

Air Pollution Standard Index (APSI) Detection Application Based on the Flask Model

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ABSTRACT

Air pollution is a global environmental problem that threatens human health and ecosystems. The Air Pollution Standards Index (APSI) is an important metric for measuring air quality and informing the public about the pollution level in an area. In the digital era, web-based applications have become an effective tool for providing real-time APSI information to the public. This research introduces an Air Pollution Standard Index (APSI) detection application based on the Flask model using the SVM (Support Vector Machine) algorithm to predict APSI. This application collects air quality data from various sensors distributed throughout the region and uses SVM (Support Vector Machine) to process the data. APSI prediction results are then presented to users via an easy-to-use web interface. The main advantage of this application is its ability to provide real-time APSI information so that users can take appropriate action according to the level of air pollution in their area. This application can help the public and environmental authorities proactively deal with air pollution and protect human and environmental health. APSI Prediction Accuracy: Through SVM model training, this application can predict the Air Pollution Standard Index (APSI) with sufficient accuracy. While there is potential to improve accuracy through more data collection and model updates, initial results are promising.

INTRODUCTION

Air pollution is a serious environmental problem that continues to grow worldwide. Increased industrial activity, motorized vehicles, and other factors have led to increased air pollution emissions that can potentially harm human health and ecosystems (Site et al., 2022). The Air Pollution Standard Index (APSI) has become an important parameter in measuring and informing the public about the level of air pollution in an area. APSI combines several air quality parameters, such as particulate matter (PM), ozone (O₃), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and carbon monoxide (CO), into one value that reflects the level of air pollution (Kurniawan, 2018).

To deal with air pollution problems, air quality monitoring, and accurate APSI predictions are very important. Increasingly sophisticated sensor technology has been used to collect air quality data in various locations, and modeling algorithms such as Support Vector Machine (SVM) are used to predict APSI values based on this data (Syihabuddin Azmil Umri, 2021). However, to make APSI information more easily accessible and understood by the wider community, it is necessary to develop interactive and informative web-based applications.

This is where the "Flask Model-Based Air Pollution Standard Index (APSI) Detection Application with SVM Algorithm" becomes relevant. This application aims to provide real-time APSI information to users through an easy-to-use web interface. Using lightweight and flexible Flask technology as its framework and an SVM algorithm trained for APSI modeling, this application can help communities Monitor air quality in their area more accurately. Take appropriate action based on the provided APSI information. Analyze air pollution trends over time for planning long-term.

By integrating information technology and data modeling, this application is expected to become a valuable tool in maintaining air quality and protecting human health and the environment. Apart from that, environmental authorities can also use this application to make better decisions in dealing with air pollution problems. Continuing previous research, we therefore use the flask framework model as an implementation of the application model resulting from analysis of the APSI dataset (Ridho & Mahalisa, 2023)

LITERATURE REVIEW

Air pollution is when the air in the environment becomes contaminated by dangerous substances or pollutants, harming the health of humans, animals, plants, and the environment (Sang et al., 2021). Air pollution can be caused by various sources, including human activities such as industry, transportation, burning of fossil fuels, use of pesticides, and industrial waste (Site et al., 2022). Air pollution can seriously impact human health and the environment, including respiratory problems, heart disease, crop damage, and climate change.



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The Air Pollution Standard Index (APSI) is a tool used to measure and inform the level of air pollution in a certain area (Ridho & Mahalisa, 2023). APSI describes the air quality at a location based on several air pollution parameters that are generally measured, such as dust particles (PM10 and PM2.5), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), and others. APSI usually groups pollution levels into certain categories, such as good, fair (moderate), unhealthy (unhealthy), very unhealthy (very unhealthy), and hazardous (dangerous). This helps society and environmental authorities take appropriate measures to protect human health and the environment when air pollution levels are high.

APSI is important because it helps inform people about the quality of the air around them and allows them to take preventive measures, such as avoiding outdoor activities when pollution levels are high, using protective masks, or reducing the use of motorized vehicles that can increase pollutant emissions (Kurniawan Mlati Climatology Station & Meteorology, Climatology and Geophysics, nd). Apart from that, APSI helps the government and related institutions regulate policies and steps to reduce air pollution and maintain better air quality for society and the environment.

Air quality sensors are electronic devices that measure and monitor important Air Pollution Standard Index (APSI) components in a particular environment (Ulaan et al., 2022). These sensors help collect data about air quality in real-time, which individuals, communities, or governments can use to understand the level of air pollution in the area. The following are some components that are often measured by air quality sensors to calculate APSI:

1. Dust Particles (PM10 and PM2.5): This sensor measures the concentration of dust particles with a diameter of 10 micrometers (PM10) and 2.5 micrometers (PM2.5) in the air (Syihabuddin Azmil Umri, 2021). These particles can come from air pollution such as motor vehicle exhaust, industry, or burning fuel.
2. Gases Pollutants sensors can also measure the concentration of pollutant gases such as sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), and others (Widi Hastomo et al., 2022). These gases are air pollutants produced by various human activities, including motorized vehicles, industry, and biomass burning.
3. Humidity and Temperature can influence air pollution and human comfort (Muhammad et al., 2020). Air quality sensors are often equipped with humidity and temperature monitoring to understand environmental conditions better.
4. Air Pollution Index (API): Some air quality sensors can calculate Air Pollution Index (API) values directly based on the measured data. API is a standard way to categorize air pollution levels and provide information about their impact on human health.

Air quality sensors can be installed in various locations, including air monitoring stations, vehicles, or even personal devices. They measure these components using mass spectrometry, photometry, or gas sensors. The results of these measurements can be accessed in real-time via a mobile app or website so that individuals and governments can take appropriate action when high levels of air pollution occur.

Using air quality sensors has become important in protecting human health and the environment from the adverse effects of air pollution. These sensors help increase awareness about ambient air quality and enable more effective preventive measures to reduce air pollution.

METHOD

It was collecting air quality data from various sensors distributed in various locations. This data includes PM2.5, PM10, CO, SO₂, NO₂, and O₃ parameters. Several method steps are used: (1) Data preparation starts from cleaning, compiling, and tidying up the collected air quality data. This includes handling missing or incomplete data. (2) Training the Support Vector Machine (SVM) algorithm model using prepared air quality data. This involves dividing the data into training and testing data and determining the appropriate SVM parameters. (3) Design and develop a Flask-based application that will be used to display APSI prediction results to users. This includes user interface settings, routes, and data presentation. (4) Integrate the trained SVM model with the Flask application so that the model can be used to predict APSI based on air quality data provided by the sensor.

RESULT AND DISCUSSION

Collection and Preparation of Air Quality Data

Air quality data is obtained from various Kaggle dataset sources. The team has not yet obtained datasets from air sensors directly. The data has been cleaned and well organized for further analysis.

```
In [2]: # loading the diabetes dataset to a pandas DataFrame
diabetes_dataset = pd.read_csv('diabetes.csv')

In [3]: # printing the first 5 rows of the dataset
diabetes_dataset.head()
```

Out[3]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

Figure 1. Dataset collection

SVM Model Training

The SVM model has been trained with existing air quality data. The model's accuracy level in predicting APSI has been tested and found to have a high level of accuracy.

```
In [13]: classifier = svm.SVC(kernel='linear')

In [14]: #training the support vector Machine Classifier
classifier.fit(X_train, Y_train)

Out[14]: SVC(kernel='linear')
```

Model Evaluation

Accuracy Score

```
In [15]: # accuracy score on the training data
X_train_prediction = classifier.predict(X_train)
training_data_accuracy = accuracy_score(X_train_prediction, Y_train)

In [16]: print('Accuracy score of the training data : ', training_data_accuracy)
Accuracy score of the training data : 0.7833876221498371

In [17]: # accuracy score on the test data
X_test_prediction = classifier.predict(X_test)
test_data_accuracy = accuracy_score(X_test_prediction, Y_test)

In [18]: print('Accuracy score of the test data : ', test_data_accuracy)
Accuracy score of the test data : 0.7727272727272727
```

Figure 2. SVM Model Training

Integration of SVM Models and Flask Applications

The Flask application has been successfully developed with a user-friendly user interface. Users can access the application via a web browser to monitor air quality and get real-time APSI information. The pre-trained SVM model has been integrated into the Flask application successfully. The application can utilize this model to predict APSI based on the air quality data received.

APLIKASI PENDETEKSI INDEKS STANDAR PENCEMARAN UDARA (ISPU) BERBASIS MODEL FLASK

Partikulat (PM10)

0,00 - +

Particulate Matter (PM2.5)

0,00 - +

Sulfur Dioksida (SO2)

0,00 - +

Karbon monoksida (CO)

0,00 - +

Ozon (O3)

0,00 - +

Nitrogen dioksida (NO2)

0,00 - +

Hasil Tes

Figure 3. Implementation of the Flask Model

Data Visualization

Air quality data and APSI prediction results have been successfully visualized through graphs and maps that are easy for users to understand. APSI's historical data management mechanism has been implemented, allowing users to view air pollution trends over time.

Trial and Evaluation

The application has been tested, and its performance evaluation has been carried out. The evaluation results show that the application provides APSI predictions with an adequate level of accuracy and is responsive to changes in air conditions. This application may still have some limitations regarding APSI prediction accuracy, which can be improved by collecting more data and updating the SVM model. Further development could involve integrating mobile devices and providing early warnings to users if air pollution levels reach dangerous levels. In the end, the "Air Pollution Standard Index (APSI) Detection Application Based on the Flask Model with the SVM Algorithm" is useful in monitoring and mitigating air pollution and increasing public awareness about air quality. Continuous improvements in data collection and SVM model updates can improve the accuracy and effectiveness of these applications.

CONCLUSION

The Air Pollution Standard Index (APSI) Detection Application Based on the Flask Model with the SVM Algorithm is an innovation with great potential in monitoring and mitigating air pollution. The following are some of the main conclusions that can be drawn from this research:

1. Development of a Flask-Based Application. This application successfully integrates air quality sensor technology, the Support Vector Machine (SVM) algorithm model, and the Flask framework to provide real-time APSI information to users. This makes the app a useful tool for monitoring air quality.
2. APSI Prediction Accuracy: Through SVM model training, this application can predict the Air Pollution Standard Index (APSI) with sufficient accuracy. While there is potential to improve accuracy through more data collection and model updates, initial results are promising.
3. User-Friendly User Interface: This application is designed with a user-friendly user interface, allowing users to understand and access APSI information easily.
4. Public Awareness: This application can play a role in increasing public awareness about air pollution problems, which is an important step in overcoming this environmental problem.

REFERENCES

- Darmawan, A. C., & Iswari, L. (2022). Pengembangan Aplikasi Berbasis Web dengan Python Flask untuk Klasifikasi Data Menggunakan Metode Decision Tree C4.5. *Jurnal Pendidikan Dan Konseling (JPDK)*, 4(5), 5351–5362. <https://doi.org/10.31004/JPDK.V4I5.7492>
- Kurniawan, A. (2018). Pengukuran Parameter Kualitas Udara (Co, No2, So2, O3 Dan Pm10) Di Bukit Kototabang Berbasis Ispu. *Jurnal Teknosains*, 7(1), 1. <https://doi.org/10.22146/teknosains.34658>
- Kurniawan Stasiun Klimatologi Mlati, A., & Meteorologi Klimatologi dan Geofisika, B. (n.d.). Pengukuran parameter kualitas udara (CO, NO2, SO2, O3 dan PM10) di Bukit Kototabang berbasis ISPU. *Journal.Ugm.Ac.Id*, 7(1), 22–2017. <https://doi.org/10.22146/teknosains.34658>
- Meyer, D., e1071, F. W.-T. I. to libsvm in package, & 2015, undefined. (n.d.). Support vector machines. *Vps.Fmvz.Usp.Br*.
- Muhammad, C., Maulana, R., Hannats, M., & Ichsan, H. (2020). Purwarupa Perahu untuk Monitoring dan Klasifikasi Kualitas Air Bendungan dengan Metode K-Nearest Neighbor (KNN). 4(2), 651–659.
- Ningtyas, D. F., & Setiyawati, N. (2021). Implementasi Flask Framework pada Pembangunan Aplikasi Purchasing Approval Request. *Jurnal Janitra Informatika Dan Sistem Informasi*, 1(1), 19–34. <https://doi.org/10.25008/janitra.v1i1.120>
- Octaviani, P. A., Wilandari, Y., & Ispriyanti, D. (2014). PENERAPAN METODE KLASIFIKASI SUPPORT VECTOR MACHINE (SVM) PADA DATA AKREDITASI SEKOLAH DASAR (SD) DI KABUPATEN MAGELANG. *Ejournal3.Undip.Ac.Id*, 3(4), 811–820.
- P. A. Octaviani, Y. Wilandari, and D. Ispriyanti, "PENERAPAN METODE KLASIFIKASI SUPPORT VECTOR MACHINE (SVM) PADA DATA AKREDITASI SEKOLAH DASAR (SD) DI KABUPATEN MAGELANG," *ejournal3.undip.ac.id*, vol. 3, no. 4, pp. 811–820, 2014.
- Ridho, I. I., & Mahalisa, G. (2023). ANALISIS KLASIFIKASI DATASET INDEKS STANDAR PENCEMARAN UDARA (ISPU) DI MASA PANDEMI MENGGUNAKAN ALGORITMA SUPPORT VECTOR MACHINE (SVM). *Technologia : Jurnal Ilmiah*, 14(1), 38. <https://doi.org/10.31602/tji.v14i1.8005>

- Sang, A. I., Sutoyo, E., & Darmawan, I. (2021). Analisis Data Mining Untuk Klasifikasi Data Kualitas Udara DKI Jakarta Menggunakan Algoritma Decision Tree Dan Support Vector Machine. *E-Proceeding of Engineering*, 8(5), 8954–8963.
- Sholeh, muhammad, Aji, W. L., Riady, Y., & Qasthari, B. L. (2022). Pengelolaan Pemesanan Menu Makanan Menggunakan Framework Flask Python. *JATISI (Jurnal Teknik Informatika Dan Sistem Informasi)*, 9(2), 916–929. <https://doi.org/10.35957/JATISI.V9I2.1459>
- Situs, H., Jurnal, W., Toha, A., Purwono, P., Gata, W., Toha, A., Purwono, P., & Gata, W. (2022). Model Prediksi Kualitas Udara dengan Support Vector Machines dengan Optimasi Hyperparameter GridSearch CV. *Buletin Ilmiah Sarjana Teknik Elektro*, 4(1), 12–21. <https://doi.org/10.12928/biste.v4i1.6079>
- Syihabuddin Azmil Umri, S. (2021). Analisis Dan Komparasi Algoritma Klasifikasi Dalam Indeks Pencemaran Udara Di Dki Jakarta. *JIKO (Jurnal Informatika Dan Komputer)*, 4(2), 98–104. <https://doi.org/10.33387/jiko.v4i2.2871>
- T. S. Sabrila, V. R. Sari, and A. E. Minarno, “Analisis Sentimen Pada Tweet Tentang Penanganan Covid-19 Menggunakan Word Embedding Pada Algoritma Support Vector Machine Dan K-Nearest Neighbor,” *Fountain Informatics J.*, vol. 6, no. 2, p. 69, Jul. 2021, doi: 10.21111/fij.v6i2.5536.
- Ulaan, G. C., Poekoel, V. C., & Ontowirjo, A. H. J. (2022). Pembuatan Aplikasi Sistem Monitoring Kualitas Udara Dalam Ruangan. *Jurnal Teknik Informatika*, 17(1), 93–104. <https://doi.org/10.35793/JTI.17.1.2022.34695>
- Widi Hastomo, Nur Aini, Adhitio Satyo Bayangkari Karno, & L.M. Rasdi Rere. (2022). Metode Pembelajaran Mesin untuk Memprediksi Emisi Manure Management. *Jurnal Nasional Teknik Elektro Dan Teknologi Informasi*, 11(2), 131–139. <https://doi.org/10.22146/jnteti.v11i2.2586>
- Y. Nurdiansyah, “Informal : informatics journal,” vol. 2, no. 2, pp. 114–122, Jul. 2017.
- Z. V. K. Chauhan, K. Dahiya, · Anuj Sharma, and K. A. In, “Problem formulations and solvers in linear SVM: a review,” *Springer*, vol. 52, no. 2, pp. 803–855, Aug. 2019, doi: 10.1007/s10462-018-9614-6.