EMERGING TECHNOLOGIES DURING THE ERA OF COVID-19 PANDEMIC

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PREFACE

The book chapters on **COVID-19** present the novelties of concepts, awareness, reviews, impacts, monitoring, social media platform, motivation and challenge, tracking, and various aspects in this field.

Hoe Shin *et al.*, in Chapter 1, generate a social distancing report score on social distancing practices, so that social distancing awareness can be increased to ensure the SOPs during the COVID -19 pandemics are performed by students. Aziman Abdullah identifies excessive screen time during the COVID-19 pandemic in the earning management system. Chapter 3 by Norhayati Rosli *et al.* presents the predictive analytics of the disease spreading during the COVID-19 outbreak under uncertainty. Roshahliza M Ramli *et al.,* in chapter 4, describe the novelties that reduced the risk of personnel death, by making the disposal process more reliable than the current way, and the safety of the authorities can be improved. Chapter 5 by N.M.A Ghan *et al.* propose a novel configuration for an obligatory self-quarantine system, and facilitate communication between wearable and contact tracing technologies. Nurul Najihah Nazaraly *et al.*, in Chapter 6, present the method used for the detection and recognition of students' faces to develop and evaluate the system for automated attendance.

Chapter 7 by Tang Jing You *et al.* provides the functions for inventory management for SSM company. Nadzirah Abd Rahman *et al.,* in Chapter 8, design a mobile app to evaluate the live courier tracking and delivery system based on hardware and software specifications. Chapter 9 by Nur Hafieza Ismail *et al.* explores and discusses the related studies of social media

platforms' usage during the COVID-19 pandemic, which categorises social media data used, and introduces different deployed machine learning, feature engineering, natural language processing, survey methods, and outlines directions for future research. Chapter 10 by Zuraina Ali *et al.* presents the students' motivation and challenges in learning vocabulary using social media during the COVID-19 pandemic. Chapter 11 by Eng Jun Yew *et al.* demonstrates the impact of the COVID-19 pandemic on E-commerce and online shopping behaviour among students of higher education institutions (HEI). Ragad M Tawafak *et al.* present a systematic review of potential e-learning systems used effectively and with continuous intention to improve students' performance.

I am very much grateful to all the authors, staff of UMP and publisher for their excellent contributions.

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CHAPTER 3

PREDICTIVE ANALYTICS OF THE COVID-19 OUTBREAK UNDER UNCERTAINTY OF THE DISEASE SPREADING

Norhayati Rosli, Noryanti Muhammad,
Muhammad Fahmi Ahmad Zuber

ABSTRACT

COVID-19 pandemic was identified in Wuhan, China in 2019 and has spread at a tremendous rate affecting all countries over the world. Understanding the spreading disease is crucial; hence, the dynamic behaviour of the disease can be predicted. This paper is aimed to model the COVID-19 outbreak by extending the deterministic susceptible-infected-recovered-death (DSIRD) into a stochastic SIRD (SSIRD) model. Infectious rate parameter of the DSIRD model is perturbed with Brownian motion to reflect the uncertainty of the COVID-19 outbreak. Fourth order stochastic Runge-Kutta (SRK4) method is used to simulate the model. Parameter estimation is estimated using the Markov Chain Monte Carlo (MCMC) method. The simulated results for three ASEAN countries of Malaysia, Indonesia and Singapore indicate that SSIRD model is consistent with the infected COVID-19 data; hence, shows the model is adequate in explaining the behaviour of the infectious disease.

Keywords Mathematical model, COVID-19, Pandemic, Stochastic Runge-Kutta, Markov Chain Monte Carlo

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Norhayati Rosli, Noryanti Muhammad, and Muhammad Fahmi Ahmad Zuber
Centre for Mathematical Sciences, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang

Noryanti Muhammad
Centre of Excellence for Data Science & Artificial Intelligence, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang

Norhayati Rosli (Corresponding Author)
e-mail: norhayati@ump.edu.my

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INTRODUCTION

Coronavirus disease (COVID-19) that was first detected in Wuhan, China in December 2019 has resulted in a tremendous disaster worldwide. There have been 526,182,662 confirmed cases of COVID-19, including 6,286,057 deaths till May 2022 (World Health Organisation, 2022, May 31). Most of the infected patients have experienced mild to moderate symptoms and have recovered without special treatment. However, some of the infected people become seriously ill and need medical attention. Mathematical models are important tools to gain understanding in informing evidence-based decisions (Norris et al., 2018). It is crucial for researchers and practitioners to develop a mathematical model of the COVID-19 outbreak and predict the severity of the epidemic trajectories that can alarm public health and the severe impacts on the healthcare system. Dynamics of the disease over time provide an overview of the epidemiological situation and identify whether epidemic control measures have a measurable impact (Bick et al., 2021). With regards to the studies carried out so far, numerous researchers have reported the deterministic model about the transmission of the pandemics. For the incomplete list are Wang et al., 2020; Imai et al., 2020; Anastassopoulou et al., 2020; Xiong & Yan, 2020; Singh & Adhikari, 2020; Azar et al., 2020; Tang et al., 2020a, 2020b; Roda et al., 2020; Leung et al., 2020; You et al., 2020; Yu, X., 2020; Zhuang et al., 2020; Zhao et al., 2020.

The deterministic classical compartmental mathematical models such as Susceptible-Exposed-Infected-Remove (SEIR) and Susceptible Infected-Remove (SIR) are frequently employed to describe the disease outbreak. While these models are useful, the models did not include the influence of stochasticity. Many individuals within the populations are assumed to react unpredictably in response to the pandemic (David et al. 2022). Hence, there is a need to consider stochastic models in capturing these effects.

This paper is aimed to model the COVID-19 outbreak by extending the deterministic susceptible-infected-recovered-death