An evaluation of air quality during the COVID-19 pandemic.

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Abstract:

This study provides an overview of strikingly changed air quality during the present pandemic same was the motivation for this research, aims and limitations. A machine learning method to analyze the situation is proposed. COVID-19 and air quality are linked to respiratory disease caused by SARS-Cov2 virus and was declared a pandemic by WHO from 11- March-2020. The pandemic infection spreads through human-to-human contact SARS-Cov2 virus. Communicate, and prognosis are potentially affected by many factors, including air quality. An Air Quality Index (AQI) is used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. AQI is a higher risk to human health that impacts the global and human body organs; unfortunately, the massive risk of infection is the severity of the dis- ease.

AQI is paramount to maintain a sustainable environment. Otherwise, it will result in lifelong individual and society problems and cause infection within the human race. Declining AQI intensified pandemic mortalities. During the past pandemics, Spanish flu in 1918 and SARS-CoV-1 in 2003, increased mortality and virulence of respiratory infections and decreased viral clearance the study into the impact between AQI and SARS -Cov2 infection risk. If AQI particle level plays a significant role in COVID-19 incidence, it has a strong relationship for the mitigation strategy required to prevents spreading.

This paper uses a regression model to find during pandemic AQI level and a time series model to predict future year's prediction of the transmission of the exponentially growing current pandemic and air quality. Time-series is to check lockdown line air quality rises or not. Auto-Regressive Integrated Moving Average (ARIMA) model prediction performed on PM25 air particles PM25 and CO level in air quality. The paper highlights the changes in air quality during the pandemic noticed in European countries. The impact of the environment in the pandemic due to changes in air quality is studied. Also, analyze and compare the COVID- 19 air quality situation to previous year pandemics like Spanish flu and Black Death.

Keywords:	Times Series, Arima Model, Deep learning, Fatality Case T-test method, RegistrationOLS model, Xgboost.
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The thesis is a product of a multifaceted one-year endeavour from 2020 to 2021. The study removefocuses on air quality in the pandemic of COVID-19 and its impact on people via machine learning and deep learning technique. The study was with the guidance of Dr. Amin Majd, Researcher in Arcade Applied by Sciences).

I wish to express my deep research s of gratitude to my assessor Dr. Magnus. For his invaluable guidance and inspiration throughout this course of research work. His advice, encouragements, and patience were precious and vital to me to complete this valuable and prestigious work.

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Madhu Singh

1 INTRODUCTION

The pandemic is a reminder of the familiar and delicate relationship between humans and the planet. Efforts to make our global surroundings safe are predestining to fail. They address the critical interface between humans and viruses and the existential hazard of climate (World Health Organization and others, 2020). AQI refers to the impurity of the air by excessive quantities of harmful substances in AQI particulate matter forms.

AQI has several parameters such as Particulate Matter (PM10, PM25), Sulphur dioxide (SO2), Carbon monoxide (CO), Ozone (O3), and Nitrogen dioxide (NO2). Air quality affects public health as respiratory diseases (Marino, 2015) of the virus emerge from various things, including climatic conditions (e.g., temperature, air quality, humidity), inhabited areas, and health quality. Air pollution in many regions and the whole planet has increased bad air quality. Better air quality can reduce both the risks of climate change and COVID-19 spread, but the related common hazards to climate change and COVID-19 are not yet apparent what kind of air pollution (if any) is causing the spread. The information to the Centre for Research on Energy and Clean Air, the methods of SARS-CoV-2, such as quarantine and travel restrictions, have reduced carbon emissions in China by 25 percent. (Giacobbe, 2020), CREA (Centre for Research on Energy and Clean Air) In the first month of the lockdown, due to air traffic reduction, oil refining, and coal consumption.

The European Space Agency saw a significant reduction in nitrous oxide emissions from cars, power plants, and factories in the EU (European Union), a lockdown in the region ESA (European Space Agency), (Manne R. and Kantheti, 2020). The study shows substantial reductions of 40–45% in the first lockdown in southern Europe, such as Spain, Italy, and France. After lockdown, the data suggests that the concentrations are still 10% to 20% lower than before COVID-19 ESA, (Myllyvirta, 2020).

Coronavirus patients in countries with high air pollution levels before the pandemic are more likely to die from the infection than patients with better AQI. A new global study offers the first clear link between long-term exposure to air quality (Xiao and Nethery, 2020).

The researchers at the Harvard University T.H. Chan School of Public Health found that higher levels of the small, dangerous particles in the air known as PM 25 were associated with higher death rates from the disease. COVID-19 and Air particles PM25 exposure and increased risk of death from many other illnesses result in the importance of enforcing existing AQI level regulations to protect human health during a pandemic crisis (Wu Xiao and Nethery, 2020).

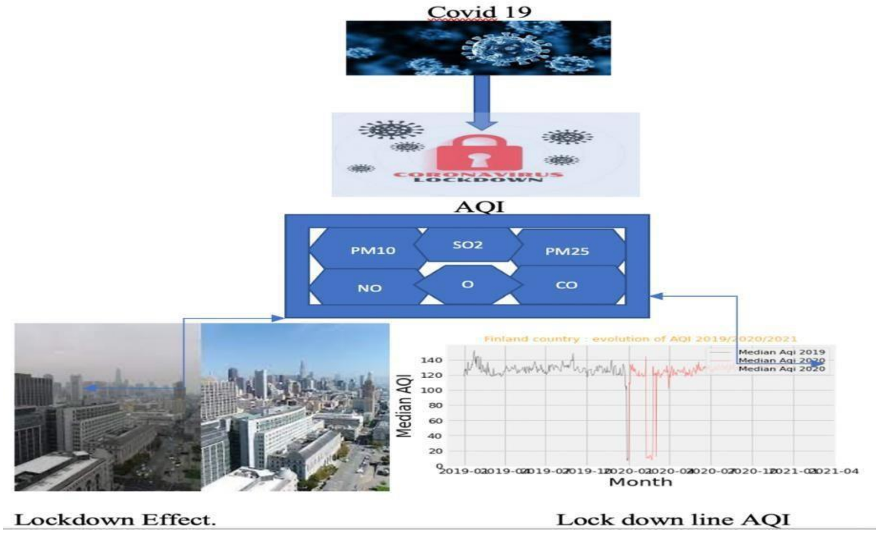


Figure 1 A graph relationship COVID-19 Air quality effect

1.1 Background

Our world is safer from an illness to fail; they noticed the critical interface between people and a bacterium and the existential hazard of climate WHO (World health organization, Ambient air pollution) report. The COVID-19 disease pandemic killed millions in the whole world and hundreds of thousands within Europe. Research support recent medical proof on the link between pollution and contagious disease infection and indicates that poor air quality is a significant cause of death throughout illnesses. Air quality has been dropping. Air quality has been declining due to moving around in the community and influenced by industrial activities. Thus, the lockdown condition during the pandemic. The shutdown of some industries and decreasing amount of transport activities caused air quality to improve through several parameters such as Particulate Matter (PM10), Particulate Matter (PM25), Sulfur dioxide (SO2), Carbon monoxide (CO), Ozone (O3), and Nitrogen dioxide (NO2). Air quality parameters find out air quality. Air quality affects public health as respiratory diseases. Transmission of the virus suffers from various things, including climatic conditions (e.g., temperature, air quality, and humidity), inhabited areas,and health quality.

Prolonged exposure to pollution is related to a rise in the incidence of metabolic diseases and deaths. The size of a particle is between 0 <25 m, PM25. The same is also causing lots of deaths worldwide annually. The presence of PM25 and it's associated with an inflated rate of PM10, particularly in hospital admissions for metabolism unwellness and chronic respiratory organ disease and respiratory illness gas NO2 is another vital air waste matter that's toxic to the human system once in high in the atmosphere, as an organic process (Xing and Yu-Fei, 2016).

NO2 is a cause of many diseases and chronic disorders like cardiovascular disease, a polygenic disorder that may cause death. An early associate study showed that chronic exposure to NO2 would cause cytokine-mediated inflammation within the lungs. Deaths from pollution don't embody respiratory disorder, inflated bronchial asthma, metabolism allergies, heart condition, and stroke. Air pollution in many regions and the whole total planet has declined. Increased air quality can reduce both the risks of climate change and COVID-19 spread, but the related common hazards to climate change and COVID-19 are not yet apparent what kind of air pollution is causing spread. The methods of SARS-CoV-2, such as quarantine and travel restrictions, have reduced carbon emissions in China by 25 percent, according to the CREA, (Forster, Piers M., et al., 2020) in the first month of the lockdown due to air traffic reduction, oil refining, and coal consumption.

The researchers at the Harvard University T.H. Chan School of Public Health found that higher levels of the small, dangerous particles in the air known as PM 2.5 were associated with higher death rates from the disease (Leonardo et al., 2021).

Hence focus of the report remain vital as stated on: Research support recent medical proof on the link between pollution and contagious disease infection and indicates that poor air quality is a fundamental cause of death throughout infections. As external anthropogenesis sources, NO2 is mainly free from fuel combustion and transport. Emission from vehicle exhaust gases and domestic heating. NO2 in the main affects the system however, prolonged exposure to NO2 is related to severe diseases like cardiovascular disease, polygenic disorder, and upset and may even cause deaths. An early associate study showed that chronic exposure to NO2 would cause cytokine-mediated inflammation within the lungs. Deaths from pollution don't embody respiratory disorder, inflated bronchial asthma, metabolism allergies, heart condition, and stroke.

1.2 Motivation

Air Quality Index (AQI) and pandemic concentrations for EU countries were more polluted, and countries with more COVID-19 have been identified within the current research. With AQI time series, forecast, and better information, one can organize his/her activities considering AQI health effects during COVID-19. The right choice based on the clean-air countries, best air quality and the time of other national restrictions factored. On a national level, accurate forecasting will assist the government in planning and establishing procedures to reduce the adverse effects of AQI. However, the air quality issue is of significant concern for many European countries. To tackle air quality the federal restrictions to reduced CO, PM25 level Ozone level in the AQI Clean Air Force Europe (CAFE), (Sigmund and Aurdal, 2019) , plans are taken to set action plans, reduce pollution and decrease COVID-19 casualties.

The studies suggest that AQI levels play a vital role in the mortality of humans during the current pandemic compared to the previous epidemics (Ciencewicki, 2007). Air partials (PM25) in the air amplify impact in transmission of the virus. Fine air particles and COVID can penetrate the pleura of the lungs. However, few studies have evaluated the effects of prolonged exposure to air pollution on SARS-CoV-2019 susceptibility. Hence the thesis work underlines the criteria for assessing COVID-19 and AQI relationship between different EU countries and forecasting. AQI and COVID-19 information and their prediction are valued by governments within the EU and outside.

1.3 Purpose of the study

Analysis aims to look at changes in air quality levels and share knowledge on within the EU as COVID-19 unfolds. The lockdown has resulted in better air quality & decreased COVID-19 cases, but it is short-lived till the time lockdown is in place. The study aims to discuss same the impact of COVID-19 on human lives physically, mentally and fatality rates concerning air quality within the EU countries.

1.4 Statement of the problem

The link tracing between AQI and the transmission of infectious diseases, for example, poor air quality, is related to accrued respiratory diseases as the accumulated incidence of flu. I am using a Deep Learning model to find out which country has more pollution vis-à-vis declining air quality.

This research aims to create a Time series (method) to find out AQI and pandemics relationship effected in human heaths using the Arima model to predict the atmosphere pollutant concentration in the EU countries. The essential research objectives of this project are:

- A critique review of existing literature on forecasting AQI and present pandemics effect on human health.
- To discover the correlation between COVID-19 and air-born particles, meteorological components, and concentration level of pollutants (PM25, PM10, NO2, O3, CO) and the hot-spot of difference.
- AQI level in polluted European countries.
- To investigate which feature has the highest impact on the machine learning algorithm's ability to perform prediction accurately.
- What is the change in AQI value from 2019 to 2020, along with correlations and limitations?
- Determining the accelerated diffusion air quality affected due to COVID-19 and related a high level of death rate?

- What has been the pandemic impact and effect on Air Quality and emissions? Reduction for mentioned countries? Epidemic emissions Country-wise.
- Is bad air quality a modern problem or not; based on 100 years of data records?

SARS-CoV-2 has shown stability in close aerosols within the laboratory atmosphere, which may significantly favor COVID-19 transmission. However, the link of the incidence of COVID-19 to close air pollutants is essentially unknown. The aerosol induces indirect, general effects on the physical body and is related to changes within the system alongside pro-inflammatory processes within the lungs.

1.5 Limitations

According to the current base of knowledge, information, and requirement, however, there are some limitations, particularly data limitations; the data time for this thesis is only valid from January 2019 to March 2021. The database used for building the model was from pre-lockdown, during the lockdown, and post-lockdown, throughout the first national lockdown rather than through post-national lockdown because of the discontinuity of data caused by sensor degradation.

1.6 Significance to the field

We noticed during research that the air quality index (AQI) improved considerably, reducing exposure to sensitive teams, we also found same in time series pattern. Our research will show how the air quality index affected the COVID-19 exposed group.

1.7 Definitions

Our research aims to find a relationship between the pandemic and its effect on air quality during the pandemic.

1.8 Ethical consideration

Ethical problems that need significant observation are personified public participation, cleanliness watching, investigational involvements on virus mutations & spreading. The decision-making method of the COVID-19 guidelines involves inputs from government, military, industrial businesses, analysis funding, academia, the European Society of Cardiology, public health officers, researchers, ethics scientists, health care employees, volunteers, associations, and families. All of them have entirely different ethical or legal obligations to meet COVID-19 with AQI relationship and effect on human health. However, it is debatable that air-born harmful particulate matter bearing the COVID-19 viruses present outside the human organs more ever dangers humans heaths (Xian, 2021) .

2 BACKGROUND THEORY

This theory introduces the relevance of airborne particles and how it affects human health during the pandemic time. The COVID-19 pneumonia effect severely even healthy people in countries with high pollution and bad AQI level. Many cases developed countries have more airborn harmful particles than to under develop countries. The World health organization (WHO) reports that the pandemic situation and about carriage impact on health. We need to decrease social interaction between individuals and control the mortality rate. We understand through COVID-19 and air-born partials such as PM25, NO2, SO, CO, PM10 pollution and weather conditions sucking in people in contact with other affected locations. For example, temperature, humidity, and pollution index. As known by now these COVID-19 virus-accumulating atomizers are easy to transmit among individuals. SARS-Cov, airborne particles and COVID-19 viruses increase the transmission of infections like influenza viruses.

2.1 Pandemic and AQI

The European agency uses the associate Air Quality Index, (Gaia Air Quality Monitors, 2020), (Ying and Lin, 2020) to give information about air quality and air pollution levels. The higher value of air quality particles indicates the higher air pollution level and higher health effects. The AQI has six sets based on the importance of the index from the below table, and it's clear that AQI worth it. Every citizen must take precautions to maintain good health when AQI values increase.

Particulate matter (PM10/2.5)	Airborne particulate matter is a physical and chemical composition. PM10 air particles are of minimal size (0<10 µm), and PM2.5 particles (0<2.5 µm) are of significant risk for human health risk. Large particles mean it is not readily inhaled and easily removed relatively efficiently from solid air residue from large particles.
Nitrogen oxides (NO2)	NO2 is a term used to describe nitrogen dioxide (NO2). They are harmful liquid mineral gases formed by the combination of oxygen with NO from the air and oxidizes to NO2 in the atmosphere but, NO2 causes detrimental effects to the bronchial organs system. Nitrogen dioxide concentrations frequently approach and sometimes exceed air quality standards in many European cities.
Ozone (O3)	O3 is a unlike other pollutants mentioned, is not emitted directly into the air but is the second level of pollutant produced by a reaction between NO2, hydrocarbons, and Sunlight. Ozone levels are not as high in urban areas but the high level of NO2 in urban areas due to vehicles. And chemicals
Sulphur dioxide (SO2)	Fossil fuels contain traces of Sulphur compounds, and SO2 produced when they are burnt. The majority of the SO2 emitted to the air is from power generation, and the contribution from transport sources is small (shipping being an exception). Exposure to SO2 can damage health by its action on the bronchial system. Sulphonic acid generated from atmospheric reactions of SO2 is the main constituent of acid rain.
Carbon monoxide (CO)	CO is an unseen gas produced by the incomplete burning of materials that contain carbon, including most transport fuel's reaction haemoglobin and reducing its capacity for oxygen transport in the blood. Even in busy urban centres, CO concentrations rarely exceed health-related standards. such as wood industrial

Table 1 Particulate Matter Pm10/2.5, No2, Co, And O3

2.2 Air quality index

The USA environment Protection Agency (EPA, 2018) measures a level of overall air quality EPA, thus has set a standard guideline of pollution and providing acceptable procedures. The similar guidelines also set by EU agency.

Air quality index indicator created to report air quality affected by air particles to the potential for human health risks. It affects country nearby and higher AQI indicates the most significant threat to nation's health, hazardous to health in Europe and globally. The European

Environment Society's European Air Quality Index allows users to understand more about air quality where they live. Providing information, a whole of Europe, users can gain new insights into the air quality of individual countries, regions and counties. Table 2 below describes the different classifications of AQI for the EU.

Qualitative name	Index or sub-index	Pollutant (hourly) concentration in μg/m^3				
		NO2	PM10	O3	PM25	SO2
Very low	0–25	0–50	0–25	0–60	0–15	0–100
Low	25–50	50–100	25–50	60–120	15–30	100–300
Medium	50–75	100–200	50–90	120–180	30–55	300–600
High	75–100	200–400	90–180	180–240	55–110	600–900
Very High	0>100	0>400	0>180	0>240	0>110	0>900

Table 2 Eu Aqi Level

Air quality is analyzed based on data set on AQI and pandemic's air pollution peak around COVID-19. The study says the population would have made COVID-19 situations worse. I am linking to the high level of airborne particles during the pandemic, impacting people coming into contact.

It appeared that chronic exposure to atmospheric PM25, PM10 contributes to increased hospitalizations and mortality, primarily affecting lungs, heart, and respiratory systems, causing various diseases and pathologies, including cancer (Fattorini, 2020). Premature early deaths due to acute respiratory diseases from harmful airborne particles are estimated to be over two million per year worldwide (AQI, 2021). Evaluate the long-term exposition hypothesis (Pansini, COVID-19 higher mortality in Chinese Regions with chronic exposure to lower air quality, 2021) using annual means and analyze different pollutants (PM10, PM25, SO2, CO, NO2, and ozone).

When this pollutant has an AQI above 100...	Report these Sensitive Groups
Ozone	People with lung disease, children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets limited in certain nutrients are the groups most at risk
PM2.5	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
PM10	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
CO	People with heart disease is the group most at risk
NO2	People with asthma, children, and older adults are the groups most at risk
SO2	People with asthma, children, and older adults are the groups most at risk

Table 3 Show Aqi and Human Health

2.3 Impact on air quality during a lockdown

AQI shows how concentrations of NO2, a pollutant mainly emitted by road transport, have decreased in many European countries whereas federal restrictions and needed measures implemented to contain situation. Although dropping of delicate particulate matter (PM25, PM10) may also be expected across EU countries.

Particulate matter originates from multiple sources, including the combustion of fuel heating real estate, industrial operations, and road traffic, a significant fraction of the particles in the atmosphere formed by the recirculation of land dust pollution.

3 LITERATURE REVIEW

This Literature review presents the associated work of air quality prediction with machine learning and deep learning methods. This chapter also addresses the concept and related work of the AQI, and COVID-19 project initiative.
Hence, a highly contagious Coronavirus causes the COVID-19 pandemic to tackle Global management measures like group action and internment is vital. COVID-19 management activities across the globe improved air quality domestically and globally within the short term by limiting human activity. Therefore, air pollution caused by human activities plays a significant role in people's deaths due to the coronavirus (Bellouin, 2020).

3.1 Air quality index

Some researchers already studied the effect of the coronavirus and changes in air quality during the corona pandemic. Numerous pandemics have occurred in the last 100 years. In 2019 WHO (World health organization) first studies COVID-19, The origin was founded in China at Wuhan city. After that, so many researchers have worked on this topic worldwide (Thomas et al., 2021), worked on air quality by NO2 in the few cities of Spain in the corona pandemic (Burns, 2020), Studied COVID-19 mitigation measure and nitrogen dioxide-A quasi-experimental study of air quality in Germany. Air quality with viruses tends to affect harmful health, especially guts, lungs, and blood vessels. Suppose a person has already got cardiopathy and gets lung drawback due to pollution and coronavirus infection. In that case, this can cause aggravation in clinical symptoms which may result in heart attacks, heart disease, or stroke Cancer," Prof. Münzel" (Prof. Münzel, 2021).

The COVID-19 deaths cross during a European nation in Italy, Spain, France, and Germany, 78% of them occurred in only four regions, which were the foremost impure in AQI. " Says Yaron Ogen" (Yaron Ogen, 2020).

3.2 Background

Time-series and forecasting for AQI and COVID-19 for future prediction and statistical methods for this research. The first machine learning model is the theoretical method emissions and environment chemical method, Models based on a Machine learning regrating model. Quantifies the relationship between the AQI and COVID-19 sources, including its emission, exchange, diffusion and meteorological method, gas and emission, and pollutant concentrations and so on. On the other hand, the Machine learning approach uses statistical modelling techniques such as multiple linear regression (Box G.E. & Jenkins G.M., 2015), and so on. However, these methods using the best result AQI during a pandemic.

3.3 COVID-19 and Air pollution

Recently, air quality has increased during the COVID-19 pandemic. Some research information has indicated that air pollution is a significant contributor to mortality from COVID-19 as it can increase health risks and lead to increased mortality from the disease. The first impact is related to aerosols; containing the virus can spread more quickly in areas where there are more aerosols from air pollution. The second impact concerns that air pollution can cause high blood pressure, diabetes, and respiratory disease conditions where air pollution and COVID-19. Mortality regarding the harmful effects of air pollution on the immune system and air pollution is beyond the present study's scope.

3.4 Chapter Summary

Implementing relief in the COVID-19 restrictive action has led to native and abrupt changes in air quality. Reduced human and industrial activities have reduced pollution emissions and air important Global air quality enhancements expected in 2020. precisely, in central China, in the Previously rumoured COVID-19 certified case, a significant reduction in particle case internment been noticed like a shot.

Research about the air Pollutant Levels and meteorological conditions in lockdown. In this paper, daily and weekly averages calculated to check pollution levels per hour and check them. This study analyses overall pollution levels over the past three years (2019-2021). Social Disorders (SD) Observation conducted from January 1 to May 5, 2020, Implemented. In this study, air pollution levels analysis for a total of 18 weeks. They introduced a new method called the attributable method to find the avoided deaths due to PM25, PM10, and NO2 during the COVID-19 pandemic. Concentration-response functions are wide. The high worth PM25 and PM10 levels of ancient indicators into direct measurements of heart and Lungs. The consequences of pollution on COVID-19 infections and mortality area unit mentioned support current knowledge and used as data during this review.

Pollution levels in cities across the country have slowed considerably in barely some days because of forced sanctions, magnifying the discussion concerning lockdowns for different effective measures to regulate pollution. The current article finally worked during this direction with relevancy.

The beauty of this robust algorithm is in its adjustability, which operates fast learning through parallel and distributed computing and provides well-organized memory usage. It's no wonder then that CERN recognized it as the best approach to classify signals from the Large Hadron Collider.

CERN's solution would be to process data being initiated at the rate of 3 petabytes per year and effectively distinguish a periodic signal from background noises in a complex physical process.

4 MATERIALS AND METHODS

(Source: open-source data) The air quality data from the WAQI project and John Hopkins data. The study covered a total of 5 countries of Europe (Spain, Finland, France, Germany, and Italy). We have focused our analysis on these mentioned countries. We are using a Machine learning module to check the relation between AQI & COVID-19. We are using the T-test model to find out both database relationships. A T-test is a type of inferential statistic used to determine if there is a significant Correlation between both databases and the difference between both groups, which may be related to certain features.

4.1 Introduction

According to the World health organization, as of March 1, 2021, almost 3 million COVID-19 cases were registered in Germany. In other countries also the active cases increase continuously. ML models trained to predict pollutant concentrations from air quality variables, Relative humidity, precipitation, temperature, solar radiation, pressure, wind speed, and wind direction.

One of the essential and standard methods used in time series forecasting is the ARIMA model, which stands for Autoregression Moving Average model to better understand or predict future points in the series.

The characteristics to be predicted are the concentrations of NO2, SO2, CO, and PM25 in the six different counties. We work with hourly data from January 1, 2016, to June 30, 2020. The data set is divided into three parts. January 1, 2016, through January 15, 2020, will train the model based on five-time cross-validation. Then two months before the complete lockdown (January 16 to March 15, 2020), it will test prediction accuracy. Officially applied COVID-19 quarantine measures were in force on March 17, the city began to show the blocking signs from March 15, the day the national ordinance sent. Correlation is the metric chosen to evaluate the performance of the model. To validate a model, must be minimum and PCC closest to June 1, 2020) and relaxed (June 2 to June 30, 2020). The change in pollutant concentration quantified by subtracting the model's predicted values from the actual values recorded during the quarantine and the complex non-linear relationships between meteorology and air quality.

4.2 Source of Data

The reduction in NO2 observed during the pandemic. But the amplitude of this reduction was very different from region to region since the lockdown policies were different. We noticed a significant drop in some European countries, but in other parts of continents and countries such as Germany, France, Italy, the reduction was limited. To examine the relationship between COVID-19 (John Hopkins) and COVID-19 air quality (WAQI) data, we use two measures of air quality, namely fine particulate matter PM25 (mass concentration of particles with diameters 0≤25 um) and nitrogen dioxide NO2. While other pollutants are available in our dataset, we select the PM25 and NO2, SO2, O3, and others. We have given their direct link to human health. PM25 is a common cause of (lung, asthma, headache health outcomes such as chronic obstructive pulmonary disease (COPD). Due to COVID-19, nearly three million people globally Dead (Achakulwisut & Brauer, 2019).

At the same time, NO2 is the leading source of childhood asthma in urban areas globally. This study collects data on these measures from January 1, 2019, to April 30, 2021. We also use other pollutants, such as NO2, SO2, and O3, for robustness checks (Gakidou & Emmanuela and Afshin, 2017).

4.3 Data Analytics

Data analysis is a process of inspecting, cleansing, transforming, and modelling data to discover useful information, informing conclusions, and supporting decision-making. Below, we have Confirmed the case by Country with Date. The confirmed case we have till date March-2021. Confirm claims based on countries Death cases based on Countries. We can see that the case rapidly increases for almost every country, but France has the highest Corona Confirm cases, and Italy has the highest Corona death cases.

4.4 Software and Libraries

Python programming language project execution using Jupyter notebook (Python3.9) Anaconda Navigator (Anaconda3) libraries used in this project, such as Pandas, NumPy, Sklearn, for the project Seaborn, Matplotlib, Pygal, seaborn, stats models, and matplotlib SciPy, plot. graph_objs and Date-Time, Stats models were also used to check the Srima model to seasonality, and data stationery is not. They are broadly accepted in the research community to implement robust algorithms for data analysis using the Regrating model and the deep learning method.

Data be pre-processing is a vital step in any supervised machine learning, using a regrating model and deep learning process as it impacts the generalization ability of the learning algorithm.

4.5 Related Work

Machine learning predicts the air quality concentrations is a time variable we are selecting air particles PM10, SO2, NO2, CO, PM25, O3 level. We have these temporal variables for air emission patterns from 2019 to February 2021 air quality dataset used to train the model-based cross-validation. Then one month before the nation's restrictions.

Our study shows that CO and SO2 air particles account for significantly fewer particles, but PM25 represents many particles. PM25 poses health risks to humans, including lung cancer, heart disease, diabetes, and anaemia.

We collect the confirm and death cases of COVID-19 and the COVID-19 air quality data. From the dataset, we clean the data and then find out the missing value. We Choose COVID infected European Country for analyses. Choose a non-parametric ML method, selected it because it is a state-of-the-art ensemble method based on decision trees (Achakulwisut & Brauer, 2019). Feature selection is automatically integrated into the algorithm as it based on a decision tree method. Finally, it is possible to identify the importance of each variable in the resulting model.

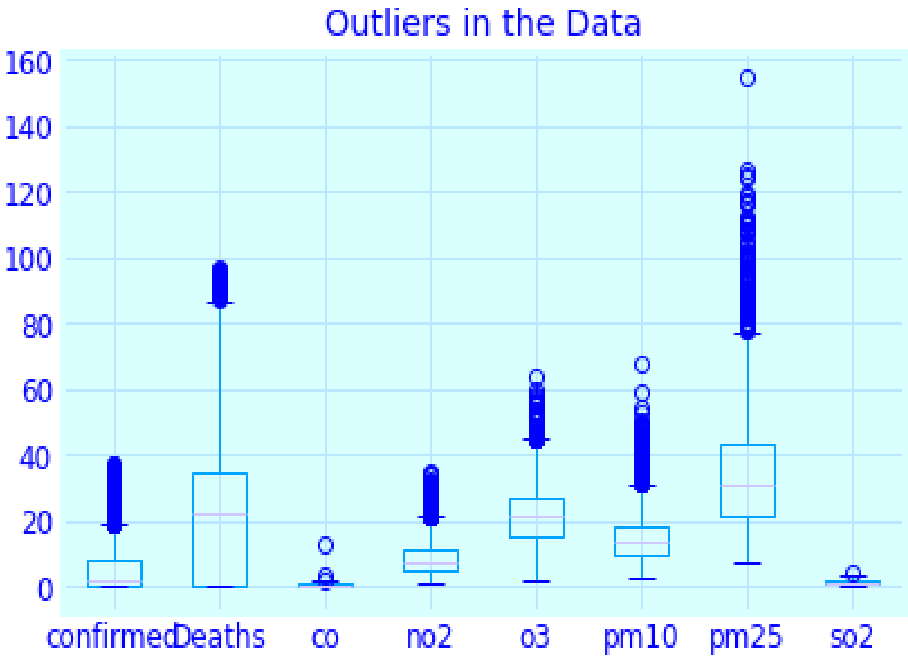


Figure 2 A Diagram Of The Outfit Of The Data

Figure 2. The base of Confirmed and Deaths to check Fatality rate Countries.The machine learning algorithms predict COVID-19 air quality, mortality rates, and fertility rates to determine which countries have the highest COVID-19 fertility rate if the government has no significant nation restrictions. In countries with poor air quality and poor health centre support, the fertility rate is higher, and the death rate is higher. Using a pygal method or pygal libraries produces good results with small data sets.

	Country	confirmed	Deaths	fatality_rate
0	France	1530514298.000000	36531752.000000	2.390000
1	Spain	1044048424.000000	25053288.000000	2.400000
2	Germany	665027550.000000	14918310.000000	2.240000
3	Italy	579397192.000000	20050304.000000	3.460000
4	Finland	3404998.000000	52976.000000	1.560000

Figure 3 Distribution with County Aqi Level

We found fatality rate based on confirmed and Death's case, a mention countries France has a lower fatality rate based on Confirmed and Deaths cases because France has substantial nation restrictions. Still, our graph shows Italy has a more Fatality rate base on Confirmed and deaths.

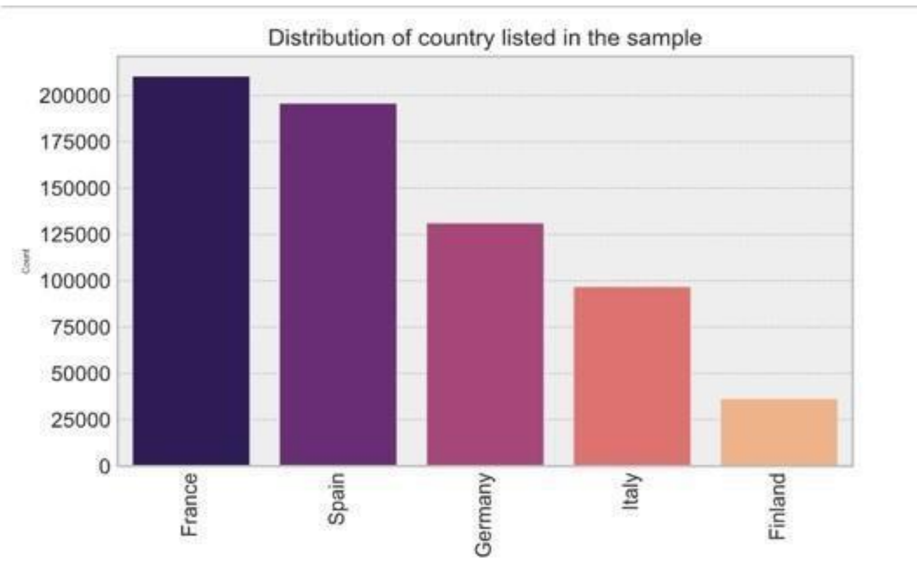


Figure 4 Distributions Aqi

Due to the non-linear relationship between COVID-19 and air quality; Our Finding depends on COVID-19 cases Fatality rate in mentioned countries. Italy has a 3.46% Fatality because of Italy. We found Italy has more death cases than COVID-19 conformed cases because Italy has more pollution and fewer federal restrictions. Germany has a 2.24%, Finland has a 1.50%, France has 2.39%, and Spain has a 2.4%. That means there is high AQI, and there are also high COVID-19 deaths as per supported data.

Figure 5 The Fertility Rate Depends on The Confirmed Cases

Apart from Italy second country after France has the second-highest deaths record and same AQI also second highest out of five countries. After lockdown, the air quality index is at the lowest, but the deaths are still high. The main limitations of studies (short and long-term) are the links between pollution incidence and mortality of COVID-19. However, the analysis does not correspond to population size, age distribution, or alternative contrast variables. Inflammatory infections and deaths in contaminated areas may be related to the different immune system immunity suppressive responses to pollution found in patients with severe respiratory disease in previous conditions.

4.6 T test method

The purpose was to find both dataset correlation and limitation to compare data from different European countries in 2020 and 2019 to see any correlation between the two datasets standard T-test in 2 datasets. Python script to find out the result and create a series of scatter plots to show relationships using to compare data on COVID-19 cases and air quality in different regions of the planet in 2020 to find any correlation between the two. It also compares the 2019 air quality data to 2020 data and runs Standard T-test on the two datasets.

Air Quality (PM25) vs. COVID Case,
Air Quality (CO) vs. COVID Cases,
Air Quality (NO2) vs. COVID Cases Based on P values,

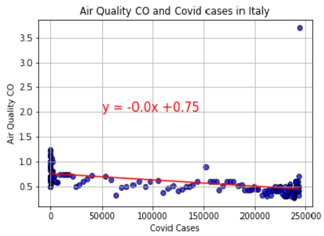
- PM25 improvements noted in Italy, Spain, France
- CO improvements noted in Italy, Spain
- NO2 improvements noted in Italy, Spain, France, Germany, Finland
- Based on correlation values, Air quality and COVID -19
- PM25 – vital to moderate negative correlation observed in Italy, Spain,
- CO - critical to moderate negative correlation in Italy, SP, France
- NO2- essential to moderate negative correlation in Italy, Spain, France,Germany, Finland, Spain

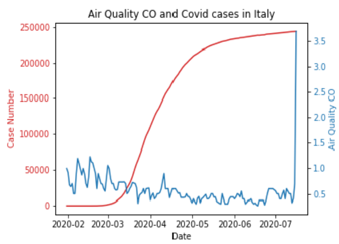
4.6.1 **Italy**

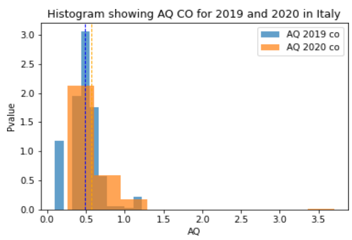
Italy has an AQI Strong relationship with the virus. At the same time, PM, NO showed a positive because of weak nation restriction and not firmly nation restriction and weak relationship massive movement from large crowed to the countryside.

CO

FIG (A) FIG (B) FIG (C)



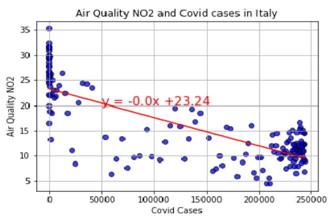


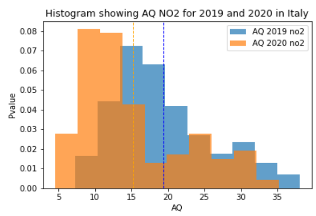


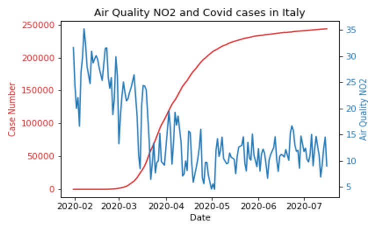
The correlation between COVID cases and Air quality measurement value is -0.39

NO2

FIG (A) FIG (B) FIG (C)



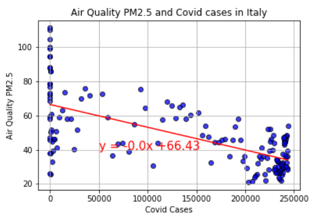


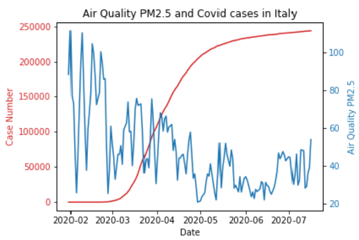


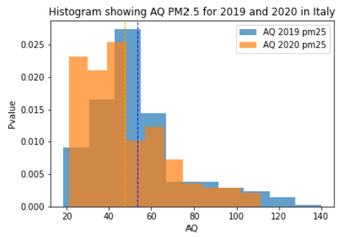
The correlation between COVID cases and Air quality measurement value is -0.77

PM25

FIG (A) FIG (B) FIG (C)







The

The Correlation between COVID cases and Air quality measurement value is -0.66

Figure 6 Italy Correlation Between C0, No2, Pm25

4.6.2 **Spain**

Spain has one of the EU more polluted country three is also COVID 19 more infected cases but Spain an opposite relationship between pandemic and COA decline of AQI level NO2, and PM-10, PM25, clear benefits during the lockdown.

CO

FIG (A)

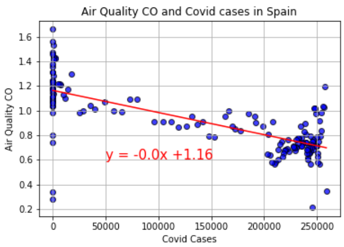


FIG (B)

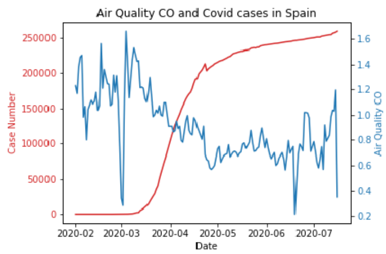
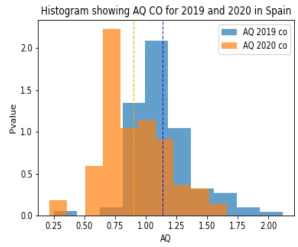


FIG (C)



The correlation between covid cases and Air quality measurement value is -0.72

NO

FIG (A)

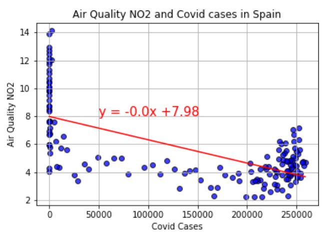
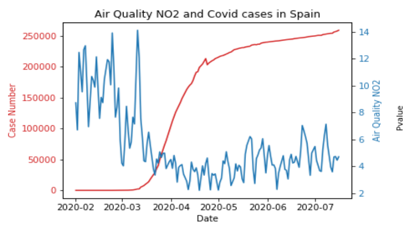
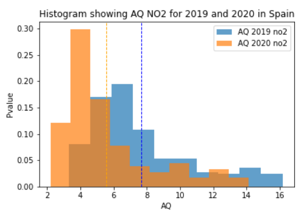


FIG (B)



FIG(C)



The correlation between covid cases and Air quality measurement value is-0.66

PM25

FIG (A)

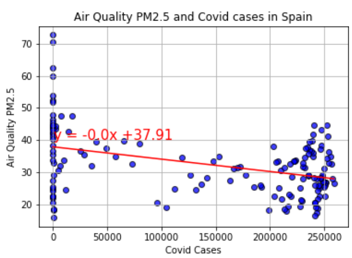


FIG (B)

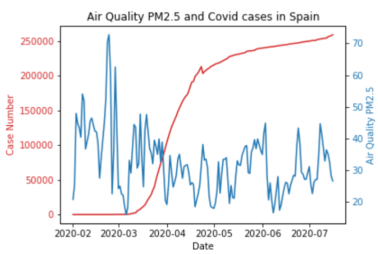
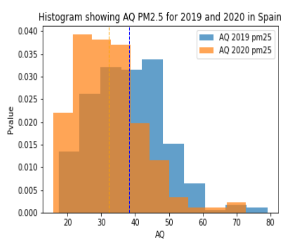


FIG (C)



The correlation between covid cases and Air quality measurement value is -0.4

Figure 7 Spain. Correlation Between C0, No2, Pm25

4.6.3 **Finland**

Depending on whether the condition in Finland CO emissions included in AQI. But Finland don't have COVID-19 case and CO level relationship because Finland has minor COVID-19 cases and good air quality; the correlation between COVID cases and Air quality measurement value is 0.2

CO

FIG (A)

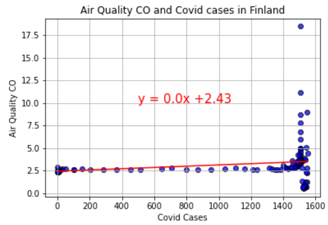
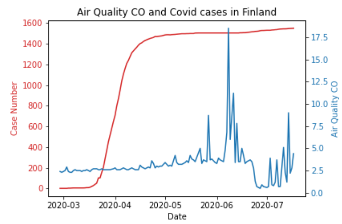
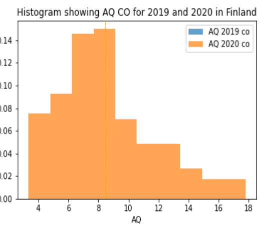


FIG (B)



FIG(C)



The Correlation between COVID cases and Air quality measurement value is 0.2

NO2

FIG (A)

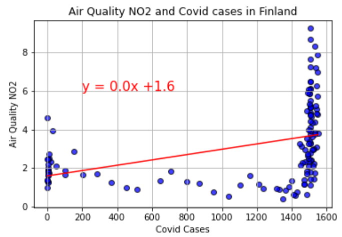


FIG (B)

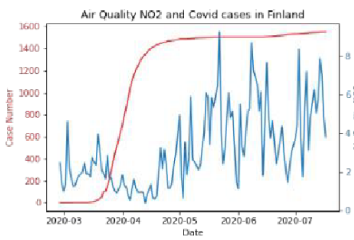
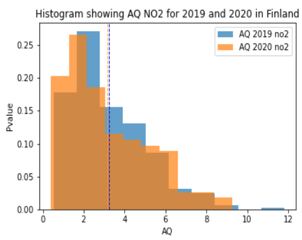


FIG (C)



The correlation between COVID cases and Air quality measurement value is 0.4

PM25

FIG (A)

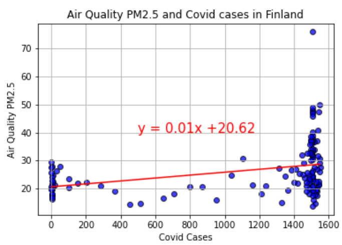


FIG (B)

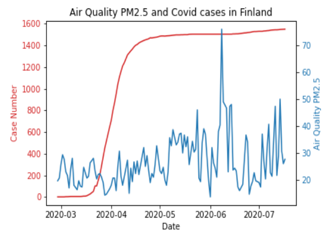
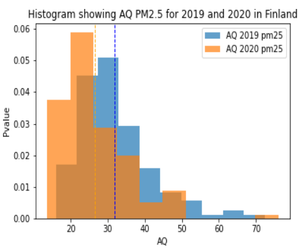


FIG (C)



The Correlation between COVID cases and Air quality measurement value is -0.4

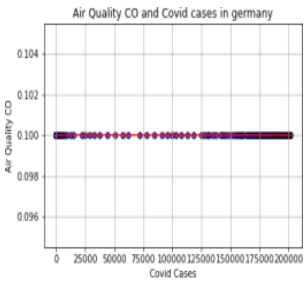
Figure 8 Finland Correlation Between C0, No2, Pm25

4.6.4 **Germany**

Germany has an AQI weak, weak relationship with a virus. At the same time, PM showed a weak negative correlation. Same is because of ineffective nation restriction and fragile relationship massive movement from large crowed to the countryside.

CO

FIG (A)



FIG(B)

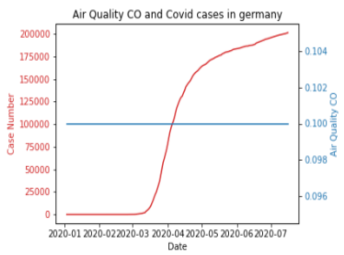
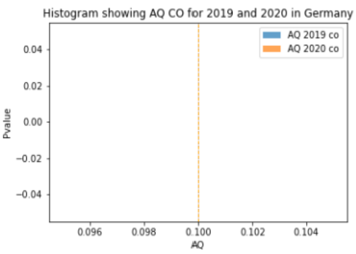


FIG (C)



The correlation between COVID cases and Air quality measurement value is -0.33

NO2

FIG (A)

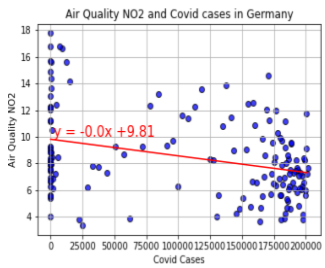


FIG (B)

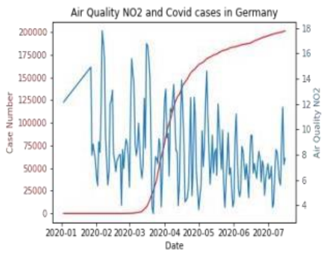
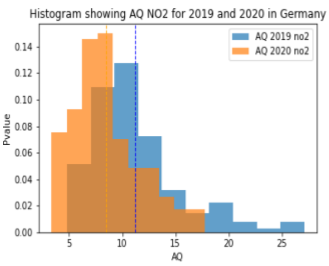


FIG (C)



The correlation between COVID cases and Air quality measurement value is -0.33

PM25

FIG (A)

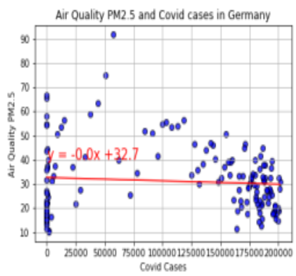


FIG (B)

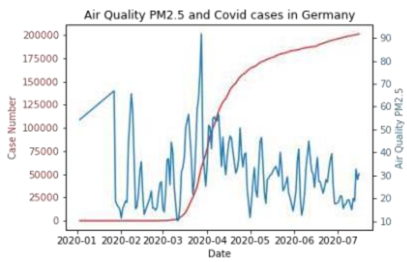
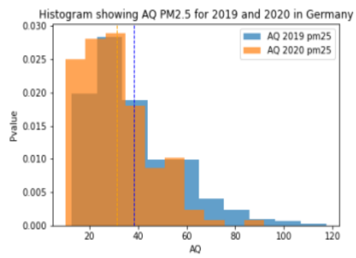


FIG (C)



The correlation between COVID cases and Air quality measurement value is - 0.08

Figure 9 Germany Correlation Between C0, No2, Pm25

4.6.5 **France**

France has an AQI positive relationship with a virus, while PM showed a weak negative correlation. Same is because no government social benefits, ship massive movement from large crowed to the countryside.

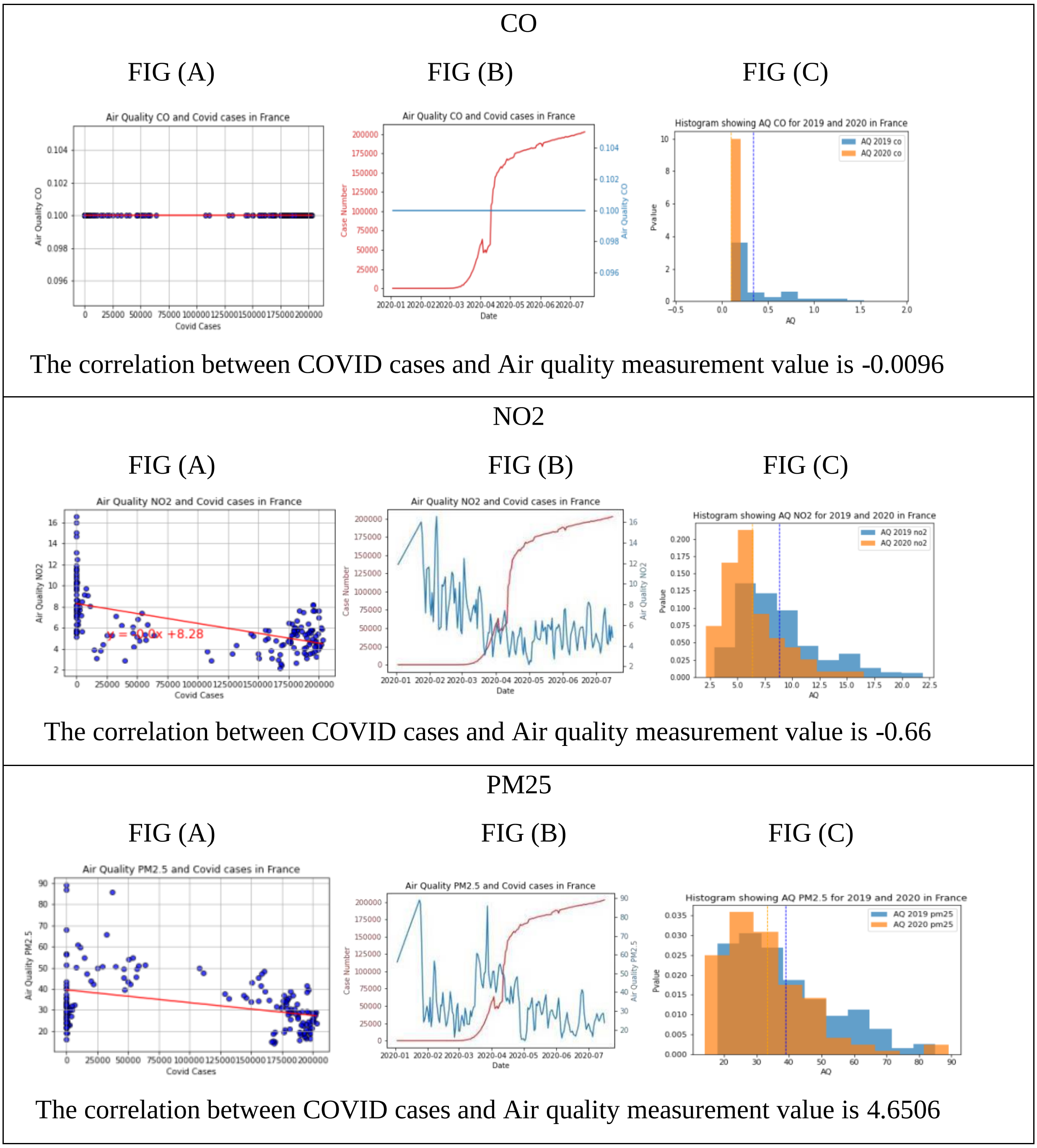


Figure 10 France Correlation Between C0, No2, Pm25

4.7 Seaborn Heatmaps Metrix

The heat map is a Data plotting magnitude of a phenomenon technic as color in two dimensions. It refers to the variation in color hue or intensity, making it clear what it means. There are fundamentally different categories of heat maps and spatial heat maps.

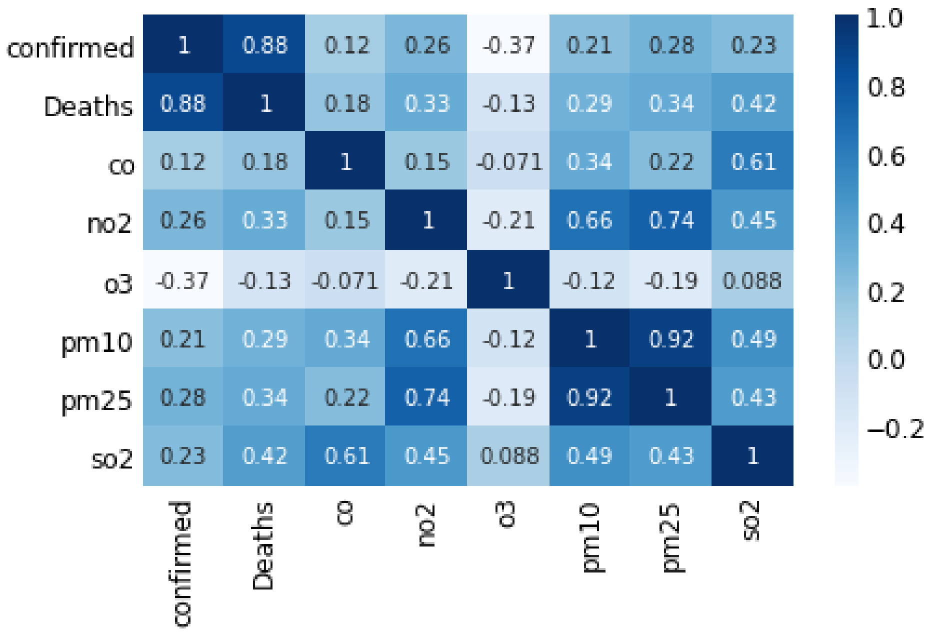


Figure 11 Correlation Between Databases

We show a correlation between all merged datasets, and we had two strong co-relations, PM10 and PM25 (up to 90%), and a second Confirmed case and Death case relationship in high we did not take PM25 into account for this study. But our plot also shows PM25, PM10, and NO2 strong relationship. Our plot show PM25 and confirmed case relationship are not strong, but PM25 and so has a strong relationship.

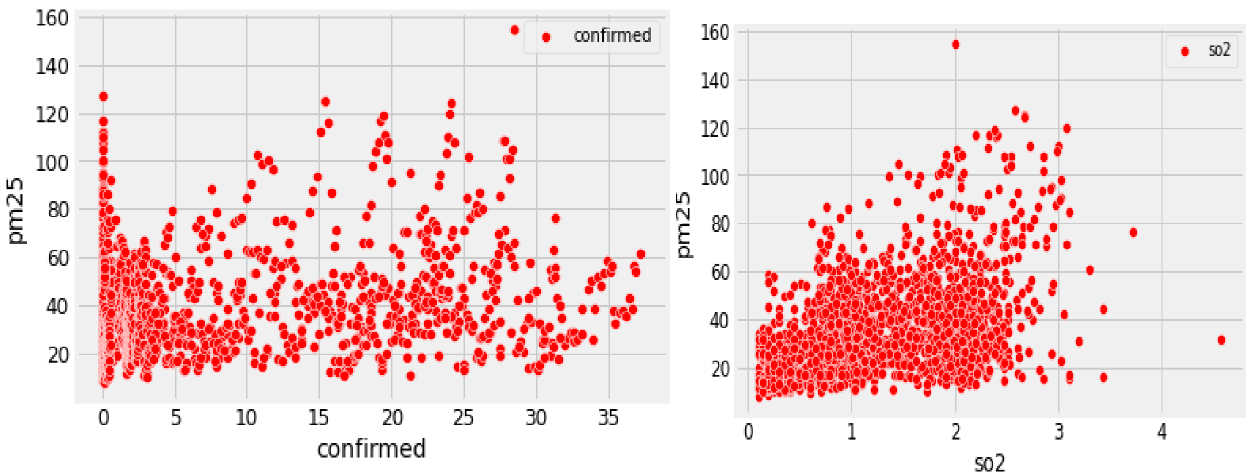


Figure 12 Strong relationship COVID-19 and AQI

4.8 Deep Learning Model

We use a Deep Learning model to determine the AQI median value yearly basics because air quality effects are not during the pandemic. Machine learning and deep learning methodto evaluate the relationships among the condition. ML methods have been used extensively for profound median air quality results for all air particles with the profound data techniques advent.

Figure 13 Using Deep Learning Model to Evolution Aqi Month Bases

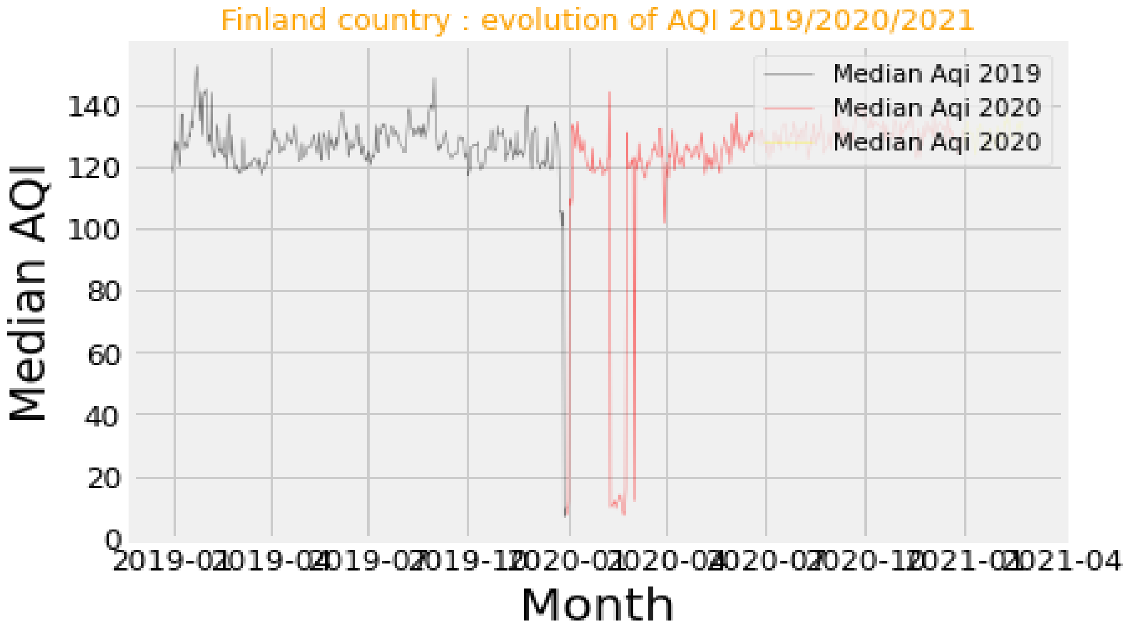


Figure 14 Using Deep Learning Model to Evolution Aqi Yearly Bases

Figure 13. to using air quality median value yearly bases to compering AQI. We got median value AQI post and present during COVID-19 air quality annual basis. Our plot shows duringthe lockdown, air quality rising due to federal restrictions. After nation restriction again starting to drop the AQI level. WHO (World Health Organization and others, 2020) recommends this classification based on the World Air Quality database.

4.9 Machine learning method

We found a graph show during a lockdown, the air quality improved. COVID-19 and AQI in different regions of mainland Italy, Germany, France, Spain, Finland before and after the lock-down period, the correlation coefficients of COVID-19 and AQI in the other country areas were quite highly polluted and what are pollution and population. After the implementation across the country, the correlation coefficients between COVID-19 and AQI in Europe, the correlation coefficients of different pollutant concentrations were also quite different. First, after implementing urban blockades in other regions, the correlation coefficients of PM10, PM25, and COVID-19 had all been reduced to a certain extent (Manisalidis & Ioannis and Stavropoulou, 2020).

The highest correlation coefficient between PM25 and COVID-19 was in Italy, while the PM10 correlation coefficient was highest in this area. The reason for this result might be different vegetation types and primary pollutants in other regions. SO2, CO and NO2 also showed significance. Because vegetation has a specific blocking effect on dust, areas with low vegetation coverage can produce particulate matter, such as PM10 and PM25. Human activities also contributed to create in the concentration of pollutants such as SO2 and NO2. Findings from most studies counsel that air quality, particularly and nitrogen dioxide, NO2. etc. Each short and long exposure considerably contributes to higher COVID-19 infection rates and to some extent, deaths with PM25, Compare COVID-19 deaths for four countries in Europe Italy, France, Germany, and Spain. Finland has a low death rate. Still, we consider Finland for research since this study is being done in Finland.

In Italy's confirmed cases, the death count is more compared to other countries because of more pollution and no substantial federal restrictions (Lovrić, 2020).

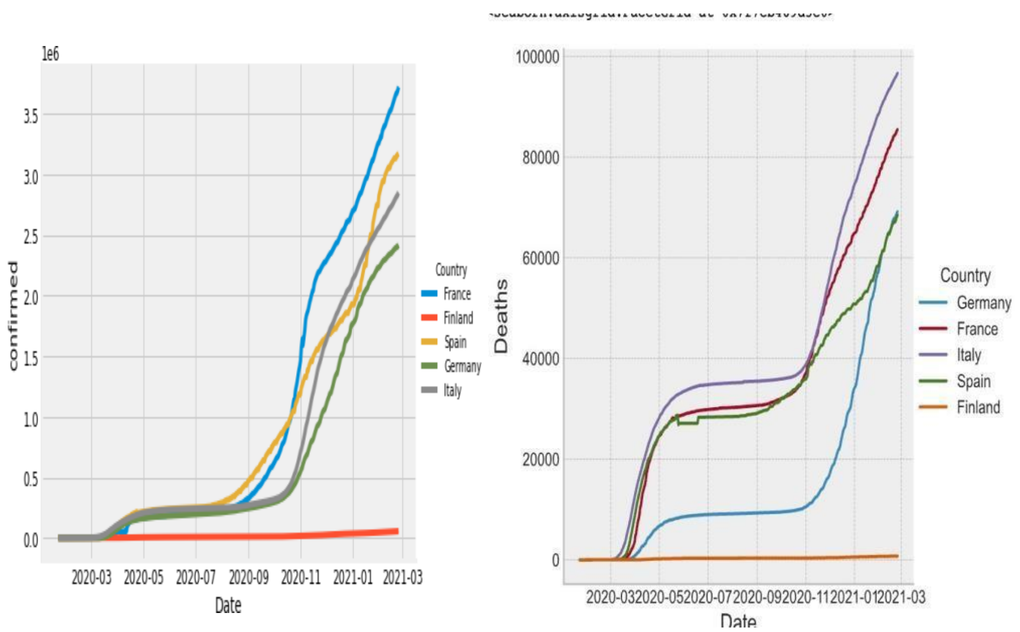


Figure 15 Using Machine Learning Model Confirmed And Deaths Cases

5 ARIMA MODEL

For pollution, especially CO, PM25 COVID-19 increases the risk of infection and mortality. The information provided indicates that COVID-19 affects transmission. In addition, corrosion can cause adverse disease effects in patients with SARS-CoV-2 infection. The results of the proposed analysis on this topic will allow epidemiologists to choose the proper lifestyle to prevent such conditions in the future. Because of the risk of serious illness from COVID-19 infections, the Poor considered exposing indoor pollution to the communities. The air quality should be an essential part of the Associate in Nursing towards a comprehensive approach to public health safety and infection exposure. NO2, CO, PM25, and others air pollutants are the cause of deaths in COVID-19. An in-depth analysis is needed (Samadianfard, 2013).

We have AQI data for the x-axis from 2019 to 2021. The corona came at the end of 2019, so here we can observe. We have compared many soft computing and machine learning methods in AQI. To obtain low estimation errors Intending, it is necessary to style very complex stratification models that combine the estimates of individual Air particles. We have clearly shown that soft computing techniques effectively apply a given linear, inconsistent, missing, and non-zero knowledge. This result confirms the previous works of a good deal of field due to the reliance on the variable.

The mean attribute results from the output of SARIMAX returns the most valuable information but will search our attention on the table of coefficients. The coef column shows each feature's weight (i.e., importance) and how each impacts the time series. The P>|z| column informs us of the significance of each feature weight. Here, each weight has a p-value lower or close to 0.05, so it is reasonable to retain all of them in our model. When fitting seasonal ARIMA models (and any other models for that matter), it is essential to run model diagnostics to ensure that none of the assumptions made by the model have violated. The plot_diagnostics object allows us to generate model diagnostics and investigate for any unusual behaviour quickly.

	coef	std err	z	P>|z|	[0.025	0.975]
ar.L1	0.8074	1.491	0.542	0.588	-2.115	3.730
ma.L1	-1.0000	4.660	-0.215	0.830	-10.133	8.133
ar.S.L12	-0.3554	5.177	-0.069	0.945	-10.502	9.791
sigma2	3.96e+04	0.000	3.37e+08	0.000	3.96e+04	3.96e+04

Table 4 Arima Model

CO airborne particle to use Arima model. Our primary concern is to ensure that the residuals of our model are uncorrelated and normally distributed with zero-mean. If the seasonal ARIMA model does not satisfy these properties, in other words, it indicates that further improvement is possible.

In this case, our model diagnostics suggest the model residuals are typically distributed based on the following:

In the upper-right plot, we see that the red KDE line that follows closely with the line where N (0,1) is the standard notation for a normal distribution with a mean 0 and standard deviation of 1 is often a direct indication the residuals generally unremarkable distributions. The Q-Q-plot on the bottom left presents an ordered distribution of residual. The leaner trend of a sample taken from a standard distribution with N (0,1).

Same does not indicate that the residuals normally distributed. The residuals over time (top left plot) display any apparent seasonality and appear to be CO. The confirmed by the autocorrelation plot on the bottom right, which shows that the time series residuals have a strong positive correlation with AQI. Those observations lead us to conclude that our model produces a flattering fit that could help us understand our time series data and forecast future values.

Although we have a Strong fit, some parameters of our seasonal ARIMA model could improve our model fit. For example, so we may find better models if we widened the grid search.

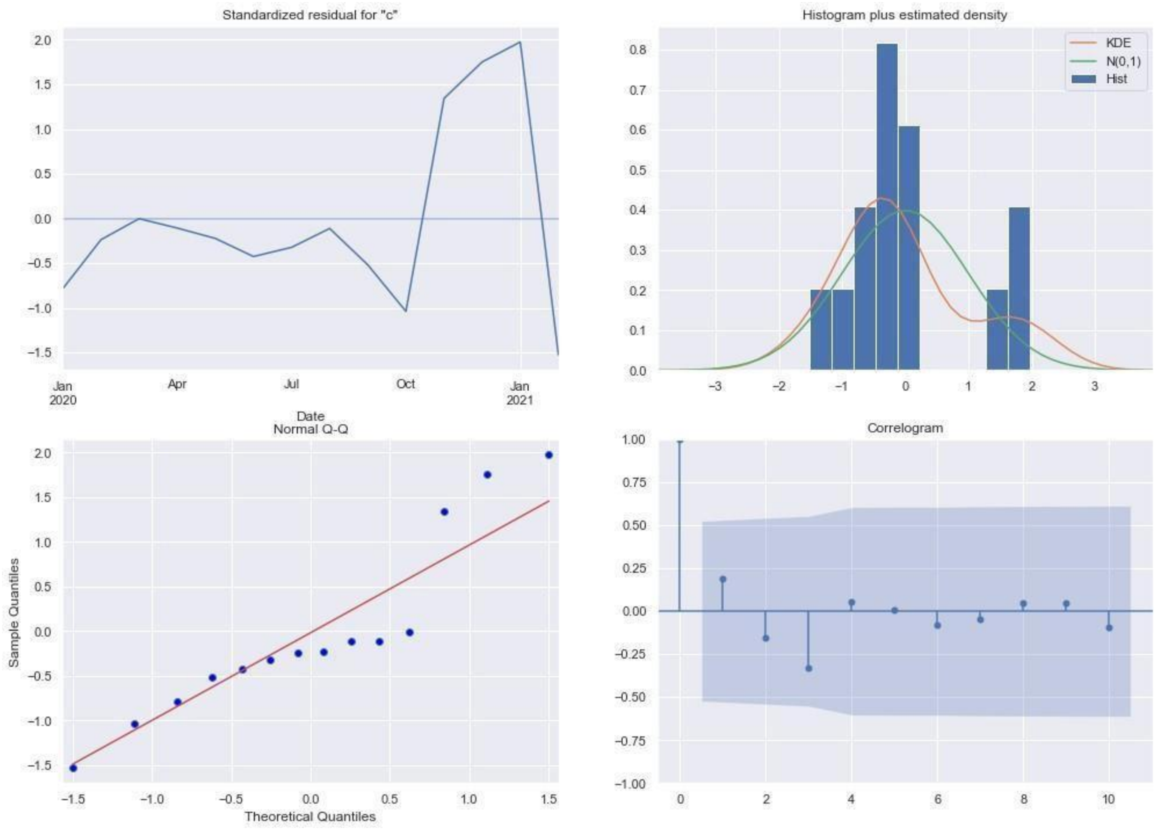


Figure 16 Arima Model

5.1.1 **Arima Forecasting**

We have the Arima time series model that can used to produce forecasts. We start by checking predicted values to the actual value of the time series; they are helping us understand the accuracy of our forecasts. The get prediction() and conf_int( ) variable allow us to present the values and confidence intervals for forecasts of the time series.

The dynamic false communication ensures that we produce one-step-ahead forecasts, meaning that forecasts at each data point. We can plot the actual and forecasted values of the O3 time series to assess. Overall, our projections align with the actual values, nicely plot showing an overall increasing trend.

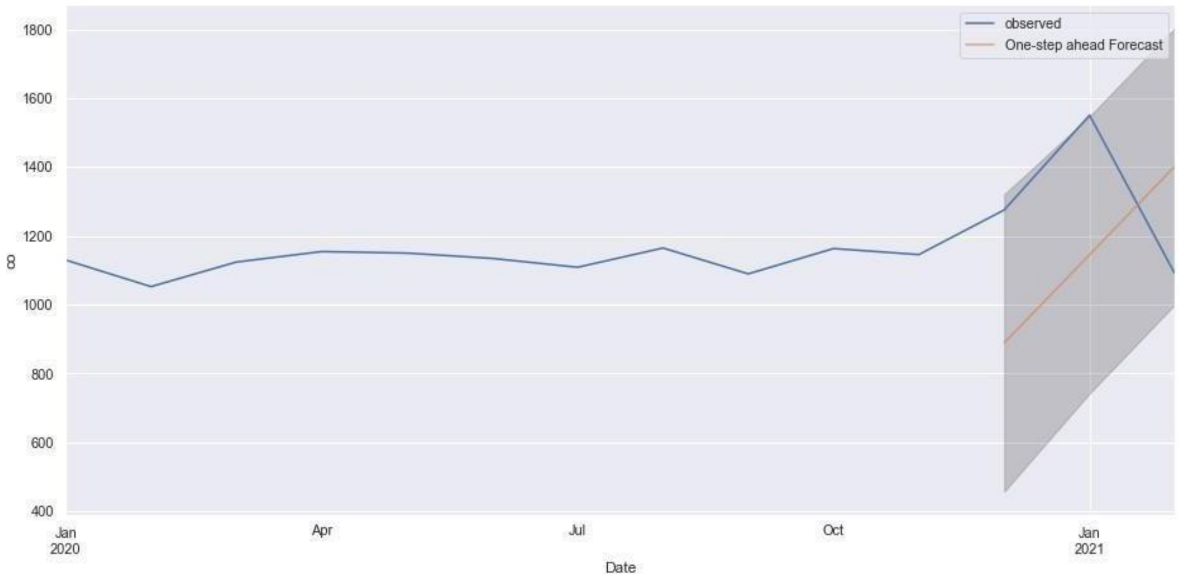


Figure 17 One Step Ahead

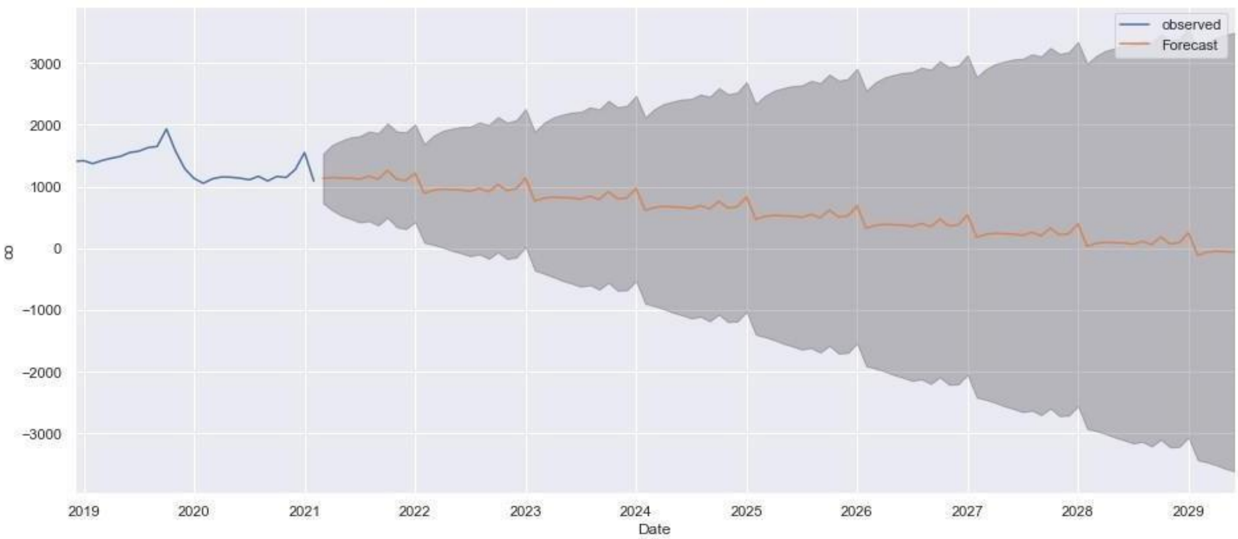


Figure 18 Arima Model Future Forecast and Observation

We have obtained an Arima model for our statistic and plot, which is turn-out forecasts. They start by comparison past and present absolute values of the statistic to perceive the accuracy of our projections. We can plot the important and forecasted values of the o3 statistic to assess however we tend to future. Notice, however, we tend to zoom in on the top of the statistic by slicing the date index. Overall, our Future forecasts align with truth values, showing an associate overall increasing trend.

It is additionally helpful to quantify the accuracy of our forecasts. We'll use the MSE (Mean square Error), which summarizes the standard error of our projections. for every foreseen worth, we tend to work out its distance to truth worth and sq. the result. Those positive/negative variations don't cancel one another out once we work out the general mean.

The emergence of COVID-19 was initially known on December 30, 2019, and declared a worldwide pandemic by the planet Health Organization on March 11, 2020. Cases speedily unfold, at first principally in China throughout January, however quickly increasing to Europe (mainly Italian Republic, France, and Spain) between late January and mid-February, before reaching international proportions by the time the pandemic declared. Progressively rigorous measures were placed in situ by world governments in a trial, initially to isolate cases and stop the transmission of the virus and later to impede its rate of unfolding. The obligatory measures ramped up from the isolation of symptomatic people to the ban of mass gatherings, necessary closure of colleges, and even necessary home confinement. The population confinement results in forceful energy use changes, with expected impacts on greenhouse emission emissions.

6 DEEP LEARNING MODEL

Relationship between COVID-19 deaths and AQI interrupted PM10 and PM25 we found our research inflammatory lungs response COVID-19 cases and AQI particle identical dangerous particles such as PM exposure alternated cardiovascular physiology COVID 19. But some time on specific circumstances implies that virus facilitated in AQI fine particles (Cosimo & Mele, 2020) correlations between dust particles COVID-19 mortality.

One microgram per cubic meter of pm25 increases a 15% mortality rate Corona virus. Confidence interval 93% in COVID-19 Death. The link between air quality statistically significant and robust, with a confidence interval of 95%. In a working (Eric S and Cavalli, 2021) this research paper in Europe during pandemic increasing. The results showed that 78% of the deaths from COVID-19 were concentrated Lynd, Spain Air Quality Index before COVID-19 lockdown. Starting of the 2020 February, the co-pick level. January, the corona time, has AQI down. Continually we have some increase and decrease. Emissions modifications because of lockdown measures at some stage in the primary wave of the COVID-19 pandemic in Europe Earlier this year, international locations internationally went into tight lockdown as a part of their efforts to lessen the unfold of the SARS-CoV-2 coronavirus and to manipulate the numbers of COVID-19 patients.

While the effect of those lockdowns has had good-sized repercussions for people and communities, there had been a few positives. One of the greater broadly mentioned of those has been the massive discount in pollution and greenhouse gases. Using satellite tv for pc observations, in situ observations, and numerical models, the Copernicus Atmosphere Monitoring Service (CAMS) has said on those modifications, including the currently launched 2020 air great report.

6.1 Finland

In Finland, air quality is good, impacts of air pollutants are minor. However, Finland has different weather. But because of lockdown due to COVID -19 until August 1, 2020, we show the Finland AQI level drape, PM10 getting lower, and level rising lock-down time because the government of Finland has begun a new program (National Air Pollution Control Programme, 2019), (Ferreira, 2019). They make a goal to control air pollution by 2030. Air quality in Finland is good.

Although both long-range trans boundary air pollution and emissions from domestic sources fall significantly by 2030. Thanks to the EU's climate and air quality policy. Finland does not have a lot of change in air quality due to industries that open in the summer, for example, wood scale industries, forest, fire woodburning. These CO emissions are generated close to inhalation height and are still partially unregulated. The adverse effects of air pollutants on the human health area unit in the main (64%) caused by fine material (PM25) contain cancer compounds and weighty metals. These particles area unit carried by air into all elements of the tract and not solely cause direct allergic, medical specialty, and nasty effects within the lungs however conjointly part enter the blood and area unit transferred any to different elements of the body, like the heart muscle and therefore the brain. However, the consequences of varying air pollutants are severe, slighter than those of fine material (Andrea and Dominici, 2020).

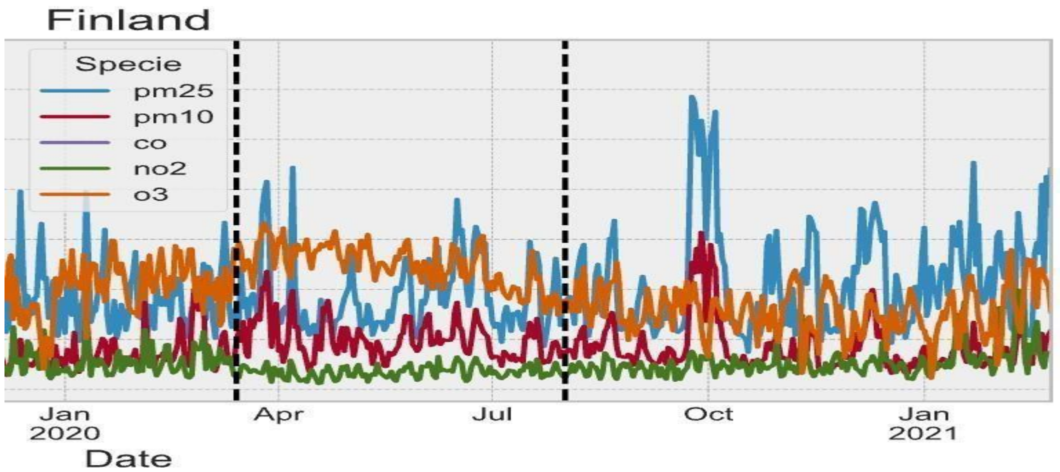


Figure 19 Finland Aqi Deep Learning

6.2 Italy

The first lockdown time in Italy saw a rapid decline in air pollution because Italy suffered many causes of COVID 19 mortality. AQI after COVID-19 lockdown, we have low CO as seenin the plot. Pre-lockdown time and lockdown time, we have the lowest AQI. So, we can say yes during pandemic emission reduction. As per EU Record, in Italy in 2016, for every 100 000 individuals, there have been 96.6 premature deaths attributable to PM25 and attributable to NO2 or 23.8 and 5.9 premature deaths in three months, respectively, the lockdown has temporarily reduced the cost of air particles by a substantial amount.

Second, this paper is relevant to pollution control policies in the domain of study. Lombardy (Italy) is a high-income, densely populated region, home to approximately 10 million people, and one of the most polluted OECD (Better Policies better life) cities. The European Commission has repeatedly referred Italy to the Court of Justice of the European Union over persistently high level of NO2 and PM10, mainly in Lombardy and the rest of the PoValley European Commission in the Italian Republic. This study sheds light on the sectoral contributions to emissions of PM25 and NO2, offering tools to regulators and policymakers.

Several studies have conducted the effect of air pollution on the spreading of COVID-19. Studies answer different questions and may also have their weaknesses. Exploring the prognosis of COVID-19 is less influenced by the dynamics of infection and thus leads to more minor internal validity threats such as unmeasured confounding. COVID-19 mortality, the particle of NO2 was related to COVID-19 in a study covering mentioned countries that revealed 83% of COVID-19 fatalities of these mentioned countries (Ranjeet S and Singh, 2021).

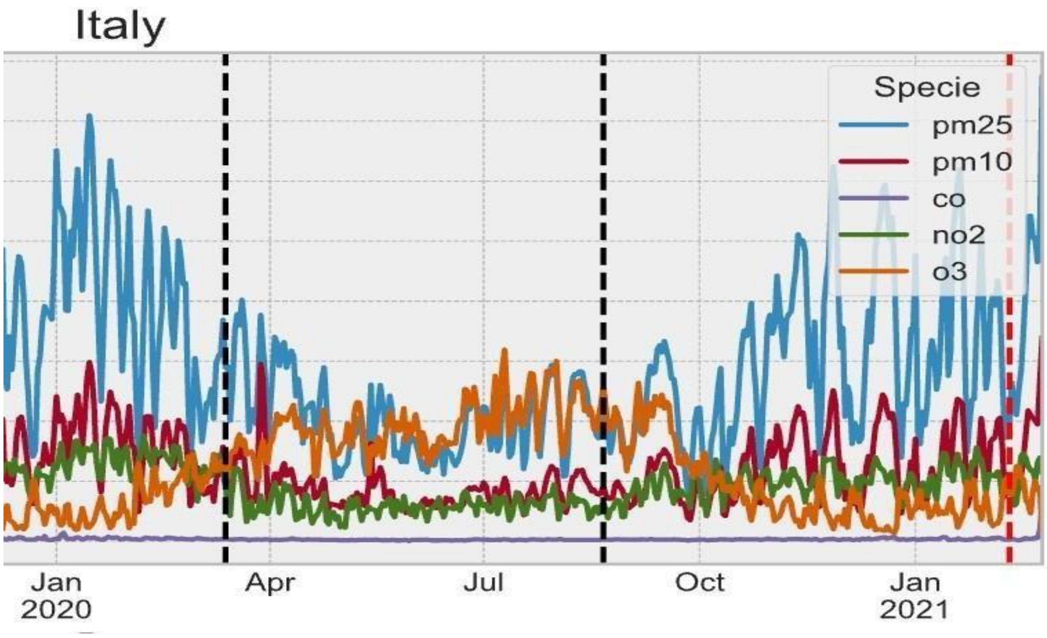


Figure 20 Italy Aqi Deep Learning Model Germany

6.3 Germany

During the COVID-19 Epidemic emissions in the Germany Country 1st restriction, Various air quality emission reductions simultaneously result in a lower number of COVID-19 cases to estimate the effects of air pollution.

The 1st lockdown 2020 had significant positive effects on NO2 levels dropping in Germany, but it was a short-term effect. Only yearly mean effect NO2 values. Bad diffusionconditions partly reimburse emission reductions. The lockdown has shown that transportation and industrial activities are a significant source of NO2 pollution and lower NO2 concentrations.E.g., The lockdown in March 2020 affected PM concentrations, as transportation one of the only dominant source for PM. Secondly, New Year Day 2021 without high peak concentrations caused by fireworks.

High pollution index in industrial economies is vital because the air affects the mortality rate from COVID-19 Germany shared those low emissions areas have seen a 5–9% improvement in air quality. The referred notes where environmental changes are minor to a conclusion over human health.

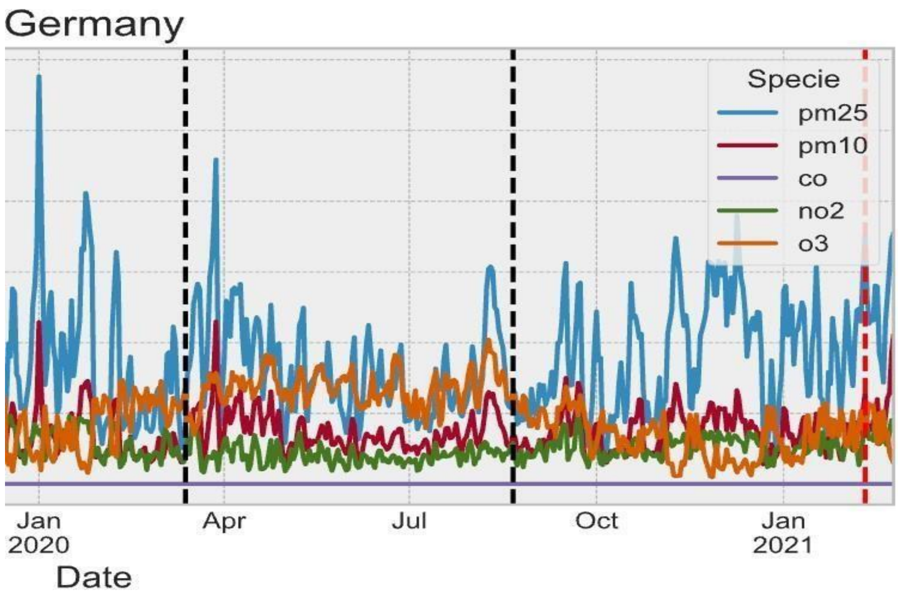


Figure 21 Germany Aqi Deep Learning Model

6.4 France

Air quality can be considered a co-relation of diseases and mortality by COVID-19. The increase in ozone and the dropping in NO other air particles drooping down linked to human activity, which consume ozone. The formation of O3 due to the rise in solar energy, Sunlight, temperature, and humidity. A rise in temperature increases emissions such as PM25. These species lead to the formation of ozone and organic aerosol and increase PM during the lockdown. France showed a non-linear association between NO2 levels and the privation index, with midlevel privation levels having the highest levels of NO2.

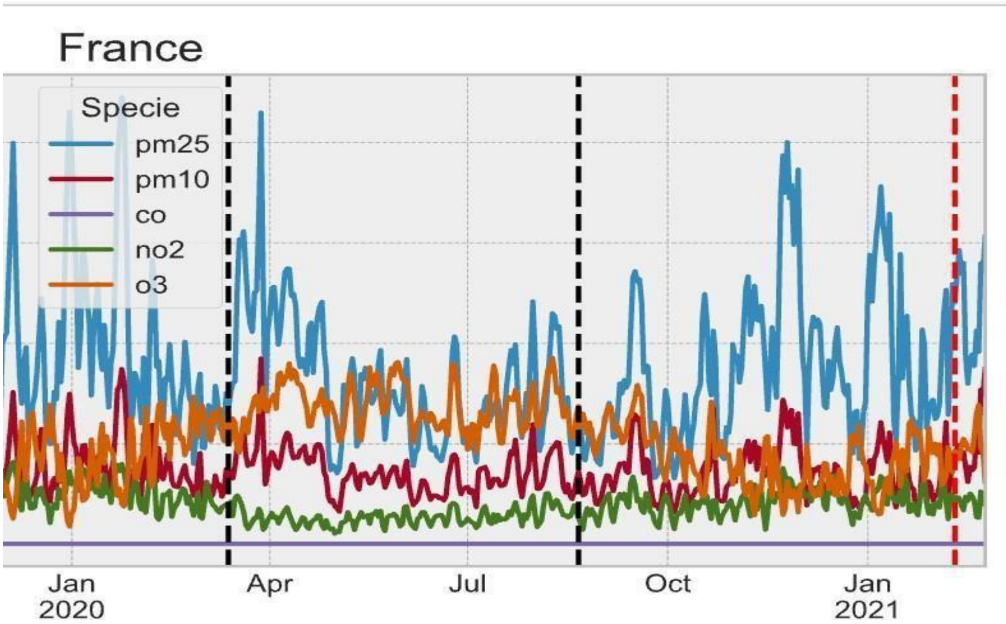
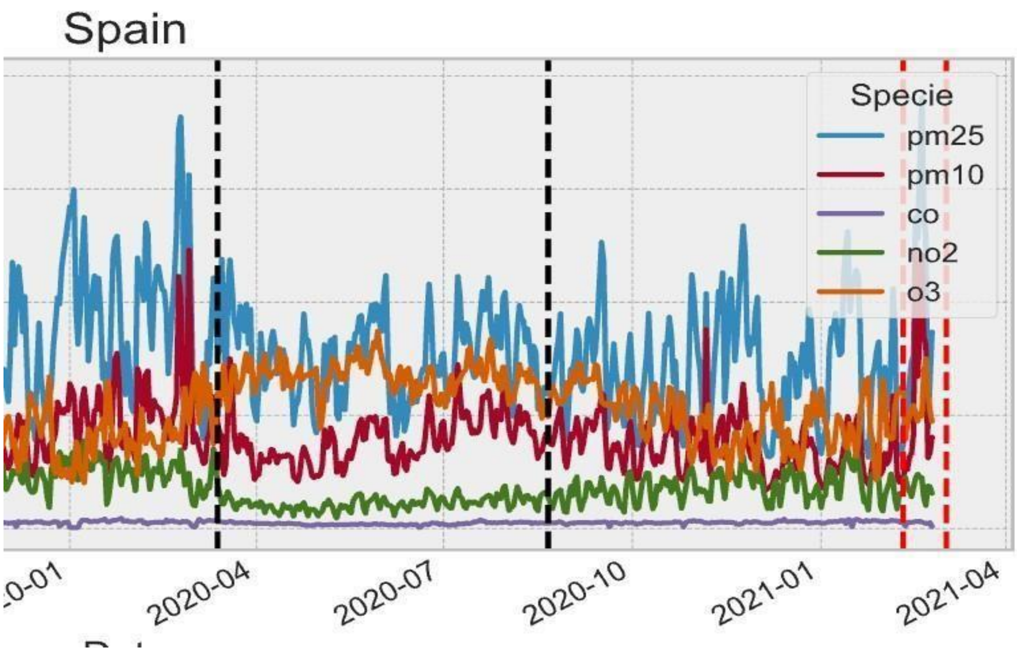


Figure 22 France Aqi Deep Learning Model

6.5 Spain

Spain air quality is not good, but we saw in Spain AQI level draping during lockdown due to COVID -19 till August 1, 2020. Showing PM10 getting to drop down level rising lockdown time because Spain firms national restricting March 14th government declared nationwide lockdown Spain due to the COVID-19 health crisis. Imposed lockdown of all non-essential industries, transportation, and activities. They are starting to use teleworking wherever possible. These measures were strictly forced on March 27, again allowing only essential services to remain in operation. During the lockdown, the AQI level was increasing.



7 OLS REGRESSION MODEL

I am using to Ordinary least squares (OLS) regression model to find out PM25. Ordinary least squares (OLS) statistical method base on probability theory. OLS regression in a context of a bivariate model, in which there is only one dependent variable that prediction (X) dependent on (Y) out Figure OLS show Depend on variable PM25, our data fit the regression line is with the coefficient of (R2) value determination. The coefficient of determination (R2) is: o.884, OLS model algorithm Y = beta_0 +beta_1 * X

OLS Regression Results

Dep. Variable:	pm25	**R-squared:**	0.884
Model:	OLS	**Adj. R-squared:**	0.883
Method:	Least Squares	**F-statistic:**	1731.
Date:	Wed, 26 May 2021	**Prob (F-statistic):**	0.00
Time:	13:16:01	**Log-Likelihood:**	-5317.0
No. Observations:	1600	**AIC:**	1.065e+04
Df Residuals:	1592	**BIC:**	1.069e+04
Df Model:	7		
Covariance Type:	nonrobust		

Figure 23 Ols Regression Model To Find Out Pm2

8 IS BAD AIR QUALITY A MODERN PROBLEM OR NOT, AND HOW IT AFFECT IN PANDEMIC?

8.1 Introduction

Modern age and history show, but it's not confined to a current problem. Poor air quality also found in big industrialist countries: burned woods and crafts industries. Last 100 years, we may see four pandemics originating the avian influenza virus that may start from animals and then transferred to familiar human viruses that can arise from infection cause efficient and sustained transmission.

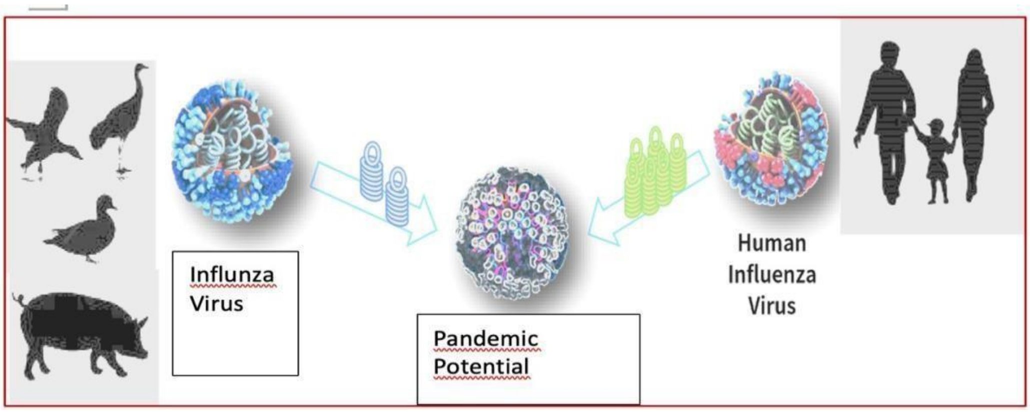


Figure 24 Relation Between Pandemic Virus and Human

The Air quality has not got any attention during the pandemic, even tho cases due to pollution. In trials, mice were exposed to higher levels of material (PM) skilled raised mortality once infected with a standard strain of the contagion virus.

In the EU territory, notable success accomplished in reducing the carbon monoxide emission from 1990 to 2013. The government has taken stricter measures to cut CO emissions; for example, CO emissions can now charge to car owners. We use Supplemental data past 100 years of air quality data to Carbon monoxide to find out that modern problems are not. I use an automated method to determine the last 100 years of Carbon Monoxide air quality. During the last century total, estimatedfatalities range from approx. to 100 million (Chan, 2021).

Figure 25 Aqi Last Over 100 Years

During the 1918–1920 period, Pandemic-related Death was from 1918(October) to 1919(January). This four-month period accounted for more than 90 % of deaths due to pandemics. Among the history of epidemics to consider, all 100 years influenza pandemic is appealing for two reasons. First, the 1918 influenza pandemic is the most recent historical event to match or exceed the scale of the COVID-19 pandemic. Second, the 1918 pandemic occurred after a series of improvements in data collection and preservation because of these improvements the 1918 pandemic offers a unique opportunity for comprehensive and systematic analysis across a wide range of countries. While the COVID-19 pandemic has many significant parallels with the 1918 pandemic, there are also substantial differences (Dorigatti, 2013).

One key difference between the past all pandemics is that quality of life and overall life expectancy was much lower in 1918 than today. Cities in the 19th century and early 20thcentury were polluted, and the risk of contracting and dying was infectious. Novel Highly Contagious Viruses, past all pandemics, involve the spread of a novel, highly contagious virus that induces respiratory distress.

The consequences of infection not fully understood with an unknown virus, and the scope for medical intervention is limited. Both pandemics (1918 and 2019) involve viruses that attack the respiratory system,with the H1N1 strain of avian influenza causing the 1918 pandemic and SARS-CoV-2 stress from the coronavirus family causing the COVID-19 pandemic victim's lungs to fill with fluid and debris, limiting the exchange of oxygen (Cohen, 2017).

Death took many forms. Oxygen-deprived organs would begin to fail, the heart, strained from trying to pump blood out of the lungs, might give out, or the victim could die when muscles overworked from trying tobreathe finally become exhausted and stop. The populations most vulnerable to COVID-19 differ sharply from 1918.

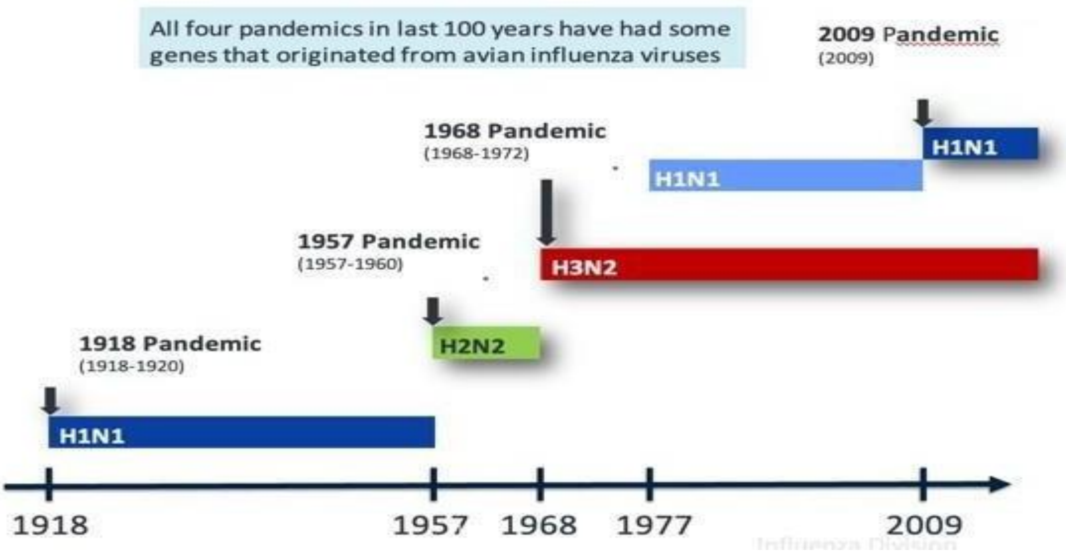


Figure 26 Showing Last 100 Years Avian Influenzas Virus

The 1918 pandemic is known for the distinct W-shaped pattern that appears when plotting age-specific mortality rates. As with many other infectious diseases, mortality rates were high for the young and the old.

8.2 Pandemic acutely

Air Quality After no attention from global stakeholders on air quality or the environment during the pandemic. The rising evidence that air quality exacerbates pandemics. In randomized management trials, the contagion virus. Furthermore, air pollution has shown to contribute to the severity of lung and heart disease (Jakab, 1993).

The effects of pollution could be notably acute throughout the 1918 pandemic, given the pathology of the H1N1 virus secondary infection, such as respiratory disease (micro-organism). Current research shows the impact of the pandemic virus on the human lungs. According to the Journal of the yank Medical Association, doctors noted that "lung lesions,advanced and variable, affected one as being quite totally different to something one had met within the least usually in thousands of autopsies one had performed throughout the last 20 years (Dr Hans Henri P. Kluge, 2021) . The 1957 H2N2 Asian flu pandemic and the third pandemic, the 1968(H3N2) Hong Kong flu pandemic (Guidetti, 2021).

However, the strains that emerged were novel influenza. Pandemic from 1957 to 1960 was not affected too much on the air quality because of planet cooling period. Our data show lousy air quality is not a new problem, but it is not a modern problem.

The plot show from 1945 to 1953 CO level drop and why. During the 20th century, world average temperatures did excellent by about 0.2°C after 1940 and remained low until 1960,after which they began to climb rapidly again (Box G.E. & Jenkins G.M., 2015).

The mid-century cooling appears to have been caused mainly by significant levels of sulphate aerosols in the atmosphere and industrial activity (volcanic eruptions), Because sulphate aerosols deflect light from the Sun. In contrast, star activity reflects that energy out into space. They have a cooling influence on the temperature. E.g., Eeruption of Mount Agung in 1963 produced aerosols that cooled the lower atmosphere by about 0.5°C while solar activity level-off after increasing at the beginning of the century. "It was the post-war industrial that caused the speedy rise in planet CO emissions. By 1945 when this began, the planet was already in a cooling phase that continued until 1975.

32 years of rapidly rising global temperatures and only a minor increase in global CO emissions. Same followed by 33 years of slowly cooling global temperatures and rapid expansions in global CO emissions, IPCC's claim that CO emissions missions were the primary cause of ascertained 20th-century global warming was deceptive (Blackburn, 2015) .

9 RESULTS AND DISCUSSION

The present work shows average air quality concentrations (NO2, CO, SO2, O3, PM10,and PM25). In the wake of rising consistently for quite a long time, worldwide carbon dioxide discharges fell by 6.4%, or 2.3 billion tons, in 2020, as the COVID-19 pandemic crushed monetary and social exercises around the world, as indicated by new information on the day-by-day petroleum product emanations. The decay is generally two-fold Japan's yearly discharges — yet more modest than numerous environment analysts anticipated given the size of the pandemic and isn't required to last once the infection managed (Gatti, 2021)

After rising steadily for decades, world air partials CO emissions fell by 6.4%, or 2.3 billion tonnes, in 2020, as the COVID-19 pandemic repressed economic and social gathering worldwide, according to new data on daily fossil fuel emissions. Given the pandemic scale, researchers expected and are not likely to last on the virus to be brought under control. I was checking during pandemic lockdown effect on AQI.

Figure 27 Aqi Co Before Lockdown

Air Quality Index co-pick before COVID-19 lockdown. Starting 2019, we have CO under 0.1 due to winter: Mid 2019, the co-pick level. January, the corona time, has AQI down. Continually, we have some increase and decrease.

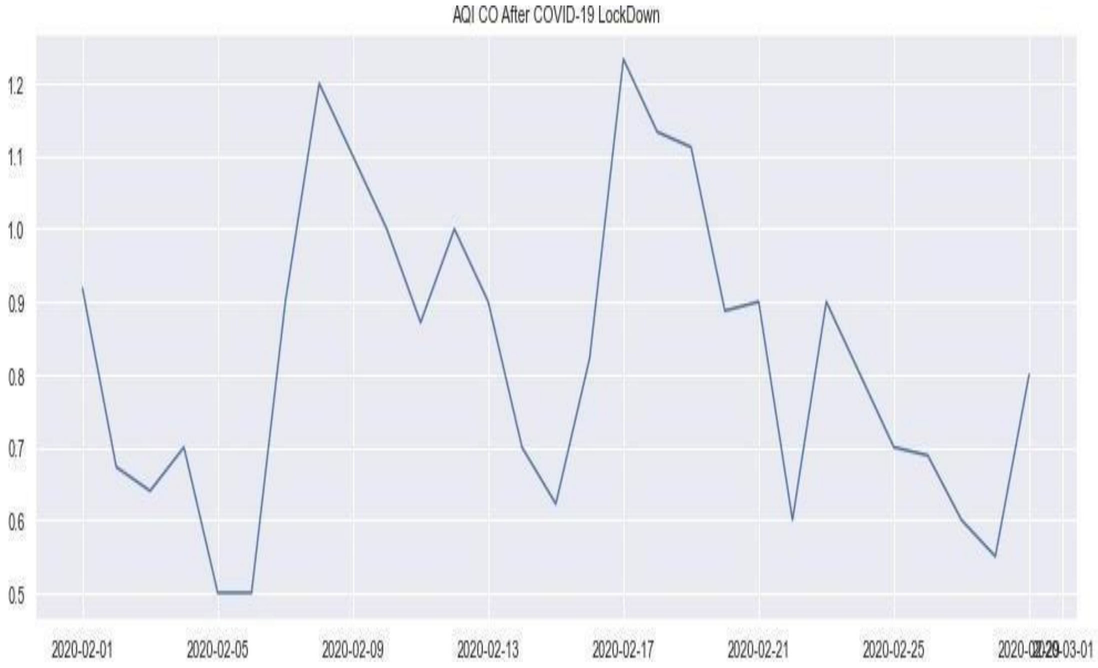


Figure 28 Aqi Co After Lockdown

AQI after COVID-19 lockdown, we have low CO, as seen in the plot. Pre-lockdown time and lockdown time, we have the lowest AQI. So, we can say yes during pandemic emission reduction. This discussion describes the experimental setup with dataset stipulation according to the aim. That was showing experimental results visually and resulted from validation with the dataset. Following the results are discussed and validated with dataset requirement, qualification, and objectives.

9.1 Feature correlation experiment and AQI in Countries

Finding the answer to research discovering the correlation between AQI dependent variables air-born, mainly meteorological components, Countries, and pollutants that affect the air quality, a pair plot performed. Figure 24: Seaborn Pair plot of dependent variables (temperature, humidity, and air pressure) and the pollutants (PM10, PM25, NO_2, CO, and O_3).

The distribution of the variable and the relationship between the objects are showed. The figure describes that the pollutant variables are positively correlated; for example, higher NO2 produces a higher level of bad air quality, although it does not prove that one causesthe other.

The correlation between AQI particles variable, e.g., meteorological variables, is also evident from the figure. For example, high temperature ensures higher pollutants concentration for NO2, CO, PM25, PM10 while high humidity and dew given lover pollution give lower pollutant concentration for NO2, CO, and O3. Given that air particle concentrations are highly dependent on the meteorological variable, particularly temperature, this study shows a COVID-19 and air quality effect on countries and human health.

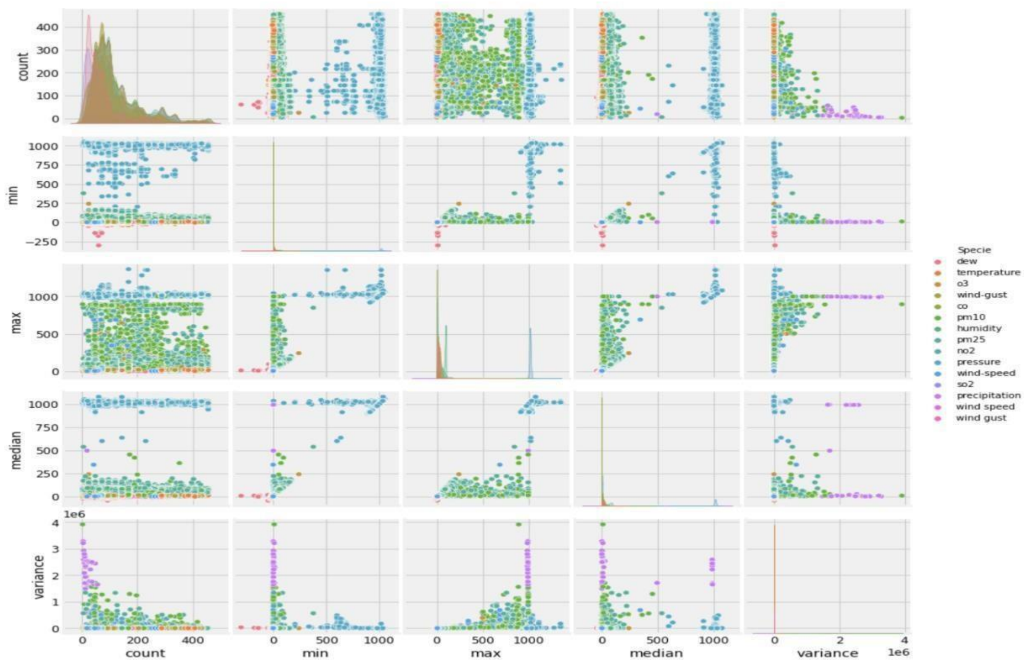


Figure 29 Aqi and Pollution Level Using Stack Model Heat Map (Using Seaborn)

Precise prediction of air quality in polluted European countries is a crucial problem for human health because of air quality. The study demonstrates the benefit of the Regrating model to depend on the variable.

Generally, regression models are usually considered some phenomenon of interest and have a dependent variable—some air particles are very harmful to human lungs. During COVID-19, if and countries suffering high COVID-19 cases and the same countries have horrible air quality, more deaths. Air born particle (PM25, PM10), if any countries suffering PM25 high, there's a most human suffering lung problem, heart diseases (Pansini, Riccardo and Fornacca, Davide, 2021)

Deep learning used to make short-term predictions of various air contaminants. Countries Industrial area air quality prediction depends on COVID-19; it is a challenging task in many parameters. Meteorological results show that air pollution is highly affected to influence air prediction. The dataset utilized in this thesis project has constrained with Air quality and COVID-19, both datasets. The data quality has been increasing for the using machine learning process.

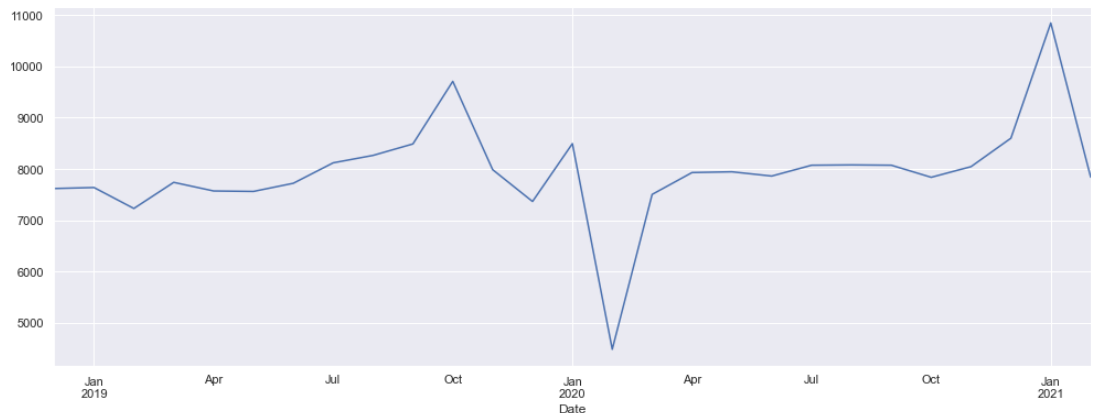


Figure 30 Pollution Level Check Deep Learning

The air quality prediction based on the machine learning method, because of its flexible non-linear modelling ability, is often superior to the traditional statistical methodology in the prediction effect. Still, a single machine learning model often depends on expert knowledge and feature engineering to improve the prediction effect of the model. Its basic idea is to constantly use a "weak" classifier to make up for the shortcomings of the previous "weak"classifier and finally form a "strong" classifier serially

Using an XGboost model to predict machine learning algorithm, train, and test data to findout accuracy value or best-fitting model. Applying this method train and test data frame to like to have unbalanced label classes, we want to balance data classes and label tsclasses by randomly select set numbers of reviews from each class. That means to train and test data algorithms. Figure 33 shows the Xgboost model fitting aTrain X and Y value output.

```
XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
              colsample_bynode=1, colsample_bytree=1, gamma=0, gpu_id=-1,
              importance_type='gain', interaction_constraints='',
              learning_rate=0.300000012, max_delta_step=0, max_depth=6,
              min_child_weight=1, missing=nan, monotone_constraints='()',
              n_estimators=100, n_jobs=8, num_parallel_tree=1,
              objective='multi:softprob', random_state=0, reg_alpha=0,
              reg_lambda=1, scale_pos_weight=None, subsample=1,
              tree_method='exact', validate_parameters=1, verbosity=None)
```

Figure 31 Xgboost

We found using a boosting method to Train and test data set accuracy value

XG BOOST ACCURACY		
Result Parameter	Train Data	Test Data
Accuracy Score	0.8961100569259962	0.5120307988450433
Target	[1456, 844 1902 ... 321 298 1029]	[2329 1719 1078 ... 413 1542 839]

Table 5 Xg Boost Accuracy

10 CONCLUSIONS

This paper studies the effect on the air quality epidemic of Diseases in the European countries to find out all these five countries' quality and COVID-19 has any relationship with Air quality and COVID-19 based on the Arima model. Our research was based on precise WHO statistics on the number of verified cases and deaths. We combine this information with data from nations affected by pandemics and air quality particles to assess the practical impact of air pollution. Issues of COVID-19 We instrument for PM10 concentrations by utilizing local variation in daily wind directions following (Deryugina to determine the influence of air pollution from confounding factors. Following Deryugina et al. 2019), Ourfindings suggest a strong impact of pandemic variation in ambient air quality on the severityof the COVID-19 pandemic. Specifically, we find that higher particulate pollution between pandemic and lockdown effects.

These results are qualitatively in line with air quality and COVID-19 correlations between severity that have documented. We further compliment two quasi-experimental studies using within-region short-term fluctuations in PM to identify effects on COVID-19 case numbers. We find strong evidence that current air quality almost immediately affects the severity.
According to our results, one PM25 increase in PM 2.5 (about 15% of the average concentration of PM 2.5) increases the number of severe cases by roughly 2% and same-day deaths by 3% from the mean case rate in a county. Our results rely on arguably exogenous variation in wind direction and are robust to a wide variety of specifications. Overall, our study points to a potentially important role for policy levers to lower pollution in addressing the pandemic. Instrument daily levels of PM25 using the same instrumental strategy that we employ in this paper. This relatively modest effect contrasts with the substantially more significant impact of one PM10 increase in predicted PM25 doubling the dependent death rate from COVID-19. Our data does not contain the exact day of death but the onset of symptoms (Isphording, 2021).

As we estimate the effects of PM levels relative to the start of symptoms, our results implythat PM levels matter most around the average span between the onset of symptoms and death.
Our empirical design allows us to interpret the estimated effects causally. Our result patterns largely confirm previous cross-sectional and time series-based studies and show that prior results are likely to hold when unobserved confounders considered. these studies by relying on

fine-grained daily data on the onset of illness,which allows us to discriminate between transmitting mechanisms (Kumar S., 2020).

The timing of the estimated effects only affecting severity after the start of disease – supports mechanisms of increased inflammatory reactions causing additional stress for the immune system.

Further, our results show substantial effects in a setting of modest pollution levels in an industrial area, a sufficient supply of high-quality health care, intensive care units, and ventilators. The reason to fear – and a need for additional research to confirm –intensified when the pandemic reaches less-developed world regions where PM pollution and associated health risks hold much more vital importance. E.g., through the more widespread (indoor) use of fossil fuels for cooking and heating, and the supply of high-quality medical care constrained.

Shutdowns across the globe affected the Air Quality parameters. Data indicates that reduced industrial activity and vehicle emissions helped improve air quality parameters. Country data from France and Italy show that the shutdown period (resulting in reduced vehicular emissions and industrial activity) leads improved Air Quality parameters compared to 2019.

Countries with high COVID-19 cases show a relationship with improved Air Qualityparameters. The negative correlation indicates that the rise in COVID cases (The X variable) resulted in the reduced air Quality parameters (Y variable).

The study showcases a decrease in the air pollution concentration after O3 along/after COVID-19 decomposition. The relation between COVID-19 and air quality was organized statistic significant analysts. The intermittent expose to the pollution which includes particle of PM25, NO2, and PM10. Same can contribute to an increase from the first day cases started. The analysis provides several tests related to the interaction between air quality. The isolation measures recommended controlling measures and prevention canstop the transmission and minimize the spread of the COVID virus by reducing air pollution in the environment.

The study focuses on the actual prediction of the situation based on a factor of transmissionof COVID-19. These can be regulated by improving operations in some areas, productions,and procedures, the importance of environmental protection. Therefore, we are integrated future of life and strategy to avoid the COVID-19 situation to develop healthy and sustainable surroundings. As a standard machine learning approach of regression analytic and T-test method, Arima time series method European country-level information. Then Arima time series forecast to research if a pandemic does not stop what happens next ten years. Also, time series analysis of COVID-19 incidence long-term limits camper sectionrecognized mortality and fertility rate.

We use individual data for COVID-19 and air quality during COVID-19 to find the opposite direction of actual results at the individual and combination results.

However, more variables found to determine a reasonable and main factor responsible for spreading infection human to human transmission and local outbreak size. But current pandemic, we show the impact of air quality and COVID-19 positive and negative results. Positive impact yes, we have a clear, clean sky that is a good result for the environment. But the negative outcome we show human health lost is in a home because of nation restriction such as travels social descending and family gathering. It has indicated outdoor activities—effect of human health. If regression analysis Y should be considered for future studies, it is an essential global effect on how humans recover from this pandemic. We are also searching past 100 years' pandemic. Yes, every pandemic time, airquality changed because humans stop to a lot of activities. However, regression and Arima model show during pandemic times, the air quality is cleaner.

Some countries don't have good economic conditions, health care, and public health diffusion of air quality limits during COVID-19 changed and human health. Air quality has clearly shown to increase respiratory infections from a variety of diseases, such as careful research involving the study of air quality data to Countries air particle median value to find out all result and air quality exposure, demographics, and individual-level of air particles to the response needed to qualified to effect data reliably.

11 RECOMMENDATION FOR FUTURE RESEARCH

Future research is interesting to find out how to stop the air-born viruses and countries' national restrictions on environment AQI. What will happen now when the nations start opening up and reducing the number of measures taken. How will the trends develop in the countries that have implemented the same standards? And future research could explore certain health benefits from changes caused by lockdowns in air pollution levels, especially from a long-term perspective. A comparative assessment of this epidemic's economic risks and health benefits can help policymakers make informed decisions about developing future air pollution reduction policies. The variance in reducing the impact of different pollutants from the city also requires further analysis.

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