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PREDICTION OF COVID-19 TRANSMISSION BY SIRS MODEL USING 3-STEP PREDICTOR-CORRECTOR METHOD

(Peramalan Penularan COVID-19 Melalui Model SIRS Menggunakan Kaedah Peramal-Pembetul 3-langkah)

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ABSTRACT

Effective and accurate prediction of the COVID-19 rate is vital for effective public health monitoring and intervention, but forecasting models are often hindered when it comes to striking a balance between accuracy and computing efficiency. This often calls for better prediction models that can effectively capture the dynamics of transmission and can serve as an important tool for healthcare policymaking. This study introduces a hybrid model combining the 3-step Adams-Bashforth-Moulton (ABM) method with the Runge-Kutta (RK4) method to analyze and forecast COVID-19 transmission rates in Malaysia. The hybrid model utilize the RK4 method for generating initial solutions and the ABM method for refining predictions, which is then used to solve the SIRS compartmental using Malaysia-specific COVID-19 data, including confirmed cases, recoveries, deaths, population size, and contact rates. The hybrid RK4-ABM model demonstrates enhanced accuracy in predicting COVID-19 transmission rates. By combining the computational efficiency of RK4 with the accuracy of ABM, the model delivers improved forecasting performance over time. The study will be of massive contribution to epidemiological research by demonstrating the RK4-ABM model's effectiveness in predicting COVID-19 transmission rates and providing valuable insights for healthcare policymakers in Malaysia. This hybrid RK4-ABM model shows potential for future epidemic modeling and forecasting, highlighting the importance of mathematical approaches in understanding and controlling pandemic impacts.

Keywords: epidemic model; Runge-Kutta 4th order; hybrid; Adam-Bashforth method

ABSTRAK

Ramalan yang berkesan dan tepat terhadap kadar COVID-19 adalah penting untuk pemantauan dan intervensi kesihatan awam yang berkesan, tetapi model peramalan sering mengalami masalah apabila wujud ketidakseimbangan antara ketepatan dan kecekapan pengkomputeran. Hal ini memerlukan model ramalan yang lebih baik yang dapat mengesan dinamik penularan dan kebolehfungsiaan sebagai alat penting untuk pelaksanaan dasar penjagaan kesihatan. Kajian ini memperkenalkan model hibrid yang menggabungkan kaedah 3-langkah Adams-Bashforth-Moulton (ABM) dengan kaedah Runge-Kutta (RK4) untuk menganalisis dan meramalkan kadar penularan COVID-19 di Malaysia. Model hibrid ini menggunakan kaedah RK4 untuk menjana penyelesaian awal dan kaedah ABM untuk ramalan saringan yang kemudiannya digunakan untuk menyelesaikan bahagian SIRS menggunakan data COVID-19 khusus di Malaysia, termasuk kes yang disahkan, pemulihan, kematian, saiz penduduk, dan kadar hubungan. Model RK4-ABM hibrid menunjukkan ketepatan yang baik dalam meramalkan kadar penularan COVID-19. Dengan menggabungkan kecekapan pengiraan RK4 dengan ketepatan ABM, model ini memberikan prestasi ramalan yang lebih baik dari masa ke semasa. Kajian ini akan memberi sumbangan besar dalam penyelidikan epidemiologi dengan menunjukkan keberkesanan model RK4-ABM dalam meramalkan kadar penularan COVID-19 dan memberikan pandangan yang berguna untuk pemantauan penjagaan kesihatan di Malaysia. Model RK4-ABM hibrid ini menunjukkan potensi untuk memodelkan dan meramalkan epidemik yang akan datang, seterusnya menekankan kepentingan pendekatan matematik dalam memahami dan mengawal kesan pandemik.

Kata kunci: model epidemik; Runge-Kutta peringkat ke-4; hibrid; kaedah Adam-Bashforth

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