CHAPTER

5
AIR POLLUTION INDEX FORECASTING WITH SARIMA MODEL

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5.1 INTRODUCTION

The existence of contaminations or pollutants in the environment that are detrimental to the health of humans and other living organisms which will harm the ecosystem or crops, is known as air pollution. Sulphur dioxide, particulate matter in the atmosphere, nitrogen compounds, carbon monoxide, and ozone are all considered as standard markers of air quality (Viotti et al., 2002). Air pollution control and research have long been the focus of extensive and thorough research in many fields of study. According to Shengdong et al. (2019) forecasting air quality has long been recognised as a major concern to provide air pollution early warning and control.

5.2 AIR POLLUTION EFFECTS ON HEALTH

The world's air quality has been rapidly deteriorating since the industrial revolution, where manufacturing operations release large quantities of poisonous or harmful contaminants into the environment, which can

seriously affect humans, together with animals and plants (Ayturan et al., 2018). In 2006, World Health Organization (WHO) has updated the guidelines for pollutants matter level to be half than the European law's limit values because 80% of the European metropolitan population is exposed to levels of air pollution that exceed WHO limits. The worsening of air pollution levels is considered as one of the key environmental problems worldwide, and scientific evidence correlates significant health consequences with exposure to ambient air pollution (Alimissis et al., 2018).

Carbon monoxide poisoning can occur quickly if ingested in large amounts. Depending on the level of exposure, heavy metals like lead can induce either rapid poisoning or persistent intoxication in humans. The substances induce respiratory problems such as chronic obstructive pulmonary disease (COPD), asthma, and bronchiolitis, as well as lung cancer, cardiovascular events, central nervous system dysfunctions, and skin ailments (Manisalidis et al., 2020). Chronic illnesses such as respiratory, cardiological, and pulmonary inhalation complications and premature and elderly members deaths of the population have been caused by poor air quality especially in the urban areas. Thus, it is extremely crucial for researchers to provide an accurate information regarding the air pollutions to reduce the risk and damages caused by them as well as coming out with a solution on how to minimise it.

5.3 FORECASTING AIR POLLUTANTS

During extremely severe environmental pollution issues, a large amount of relevant research has been undertaken by academicians and the forecasting of air pollution has been one of the supreme concerns (Bai, et al., 2018). Air pollution prediction methods can be narrowly categorised into three common categories: Methods of statistical forecasting, methods of artificial intelligence, and methods of computational and numerical forecasting.

According to Alimissis et al. (2018) there are two methods to perform an air pollutants modelling. The first strategy is the computational

modelling of the dispersion of air pollutants, which includes the simulation of dispersion and transport mechanisms using data from the emission source and knowledge of atmospheric chemical transformations. The second approach, on the other hand, uses advanced mathematical methods, such as machine learning methodologies, to provide data from urban air quality monitoring networks.

The method of applying statistical analysis to a dataset is called statistical modelling and mathematical formulation (or mathematical model) of observed data is a statistical model. Statistical modelling will aid analysts to have a clearer understanding and bigger picture of the data they are investigating, which will further result in a better interpretation of the given datasets. Kaminska (2018) mentioned in his study, with the advancement of computational techniques and machine learning, the issue of choosing an effective model to represent the relationships between air pollution concentration and explanatory variables becomes increasingly difficult. Therefore, it is important to always analyse the data with advanced methods to improve the results and outcome.

5.3.1 Related Works

Ayturan et al. (2018) were very concerned with all the harmful effects of air pollution thus, they came out with research to model air pollution for assessing possible concentrations and to locate the pollutant sources. To minimise levels of pollution, these models may provide policy implications for policymakers, government, and central authorities. Deep learning is a sub-cluster of machine learning, a technique that is one step beyond the artificial neural network (ANN) technique as it uses large amounts of data, resolves issues without dividing, uses more layers, processes sequential layers simultaneously and produces more reliable performance. The author believes that all these beneficial characteristics of deep learning make it an effective tool for modelling air pollution.