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A Novel Approach on Deep Learning—Based Decision Support System Applying Multiple Output LSTM-Autoencoder: Focusing on Identifying Variations by PHSMs' Effect over COVID-19 Pandemic

Jang, Yong-Ju[a] ; Kim, Min-Seung[a] ; Lee, Chan-Ho[a] ; Choi, Ji-Hye[a] ; Lee, Jeong-Hee[a] ; Lee, Sun-Hong[a] ; Sung, Tae-Eung[b]

Save all to author list

[a] Department of Computer Science, Graduate School, Yonsei University, Wonju, 26493, South Korea

[b] Division of Software, Yonsei University, Wonju, 26493, South Korea

Abstract

Following the outbreak of the COVID-19 pandemic, the continued emergence of major variant viruses has caused enormous damage worldwide by generating social and economic ripple effects, and the importance of PHSMs (Public Health and Social Measures) is being highlighted to cope with this severe situation. Accordingly, there has also been an increase in research related to a decision support system based on simulation approaches used as a basis for PHSMs. However, previous studies showed limitations impeding utilization as a decision support system for policy establishment and implementation, such as the failure to reflect changes in the effectiveness of PHSMs and the restriction to short-term forecasts. Therefore, this study proposes an LSTM-Autoencoder-based decision support system for establishing and implementing PHSMs. To overcome the limitations of existing studies, the proposed decision support system used a methodology for predicting the number of daily confirmed cases over multiple periods based on multiple output strategies and a methodology for rapidly identifying varies in policy effects based on anomaly detection. It was confirmed that the proposed decision support system demonstrated excellent performance compared to models used for time series analysis such as statistical models and deep learning models. In addition, we endeavored to increase the usability of the proposed decision support system by suggesting a transfer learning-based methodology that can efficiently reflect variations in policy effects. Finally, the decision support system proposed in this study provides a methodology that provides multi-period forecasts, identifying variations in policy effects, and efficiently reflects the effects of variation policies. It was intended to provide reasonable and realistic information for the establishment and implementation of PHSMs and, through this, to yield information expected to be highly useful, which had not been provided in the decision support systems presented in previous studies. © 2022 by the authors. Licensee MDPI, Basel, Switzerland.

Author keywords

COVID-19; decision support system; deep learning; LSTM-Autoencoder; public health and social measures (PHSMs)

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Sung, T.-E.; Division of Software, Yonsei University, Wonju, South Korea; email:tesung@yonsei.ac.kr

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