neural network architectures. *Neural Networks*, 18(5), 602–610. <https://doi.org/https://doi.org/10.1016/j.neunet.2005.06.042>
- [122] Ji, S., Xu, W., Yang, M., & Yu, K. (2013). 3D Convolutional Neural Networks for Human Action Recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 35(1), 221–231.

- <https://doi.org/10.1109/TPAMI.2012.59>
- [123] He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep Residual Learning for Image Recognition. 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 770–778. <https://doi.org/10.1109/CVPR.2016.90>
- [124] SHI, X., Chen, Z., Wang, H., Yeung, D.-Y., Wong, W., & WOO, W. (2015). Convolutional LSTM Network: A Machine Learning Approach for Precipitation Nowcasting. In C. Cortes, N. D. Lawrence, D. D. Lee, M. Sugiyama, & R. Garnett (Eds.), *Advances in Neural Information Processing Systems 28* (pp. 802–810).
- [125] Wang, H., Djemal, K., Feiz, A. A., & Chaudhuri, S. S. (2023). Prediction of Air Pollutant Concentrations in Airport Areas using Machine Learning Architecture. *2023 Twelfth International Conference on Image Processing Theory, Tools and Applications (IPTA)*, 1–6. <https://doi.org/10.1109/IPTA59101.2023.10320011>
- [126] Wu, Z., Rincon, D., Luo, J., & Christofides, P. D. (2021). Machine learning modeling and predictive control of nonlinear processes using noisy data. *AICHE Journal*, 67(4), e17164. <https://doi.org/https://doi.org/10.1002/aic.17164>
- [127] Zhang, B., Zhang, H., Zhao, G., & Lian, J. (2020). Constructing a PM2.5 concentration prediction model by combining auto-encoder with Bi-LSTM neural networks. *Environmental Modelling & Software*, 124, 104600. <https://doi.org/https://doi.org/10.1016/j.envsoft.2019.104600>
- [128] Essien, A., & Giannetti, C. (2020). A Deep Learning Model for Smart Manufacturing Using Convolutional LSTM Neural Network Autoencoders. *IEEE Transactions on Industrial Informatics*, 16(9), 6069–6078. <https://doi.org/10.1109/TII.2020.2967556>
- [129] Prakash, A., Kumar, U., Kumar, K., & Jain, V. (2011). A Wavelet-based Neural Network Model to Predict Ambient Air Pollutants' Concentration. *Environmental Modeling & Assessment*, 16, 503–517. <https://doi.org/10.1007/s10666-011-9270-6>

-
- [130] Ma, J., Cheng, J. C. P. P., Lin, C., Tan, Y., & Zhang, J. (2019). Improving air quality prediction accuracy at larger temporal resolutions using deep learning and transfer learning techniques. *Atmospheric Environment*, 214(July), 116885.
- [131] Zivot, E., & Wang, J. (Eds.). (2006). *Rolling Analysis of Time Series BT - Modeling Financial Time Series with S-PLUS®*. https://doi.org/10.1007/978-0-387-32348-0_9
- [132] Ramachandran, P., Zoph, B., & Le, Q. V. (2018). Searching for activation functions. 6th International Conference on Learning Representations, ICLR 2018 - Workshop Track Proceedings, abs/1710.0.
- [133] Chang, J. C., & Hanna, S. R. (2004). Air quality model performance evaluation. *Meteorology and Atmospheric Physics*, 87(1), 167–196. <https://doi.org/10.1007/s00703-003-0070-7>
- [134] Mishra, D., Goyal, P., & Upadhyay, A. (2015). Artificial intelligence based approach to forecast PM_{2.5} during haze episodes: A case study of Delhi, India. *Atmospheric Environment*, 102, 239–248. <https://doi.org/https://doi.org/10.1016/j.atmosenv.2014.11.050>
- [135] Schroeder, D. J. (1999). *Astronomical optics* (2nd ed.). Academic Press. p. 278. ISBN 978-0-12-629810-9, p.278
- [136] Willmott, C. J. (1981). ON THE VALIDATION OF MODELS. *Physical Geography*, 2(2), 184–194. <https://doi.org/10.1080/02723646.1981.10642213>
- [137] AgriMetSoft (2019). Online Calculators. Available on: <https://agrimetsoft.com/calculators/Index%20of%20Agreement>
- [138] Samal, K. K. R., Panda, A. K., Babu, K. S., & Das, S. K. (2021). Multi-output TCN autoencoder for long-term pollution forecasting for multiple sites. *Urban Climate*, 39, 100943. <https://doi.org/https://doi.org/10.1016/j.uclim.2021.100943>
- [139] Masood, A., & Ahmad, K. (2020). A model for particulate matter (PM_{2.5}) prediction for Delhi based on machine learning approaches. *Procedia Computer Science*, 167, 2101–2110. <https://doi.org/10.1016/j.procs.2020.03.258>
- [140] Bera, B., Bhattacharjee, S., Shit, P. K., Sengupta, N., & Saha, S. (2021).

- Significant impacts of COVID-19 lockdown on urban air pollution in Kolkata (India) and amelioration of environmental health. *Environment, Development and Sustainability*, 23(5), 6913–6940. <https://doi.org/10.1007/s10668-020-00898-5>
- [141] Middya, A. I., & Roy, S. (2022). Pollutant specific optimal deep learning and statistical model building for air quality forecasting. *Environmental Pollution*, 301, 118972. <https://doi.org/https://doi.org/10.1016/j.envpol.2022.118972>
- [142] Kumar, S., Mishra, S., & Singh, S. K. (2020). A machine learning-based model to estimate PM_{2.5} concentration levels in Delhi's atmosphere. *Heliyon*, 6(11), e05618. <https://doi.org/https://doi.org/10.1016/j.heliyon.2020.e05618>
- [143] Bond, T. C., et al. (2013). Bounding the role of black carbon in the climate system: A scientific assessment. *Journal of Geophysical Research: Atmospheres*, 118(11), 5380–5552.
- [144] Ramanathan, V., & Carmichael, G. (2008). Global and regional climate changes due to black carbon. *Nature Geoscience*, 1(4), 221–227.
- [145] Pöschl, U. (2005). Atmospheric aerosols: Composition, transformation, climate, and health effects. *Angewandte Chemie International Edition*, 44(46), 7520–7540.
- [146] Fiore, A. M., Naik, V., & Leibensperger, E. M. (2015). Air quality and climate connections. *Journal of the Air & Waste Management Association*, 65(6), 645–685.
- [147] World Health Organization (WHO). (2021). Air pollution. Retrieved from: <https://www.who.int>

7 Appendix

7.1 Line plot of input data:

























