Face) in the SIS recommended to always use a live picture of the traveller and to avoid using the face image stored in the passport chip because its low resolution decreases accuracy. However, the EES regulation allows operators using the EES to exceptionally extract facial images from the chip of the electronic machine-readable travel document, provided that the image has 'sufficient image resolution and quality to be used in automated biometric matching'. The JRC study on the SIS also recommended to store 'additional off-angle (yaw) images' for 'future potential uses of the ABIS-Face, like for example consultation using images acquired in unconstrained environments (e.g. coming from[1].

- Theoretical Context:

- Exposition of Theoretical Frameworks for Artificial Intelligence Techniques and Their Potential Implications in Enhancing Air Quality Predictions at the Urban Neighborhood: was further compared with the CFD model. Both the ANN and CFD models performed similarly when their predictions were compared with the measurements. However, the ANN model is much faster and requires less computational resources and fewer input parameters. The last factor might be critical in the context of air quality management for a smart city. For instance, acquisition of accurate real-time vehicle emission factors is difficult for CFD simulations, but traffic flow and emission factors are not required for the ANN model simulations based on the finding of the current study. These issues have been discussed in more details. Nevertheless, one of the strengths of the CFD model is that it provides the spatial dynamics of urban air pollution, which is difficult to obtain with the currently formulated ANN model , The epidemiologic evidence of particulate pollution-induced health effects is well documented. A total economic loss of USD 2.4 billion per year was estimated from PM)jo-induced premature death and chronic respiratory diseases in the Pearl River Delta of southern China. Road-side vehicular emissions are the main source of atmospheric particulates in the ambient urban air of cities that are not directly influenced by industrial emissions. Hong Kong, a megacity in southern China, suffers from a similar air quality problem. In view of this, a simulation model for urban air technology in Eurodac. The 2019 JRC study on the introduction of face identification technology (ABIS- rapid and robust results, is of urgent need for practical use. It would benefit not only Hong Kong but also other megacities around the world. For instance, more than 50% of people live in cities in China. Technological advances in urban air quality management in the context of simulations and monitoring are also essential for smart city development [2].

- Artificial Intelligence Integration for Enhanced Urban Air Quality Predictions at the Neighborhood Scale: A Theoretical Study

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Abstract: The intervention addresses the role of artificial intelligence in improving air pollution predictions in urban neighborhoods. The theoretical framework of artificial intelligence techniques and their potential applications in enhancing air quality predictions at the neighborhood level is analyzed. Research on the application of machine learning methods to improve air pollution predictions in urban neighborhoods is reviewed. The focus is on the analysis of the theoretical models used in air emission predictions and the evaluation of models used in air quality predictions at the urban neighborhood level. Anticipated outcomes from the application of artificial intelligence without practical implementation are identified, along with an analysis of previous relevant studies on air pollution predictions in urban neighborhoods. The conclusion emphasizes the importance of the theoretical study in improving air pollution forecasts in urban neighborhoods.

-**Key word** :
-Air pollution prediction,
-Machine learning
- Enhanced prediction
-Artificial intelligence integration
-Theoretical models
-Air emission forecasts
-Time series analysis

-**Introduction :**

The outstanding proposal for revising Eurodac envisages the introduction of facial images to enable searches with facial images in the system. According to the proposal, eu-LISA will be tasked to carry out a study on the technical feasibility of implementing face recognition

the aim being to recognise and keep track of multiple offenders (recidivists). Anthropometry, the science of measuring human bodies, offered a promising method to assign a stable identity to persons. The most famous anthropometric system was developed by the French police official Alphonse Bertillon in the late 1870s. Bertillon sought to collect a series of precise measures and descriptions of a convict's body in order to record his or her identity, classify the information and store it on file for later comparisons.° By the end of the 19th century, the 'Bertillonage system' (or versions of it) had been adopted by many countries in Europe and beyond[1]. **- Review of relevant references on the application of machine learning methods to enhance air pollution predictions in urban neighborhoods:** In 2020, the Commission published a roadmap" for the review of the Priim framework, suggesting a number of possible improvements, including the possibility to exchange facial images, develop central components for searching and comparing data, and add new functionalities (such as using DNA and fingerprint queries for searching missing persons and unidentified human remains). A 2020 study" on possible improvements of the Priim framework recommended the adoption of the exchange of facial images, after considering 'the maturity of the technology and its capability within the context of forensic law enforcement'. Another study on the use of facial recognition for the investigation of crime across EU Member States is forthcoming in the context of the EU-funded project, Towards the European Level Exchange of Facial Images."" (accuracy of technologies and data quality), and fundamental rights issues (bias and discrimination, data The potential for 'covert, remote, and mass capture and identification of images''™ creates serious privacy risks for individuals and threatens to transform the way in which people understand and experience public space. Critics have pointed out that mass surveillance initiatives relying on face recognition create a 'perpetual line-up' where citizens are treated as suspects.'*° In the context of EU borders, it is argued that new face recognition systems may further contribute to 'automating suspicion' in regard to third-country nationals. At the EU borders, automated risk assessments are carried out in the framework of information exchange on passengers and in the context of the VIS (and the future ETIAS). Risk assessments and analyses may rely on aggregate data extrapolated from all information systems. For example, the updated SIS regulation (on borders) tasks eu-LISA to provide Frontex with 'additional specific statistics... to be used for the purpose of carrying out risk analyses and vulnerability	In the context of borders, in 2007, the US Transportation Security Administration rolled out the Screening of Passengers by Observation Techniques system to detect air travellers' expressions of fear and stress that could lead to identifying potential terrorists. The system was criticised as both ineffective and discriminatory.' In 2021, the UK Border Agency tested a tool to evaluate stress, anxiety and deception at the immigration desk, based on a facial and thermal analysis.Frontex collaborated with the US National Center for Border Security and Immigration (BORDERS) in the context of the research project on Automated Virtual Agent for Truth Assessments in Real-Time (AVATAR)."' AVATAR developed a deception-detection system based on the analysis of facial expressions, voice, body and eye signals. The collaboration between Frontex and BORDERS took place through a number of annual workshops, experiments and field tests. An AVATAR field test was carried out in 2013 at the Henri Coanda International Airport of Romania." This paper provides an overview of EU initiatives on developing and deploying artificial intelligence (AI) technologies to improve border control and border security. First, it outlines the historical development of identification technologies (passport, fingerprints, photography, polygraphy, face recognition) in the social and political context. Second, it outlines the EU policy on smart borders, examining the EU's centralised information systems and major information exchange mechanisms for borders and security. Third, it surveys major EU initiatives on Al for borders by looking into four categories of Al applications: 1) biometric identification (automated fingerprint and face recognition); 2) emotion detection; 3) algorithmic risk assessment; and 4) Al tools for migration monitoring, analysis and forecasting. Fourth, it discusses key issues raised by the development and use of such Al applications, namely reliability issues pollution, which can produce protection and security, unlawful profiling, and transparency in EU funding on Al research). The paper concludes with reflections on the broader understanding of technologies, cautioning against the pitfalls of technological determinism and the myth of technological neutrality.The EU project iBorderCtrl has triggered significant criticism concerning its scientific validity,reliability and social impact. With respect to reliability, a 2020 paper'*> found limitations regarding the applicability of the model in a real-life context and concluded that it 'is very unlikely that the

Shrinkage and Selection Operator regression; LSTM (Long Short-Term Memory), KNN (k-Nearest Neighbor;), RF (Random Forest;), and SVM (Support Vector Machines;). Bozdag et al. reported that ANN algorithm [among other algorithms (LASSO, SVR, RF, kNN)] produces the best results (r? = 0.58; RMSE = 20.8, MAE = 14.4) when performing a spatial prediction of PMjo concentration in Turkey. Studies have shown that meteorological characteristics could play an important role in the prediction of air pollutants. Ma and Zhang commented that using some traditional algorithms, such as radical basis function, back propagation neural network and SVM model, requires too many inputs, but the prediction results are not in good agreement with the measurements. Nevertheless, an application of a ML model on neighborhood-scale air pollution dispersion within the UCL of a compact city is rarely found in the Statistical models like autoregressive integrated moving average (ARIMA) linear models and artificial intelligence models like artificial neural networks (ANN) non-linear models are	too ,Other attempts to solve the problem of identification took place in the context of criminal justice, assessments' (Article 40) [1]. **-Research Gaps** **- Analysis of previous research and identification of shortcomings or future opportunities to improve the application of artificial intelligence in air pollution prediction at the urban neighborhood scale** The EU and its Member States are increasingly turning to artificial intelligence (Al) technologies in their efforts to strengthen border control and mitigate security risks related to cross-border terrorism and serious crime. This is a recent manifestation of a broader trend towards a 'smartening' of EU borders, a trend that also includes the development and interlinking of large-scale centralised information systems and the deployment of decentralised information exchange mechanism for borders and security. These systems have gradually been expanded and upgraded in order to cover ever more categories of persons (that is, to close 'information gaps') and to process increasingly varied types of data (including an increased processing of biometric data) [1]. **-Analysis of Previous Studies on Air Emission Predictions and Evaluation of the Utilized Models within this Scope** Following the 2015 migration crisis and in line with the European agenda on migration," in April 2016 the Commission published a communication on stronger and smarter information systems proposing to 'strengthen and improve [the EU's] IT systems, data architecture and information exchange' in order to cover the 'existing information gaps'. This was followed by a number of legislative proposals to expand existing systems, create new ones and establish interoperability **-Theoretical Models -** **- Presentation of theoretical models on how to integrate artificial intelligence to improve air pollution predictions at the urban neighborhood scale** More recently, ML technique has been used in predicting regional-scale air pollution. A few studies reported better performance for ML models in regional-scale air quality prediction compared to conventional physiochemical numerical air quality models.

widely popular data-driven time series models. However, a hybrid model, which is built by combining the two methods (non-linear and linear), has been shown to produce better results than the individual models. To improve the performance of the hybrid models, signal decomposition is an important step when contracting the model]. The most popular methods for signal decomposition include discrete wavelet transform (DWT), empirical mode decomposition (EMD), and ensemble empirical mode decomposition (EEMD, among others. Recently, a new novel signal decomposition technique was developed, named the empirical wavelet transform (EWT). This technique integrates systems with a mathematical theory like wavelet transform (WT) and adaptiveness to the signal like EMD. Subsequently, this technique has proven tobe efficient in the improvement of the performance of hybrid time series forecasting models]. Long short-term memory networks (LSTM) recurrent neural networks (RNNs), which were proposed by Hochreiter and Schmidhuber, have been proven as an enhanced variant of RNNs that can learn the information contained in time series data more robustly. LSTM, a deep learning method, can more effectively capture the variability of time series data compared with other models such as ARIMA and ANN. However, the model accuracy is not high, using the LSTM network in its simplest form, to predict the time series data. Therefore, applying it in its simplest form, in a non-stationary time series data like the TCO time series used here, consideration should be given to first decomposing the time series to several more predictable components, each having less non- stationarity in order to improve overall accuracy. LSTM has been previously used in digital currency forecasting, daily land surface temperature forecasting, wind speed forecasting, and wind power short-term prediction, among others,Anumber of atmospheric chemistry research groups have been closely monitoring the slow self- the advantage of utilizing the EWT technique in the decomposition stage of the LSTM process. We compared our model with (1) an LSTM model that uses EMD, namely EMD-LSTM; (2) an LSTM model that uses wavelet denoising (WD) (WD-LSTM); (3) a	Various ML algorithms have been used in air pollution prediction, namely, ANN (Artificial Neural Network; LASSO regression (Least Absolute Urban air pollution has aroused growing attention due to its associated adverse health effects. A model which could promptly predict urban air quality with considerable accuracy is, therefore, important and will benefit the development of smart cities. However, only a computational fluid dynamics (CFD) model could better resolve the dispersion behavior within an urban canyon layer. A machine learning (ML) model using the Artificial Neural Network (ANN) approach was formulated in the current study to investigate vehicle-derived airborne particulate (PMjg) dispersion within a compact high-rise-built environment. Various measured meteorological parameters and PM concentrations were adopted as the model inputs to train the ANN model. A building-resolved CFD model under the same environmental settings was also set up to compare its model performance with the ANN model. Our results showed that the ANN model exhibited promising performance ($r = 0.82$, fractional bias = 0.002) when comparing the > 1000 h PMyo measurements. When comparing the diurnal hourly measured PMio variations in a clear-sky day, both the ANN and CFD models performed well ($r > 0.8$). The good performance of the CFD model relied on the knowledge of the in situ diurnal traffic profile, the adoption of suitable mobile source emission factor(s) (e.g., from MOBILE 6 and COPERTS), and the use of urban thermal and dynamical variables to capture PMig variations in both neutral and unstable atmospheric conditions. These requirements /constraints make it impractical for daily operation. On the contrary, the ML (ANN) model adopted here is free from these constraints and is fast (less than 0.1% computational time relative to the CFD model). These results demonstrate that the ANN model is a superior option for a smart city application. [2]. Data-driven time series forecasting is an important research topic in the domain of science and engineering. The primary objective of this data science domain is to use available data to develop a mathematical model that can forecast future situations. Over the years, there have been many efforts in the development and improvement of time series forecasting models. These models can be

wavelet denoising EWT-LSTM (WD-EWT- LSTM); and (4) a wavelet denoising noise-reducing sequence called EMD-LSTM (WD-EMD-LSTM). The model that uses the EWT decomposition process (EWT-LSTM) outperformed the other five models developed here in terms of various forecasting performance evaluation criteria, such as the root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and correlation coefficient (R). the advantage of utilizing the EWT technique in the decomposition stage of the LSTM process. We compared our model with (1) an LSTM model that uses EMD, namely EMD-LSTM; (2) an LSTM model that uses wavelet denoising (WD) (WD-LSTM); (3) a wavelet denoising EWT-LSTM (WD-EWT- LSTM); and (4) a wavelet denoising noise-reducing sequence called EMD-LSTM (WD-EMD-LSTM). The model that uses the EWT decomposition process (EWT-LSTM) outperformed the other five models developed here in terms of various forecasting performance evaluation criteria, such as the root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and correlation coefficient (R) [3]. **- Theoretical Models** **- Analysis and comparison of the models used in air pollution predictions at the urban neighborhood level** While both the ANN and CFD models performed similarly in the PMj9 predictions studied above, the computational time for the ANN model was less than 0.1% of the CFD model. Simulating a one-day hourly PMjp variation by the ENVI-met required more than 30 wall-clock hours in parallel processing mode for a computer with four cores, while a ~50-day hourly PMjo simulation by the ANN model required less than 30 wall-clock minutes using the same computer. To resolve the demanding computational LSTM system wnat 15 sus. [3]. **- Possible conclusions from the findings of previous research concerned with air pollution predictions in the urban neighborhood** Face recognition technology is currently not used in any EU	classified into statistical models, artificial intelligence models, physical models, and hybrid models recovery of stratospheric ozone for some time. The difficulty of this slow recovery is that the entire process depends solely on the self-recovery aspects of the ozone layer. Consequently, the recovery of the stratospheric ozone layer is strongly dependent on the continued decline in the atmospheric concentration of ozone-depleting gases such as CFC]. However, it is concerning that a recent study by Rigby et al. reported that the recent slowing down of the stratospheric ozone layer recovery is counterbalanced by the continual emission of trichlorofluoromethane (CFC-11) in northeast China. The suggestion of a decrease in stratospheric ozone recovery and the continuation of the ozone decline in the lower stratosphere has been presented by other authors [5]. The study by Ball et al. indicated that, while the stratospheric ozone layer has stopped declining across the globe, there is no clear increase observed at latitudes between 60° S and 60° N outside the polar region (60°-90°). Therefore, it is for this reason that TCO time series studies and the consequent design of models that can predict and forecast the dynamics of the ozone concentration in the atmosphere are imperative.Total column of ozone (TCO) time series analysis and accurate forecasting is of great significance in monitoring the status of the Chapman Mechanism in the stratosphere, which prevents harmful UV radiation from reaching the Earth’s surface. In this study, we performed a detailed time series analysis of the TCO data measured in Buenos Aires, Argentina. Moreover, hybrid data-driven forecasting models, based on long short-term memory networks (LSTM) recurrent neural networks (RNNs), are developed. We extracted the updated trend of the TCO time series by utilizing the singular spectrum analysis (SSA), empirical wavelet transform (EWT), empirical mode decomposition (EMD), and Mann-Kendall. In general, the TCO has been stable since the mid-1990s. The trend analysis shows that there is a recovery of ozone during the period from 2010 to 2017, apart from the decline of ozone observed during 2015, which is presumably associated with the Calbuco volcanic event. The EWT trend method seems to have effective power for trend identification, compared with others. In this study, we developed a robust data-driven hybrid time

centralised information systems.
However, in the near future all these systems except ETIAS are expected to process facial images for
the purpose of verification or identification.

The Schengen Information System (SIS)°" was established in 1995 and updated in 2013 and again in
2018. The SIS enables the competent authorities to access it and to consult alerts for the purpose of
refusing entry into or stay in the Schengen area, or to consult alerts on missing persons and on persons
or objects related to criminal offences. An update of the SIS legal framework in 2018"? introduced new
categories of alerts (on unknown suspects or wanted persons, on children at risk of parental abduction,
on entry bans, and on persons ordered to return). It also allowed the processing of more types of data,
including new biometric data (palm prints, facial images and DNA profiles related to missing persons).
The new SIS features are expected to become fully operational in December 2021.

The European Travel Information Authorisation System (ETIAS)"° was established in 2018 and is
expected to become operational in 2022. ETIAS will allow for the pre-registration of visa-exempt
visitors travelling to the Schengen area and for assessing security or irregular migratory risks posed
by these persons before they arrive at the border. ETIAS will also establish a watchlist of persons
who are suspected of having committed or taken part in a terrorist offence or other serious criminal
offence or persons regarding whom there are factual indications or reasonable grounds, based on

The EU's centralised information systems for borders and security are increasingly incorporating
biometric technologies for the purpose of identity verification or identification. Automated
fingerprint identification technology is currently used in three information systems (the Schengen
Information System, the European dactyloscopy database (Eurodac) and the Visa Information
variance (Supplementary Material Table S1). One of the PCs (PC3) showed high loadings
(>0.9) with the background PMjp and the predicted PMjo, suggesting a strong association
between them. The ANN model construction using only the background PMjp as the
input parameter could achieve a relatively good model performance (r = 0.77), when

series-forecasting model (named EWT-LSTM) for the TCO time series forecasting. Our model has
resource and lengthy time required by CFD simulations, a plausible solution might be a
fast-mathematical model with simplified equations for air quality predictions. However,
it is well known that a simplified dispersion equation, such as a Gaussian-type equation,
performs poorly in dispersion calculations in complicated built environments. [2].

- Expected Results

Anticipating the Potential Outcomes of Artificial Intelligence Application in the Absence of Practical Implementation

In 2019, Frontex published the technical and operational strategy for EIBM,*° which defined several
strategic objectives, including sustaining European border and coast guard capabilities by, among
others, identifying and exploiting state-of the art technology. The strategy advocated a 'knowledge-based border control' that relies increasingly on pre-arrival information and makes effective use of
all relevant information systems. The first policy document for the multiannual strategic policy and implementation cycle is expected to be finalised in the first half of 2021. [1].

The use of the EWT to decompose data before use in the model is expected to improve the
prediction accuracy and to solve the issue of long-term dependencies forecasting problems of the
TCO monthly time series, such as the one used here. The EWT-LSTM developed here is also
compared to the hybrid method based on the EMD and LSTM neural networks, namely EMD-LSTM.
This hybrid model (EMD-LSTM) was applied to geophysical data for the first time by Zhang et al.
[11]. The two above models are also compared to the LSTM model that uses wavelet denoised (WD)
data (WD-LSTM), wavelet denoising EWT-LSTM (WD-EWT-LSTM), and wavelet denoising EMD-
LSTM (WD-EMD-LSTM). For denoising, this study uses a Daubechies (db8) wavelet family in the
PyWavelets Wavelet Transform software for Python. This family of wavelets is selected because it
performed better than others in terms of applications in the forecasting of the TCO data. In addition,

compared to the observations. At this point, the result of the PCA was consistent with that
of the ANN model's sensitive test. However, an additional sensitive test by constructing
an ANN model using in-canyon wind speed and in-canyon air temperature (essential
parameters in the CFD simulation) showed a very poor model performance with r = 0.25.
The poor performance might be attributed to the omission of the background PMjp levels.
Nevertheless, our results suggested that the ML model could perform reasonably well[2].

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the LSTM system used here is a Python TensorFlow

System) and will also be used in another two (the Entry/Exit System and the European Criminal Record Information System for third-Country nationals). Automated face recognition technology (FRT) is not yet used in any EU information system, but all systems except one (the European Travel Information Authorisation System) are expected to process facial images in the near future for the purpose of verification and/or identification.The European Border Surveillance System (EUROSUR)"* was established in 2013 and became operational in 2014. EUROSUR is a framework for information exchange and cooperation between the Member States and Frontex, aiming to improve the detection, prevention and combating of
illegal immigration and cross-border crime at the EU external borders. EUROSUR is managed by
Frontex and covers land, maritime and air border surveillance (including on pre-frontier areas), as well as checks at border crossing points, border operations and integrated planning. EUROSUR's communication network is currently updated and is expected to become fully operational in 2025. [1].

Conclution

Heated moist air rising from a cooling tower forms a visible plume in winter, the rainy season,
and/or a time of day having high relative humidity, such as early morning. The plume itself is
simply an oversaturated air-water mixture, and thus not a pollutant; however, it sometimes causes environmental issues such as creating lower visibility, obstructing sunshine, increasing humidity in
the surroundings, being mistaken for fire, visually impacting the landscape, and icing [1]. Therefore, the environmental impact assessment and plume abatement of a cooling tower have been necessary for district heating and cooling systems in cities and airports, in power generation plants near cities,
and in nature parks. [4].

A series of sensitive tests for the ANN model was performed to determine whether
a single input parameter or a combination of them governed the model performance.
Prior to the tests, a principal component analysis (PCA) was performed. The PCA results
showed that the first four principal components (PCs) accounted for 74% of the total