INTISARI

Penjadwalan ruang operasi merupakan masalah yang kompleks karena melibatkan keterbatasan dokter, perawat, ruang operasi, serta variasi durasi operasi. Ketidaktepatan dalam prediksi maupun penjadwalan berisiko menimbulkan konflik, seperti tumpang tindih jadwal dokter, pelanggaran batasan tingkat kontaminasi, batasan ketersediaan ruang operasi dan batasan ketersediaan perawat, yang pada akhirnya berdampak pada kualitas layanan rumah sakit.

Penelitian ini mengusulkan integrasi prediksi durasi operasi *multiprocedure* menggunakan algoritma *machine learning* dengan optimasi penjadwalan berbasis algoritma genetika. Prediksi durasi mempertimbangkan variabel status fisik pasien ASA (*American Society of Anesthesiologists*), profil pasien dan set prosedur bedah sebagai variabel yang dipertimbangkan. Optimasi penjadwalan disusun menggunakan pendekatan *lexicographic* dengan tiga fungsi tujuan utama yaitu meminimalkan waktu tunggu pasien, *overtime* perawat, dan *idle time* ruang operasi, serta memperhatikan kehadiran dokter pada *critical phase*, tingkat kontaminasi, dan ketersediaan tim perawat sesuai *shift*.

Hasil penelitian menunjukkan bahwa algoritma CatBoost memberikan performa prediksi terbaik, di mana variabel ASA mampu meningkatkan akurasi model dengan menurunkan MAE hingga 33,880 menit dan RMSE hingga 55,575 menit. Model optimasi mampu mengurangi seluruh konflik penjadwalan hingga mencapai 0 konflik, sehingga jadwal yang dihasilkan telah sesuai dengan batasan prosedur medis yang ditetapkan.

Kata Kunci: *operating room scheduling*, prediksi durasi operasi, kehadiran dokter bedah, waktu tunggu pasien, *overtime* perawat, *idle time* ruang operasi

ABSTRACT

Operating room scheduling is a complex problem due to the limited availability of surgeons, nurses, and operating rooms, as well as the variability of surgery durations. Inaccuracies in prediction or scheduling can lead to conflicts such as overlapping surgeon schedules, violations of contamination level restrictions, constraints on operating room availability, and nurse availability limitations, which ultimately affect the quality of hospital services.

This study proposes the integration of multi-procedure surgery duration prediction using machine learning algorithms with scheduling optimization based on genetic algorithms. The duration prediction considers the American Society of Anesthesiologists (ASA) physical status classification, patient profiles, and the set of surgical procedures as key variables. Scheduling optimization is developed using a lexicographic approach with three main objectives: minimizing patient waiting time, nurse overtime, and operating room idle time, while also accounting for surgeon presence during critical phases, contamination levels, and nurse team availability according to shifts.

The results show that the CatBoost algorithm provides the best prediction performance. The inclusion of the ASA variable improving model accuracy by reducing MAE by 33,880 minutes and RMSE by 55,575 minutes. The optimization model successfully eliminates all scheduling conflicts, achieving zero conflicts, thereby ensuring that the generated schedules comply with established medical procedure constraints.

Keywords: operating room scheduling, surgery duration prediction, surgeon presence, patient waiting time, nurse overtime, operating room idle time