

Research Article

Prediction of HFMD Cases by Leveraging Time Series Decomposition and Local Fusion

Ziyang Wang,¹ Zhijin Wang¹, Yingxian Lin¹, Jinming Liu,¹ Yonggang Fu,¹ Peisong Zhang,² and Bing Cai¹

¹Computer Engineering College, Jimei University, Xiamen 361021, China

²School of Science, Jimei University, Xiamen 361021, China

Correspondence should be addressed to Zhijin Wang; zhijin@jmu.edu.cn and Yingxian Lin; yxlin@jmu.edu.cn

DW[hW \$&8VdgSck \$" \$ #- DM[eW % ? SdZ \$" \$ #- 3UWfW \$" 3bd^ \$" \$ #- BgT^eZW #"? Sk \$" \$ #

Academic Editor: Philippe Fournier-Viger

Copyright © 2021 Ziyang Wang et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Hand, foot, and mouth disease (HFMD) is an infection that is common in children under 5 years old. This disease is not a serious disease commonly, but it is one of the most widespread infectious diseases which can still be fatal. HFMD still poses a threat to the lives and health of children and adolescents. An effective prediction model would be very helpful to HFMD control and prevention. Several methods have been proposed to predict HFMD outpatient cases. These methods tend to utilize the connection between cases and exogenous data, but exogenous data is not always available. In this paper, a novel method combined time series decomposition and local fusion has been proposed. The Empirical Mode Decomposition (EMD) method is used to decompose HFMD outpatient time series. Linear local predictors are applied to processing input data. The predicted value is generated via fusing the output of local predictors. The evaluation of the proposed model is carried on a real dataset comparing with the state-of-the-art methods. The results show that our model is more accurately compared with other baseline models. Thus, the model we proposed can be an effective method in the HFMD outpatient prediction mission.

1. Introduction

Hand, foot, and mouth disease (HFMD) is a common infection caused by a group of viruses. It is likely to occur to children under 5 years old. HFMD causes a serious threat to children's health. Especially in developing Asian countries, this disease is more likely to cause big damage. China is a country with a large population and vast territory, and the development of different regions is uneven. Under this situation, it is difficult to control infectious diseases spread in China. HFMD has been a nationally notifiable disease since 2008. The new cases should be reported in 24 hours. However, the situation is still worsening. According to the data from the Chinese Centre for Disease Control and Prevention (CCDC) [1], nearly 2 million cases were reported in China in 2019, with an incident rate of over 137/100,000. Although most HFMD patients are self-limiting, HFMD can still be fatal. Thus, the prevention and control of HFMD are very important. And if health authorities had anticipated the situ-

ation before the outbreak, a lot of unnecessary damage could have been avoided.

Many methods have been proposed to predict HFMD cases. ARIMA is one of the most general time series models, which is already used in HFMD prediction work [2]. ARIMAX is the ARIMA with external parameters added, and study showed that the ARIMAX has better performance than ARIMA [3]. With the increase of computer computing power, multiple learning models are utilized in HFMD prediction, such as LSTM [4], RNN, and CNN-RNN [5]. These methods often attempt to learn the law of the disease spread trend based on a global predictor.

However, on the one hand, the HFMD outpatient data is nonlinear and nonstationary. On the other hand, the spread of HFMD is affected by complex and diverse external factors, such as climate, living habits, and living conditions. These two characteristics make it difficult to improve performance based on a global predictor. The relationship between target data and external factors provides a new idea to researchers,

