PRAGUE UNIVERSITY OF ECONOMICS AND BUSINESS

Acta Informatica Pragensia
2021, Volume 10, Issue 2, pp. 123–137
Special Issue: Inspiring Technologies for Digital Inclusivity
https://doi.org/10.18267/j.aip.151

Article Open Access

Modelling COVID-19 Hotspot Using Bipartite Network Approach

Boon Hao Hong [1], Jane Labadin [1], Wei King Tiong [1], Terrin Lim [1], Melvin Hsien Liang Chung [2]

[1] Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak, Kota Samarahan 94300, Malaysia
[2] Bintulu Divisional Health Office, Bintulu, Sarawak, Malaysia

Corresponding author: Jane Labadin (ljane@unimas.my)

Abstract

COVID-19 causes a jarring impact on the livelihoods of people in Malaysia and globally. To prevent an outbreak in the community, identifying the likely sources of infection (hotspots) of COVID-19 is important. The goal of this study is to formulate a bipartite network model of COVID-19 transmissions by incorporating patient mobility data to address the assumption on population homogeneity made in the conventional models and focus on indirect transmission. Two types of nodes – human and location – are the main concern in the research scenario. 21 location nodes and 31 human nodes are identified from a patient's pre-processed mobility data. The parameters used in this study for location node and human node quantifications are the ventilation rate of a location and the environmental properties of the location that affect the stability of the virus such as temperature and relative humidity. The summation rule is applied to quantify all nodes in the network and the link weight between the human node and the location node. The ranking of location and human nodes in this network is computed using a web search algorithm. This model is considered verified as the error obtained from the comparison made between the benchmark model and the COVID-19 bipartite network model is small. As a result, the higher ranking of the location is denoted as a hotspot in this study, and for a human node attached to this node will be ranked higher in the human node ranking. Consequently, the hotspot has a higher risk of transmission compared to other locations. These findings are proposed to provide a framework for public health authorities to identify the sources of infection and high-risk groups of people in the COVID-19 cases to control the transmission at the initial stage.

Keywords

COVID-19; Hotspot; Contact tracing; Bipartite network; Location rank.

Citation: Hong, B. H., Labadin, J., Tiong, W. K., Lim, T., & Chung, M. H. L. (2021). Modelling COVID-19 Hotspot Using Bipartite Network Approach. *Acta Informatica Pragensia*, 10(2), 123–137. https://doi.org/10.18267/j.aip.151

Special Issue Editor: Chiew Kang Leng, Universiti Malaysia Sarawak, Malaysia

Academic Editor: Zdenek Smutny, Prague University of Economics and Business, Czech Republic