USING PYTHON TECHNOLOGIES FOR FORECASTING THE SPREAD OF INFECTIOUS DISEASES

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Abstract: *This paper investigates the application of Python-based technologies for forecasting the spread of infectious diseases. The study focuses on methods for collecting, preprocessing, visualizing, and modeling epidemiological data using modern data analysis tools. Time-series analysis and regression-based forecasting algorithms were implemented using Python libraries such as Pandas, NumPy, Matplotlib, and Scikit-learn. The results demonstrate that Python technologies provide an effective and flexible framework for epidemiological monitoring, short-term forecasting of disease dynamics, and decision support in public health systems.*

Keywords: *infectious diseases, epidemiological forecasting, Python, time series analysis, data analytics, monitoring systems.*

INTRODUCTION

The rapid spread of infectious diseases represents a major challenge for global public health systems. Timely assessment of epidemiological trends and accurate forecasting of future disease dynamics are essential for effective decision-making, resource allocation, and implementation of preventive measures. Traditional statistical approaches often struggle to handle large-scale and rapidly changing epidemiological data.

In recent years, the Python programming language has emerged as a powerful tool for epidemiological data analysis and forecasting due to its open-source ecosystem, extensive libraries, and ease of integration. Python enables researchers to efficiently process large datasets, visualize complex trends, and implement predictive models. The aim of this study is to analyze the effectiveness of Python-based technologies in forecasting the spread of infectious diseases and supporting epidemiological monitoring.

Methods

This study utilized publicly available epidemiological datasets containing daily records of confirmed cases, recoveries, and mortality rates. Data preprocessing, cleaning, and normalization were conducted using the Pandas library, while numerical computations were performed with NumPy.

Time-series forecasting methods, including linear regression and moving average smoothing, were applied to model the temporal dynamics of infectious disease spread. Visualization of epidemiological trends was performed using Matplotlib, allowing clear representation of patterns and anomalies. Model performance was evaluated using the Mean Squared Error (MSE) metric to assess forecasting accuracy.

Results

The results indicate that Python-based forecasting models are capable of accurately capturing short-term trends in the spread of infectious diseases. Visual analysis revealed

critical epidemiological features such as peak infection periods, declining phases, and seasonal variations.

The implemented models provided reliable forecasts that can support early warning systems and assist public health authorities in planning medical resources and intervention strategies. The visual outputs enhanced interpretability and facilitated faster understanding of complex epidemiological patterns.

Discussion

The use of Python technologies significantly simplifies the process of epidemiological forecasting and improves analytical efficiency. Despite the simplicity of the applied algorithms, the models demonstrated practical effectiveness in real-world scenarios.

However, forecasting accuracy is highly dependent on data quality and completeness. Future research may focus on integrating machine learning and deep learning models, such as neural networks, to enhance predictive performance and handle nonlinear epidemiological dynamics.

Conclusion

This study demonstrates that Python-based technologies offer a robust and efficient framework for forecasting the spread of infectious diseases. The proposed approach supports epidemiological monitoring, enhances decision-making processes, and contributes to the development of data-driven public health strategies. Python-based forecasting systems have strong potential for practical implementation in modern healthcare infrastructures.

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