

Pengembangan Model Deteksi dan Segmentasi Berbasis U-Net untuk Lokalisasi Kelainan Paru Indikator TB pada Citra Rontgen Thorax = Development of U-Net Based Detection and Segmentation Models for Localization of Lung Abnormalities TB Indicators on Thorax X-Ray Images

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Abstrak

Dalam dokumen Global Tuberculosis Report 2022, World Health Organization (WHO) melaporkan bahwa Indonesia tercatat sebagai negara dengan beban kasus tuberkulosis (TB) terbanyak kedua setelah India pada tahun 2021 lalu, di mana terhitung dari estimasi 969.000 kasus penderita TB di Indonesia, terdapat 525.765 (54,3%) kasus diantaranya belum ditemukan dan diobati, ini berpotensi menjadi sumber penularan serta meningkatkan risiko transmisi komunal jika tidak mendapatkan penanganan segera. Menanggapi hal tersebut, dengan kemajuan teknologi kecerdasan buatan yang ada serta melalui peran pencitraan medis sebagai salah satu metode skrining pendukung, dikembangkan sebuah model pendeteksian berbasis arsitektur U-Net yang mampu secara otomatis mengenali dan melokalisasi area berbagai jenis kelainan indikator TB paru pada citra rontgen thorax. Selain melakukan tuning parameter, dibandingkan beberapa kasus segmentasi semantik multi-kelas, diantaranya terdiri atas 14 kelas kelainan spesifik, 5 kelas kelompok kelainan, dan 3 kelas kelompok kelainan, serta kasus segmentasi semantik biner. Hasil memperlihatkan bahwa pada kasus multi-kelas, semakin sedikit kelas yang digunakan, maka semakin besar nilai dice score yang didapat, yaitu mencapai 0,71. Sementara, jika dibandingkan dengan kasus segmentasi biner, meski dice score mengalami peningkatan, namun berdasarkan hasil visualisasi, kasus segmentasi multi-kelas kurang mampu dalam mengenali kondisi paru normal atau tidak memiliki kelainan.

.....In the Global Tuberculosis Report 2022 document, the World Health Organization (WHO) reports that Indonesia is listed as the country with the second highest burden of tuberculosis (TB) cases after India in 2021, where from an estimated 969.000 cases of TB sufferers in India, there are 525.765 (54,3%) cases of which have not been found and treated, this has the potential to become a source of transmission and increase the risk of communal transmission if treatment is not immediately received. In response to this, with advances in existing artificial intelligence technology and through the role of medical imaging as a screening support method, a detection model based on the U-Net architecture was developed that can automatically recognize and localize areas of various types of pulmonary TB marker indicators on chest X-ray images. In addition to parameter tuning, several cases of multi-class semantic segmentation were compared, which consisted of 14 specific disorder classes, 5 class disorder clusters, and 3 class disorder clusters, as well as cases of binary semantic segmentation. The results reveal that in the multi-class case, the fewer classes used, the greater the dice score obtained, which is 0,71. Meanwhile, when compared with binary segmentation cases, even though the dice score has increased, based on visualization results, multi-class segmentation cases are less able to recognize normal lung conditions or have no abnormalities.