Deteksi Tuberkulosis pada Citra X-Ray Dada Menggunakan Analisis Tekstur = Texture Analysis for Automatic Tuberculosis Detection on Chest X-Ray Images

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Abstrak

Tuberkulosis (TB) adalah penyakit menular dan dapat berakibat fatal, terutama di negara berkembang. WHO merekomendasikan penggunaan screening yang sistematis dan luas, salah satunya menggunakan citra X-ray dada. Sayangnya, jumlah ahli radiologi masih kurang dan belum terdistribusi dengan baik di negara berkembang seperti Indonesia. Oleh karena itu, penelitian ini mengembangkan sistem Computer-Aided Detection (CAD) untuk membantu mendeteksi TB menggunakan analisis tekstur. Terdapat tiga tahap pada sistem, yaitu segmentasi otomatis, koreksi segmentasi manual, dan deteksi lesi TB. Hasil akhir sistem memberikan visualisasi heatmap berdasarkan probabilitas lesi TB pada citra X-ray dada.
Penelitian ini fokus pada tahap deteksi lesi TB. Analisis tekstur diimplementasi menggunakan berbagai kombinasi dari fitur tekstur Hogeweg, Gray-Level Co-occurrence matrix (GLCM), dan Gabor. Selain itu, metode reduksi dimensi juga diimplementasikan untuk mendapatkan representasi optimal. Analisis tekstur ini digunakan pada area lokal patch melalui perhitungan probabilitas untuk klasifikasi patch lesi TB dan patch normal. Klasifikasi ini dilatih menggunakan Logistic Regression, Support Vector Machine (SVM), dan Multilayer Perceptron (MLP).
Hasil terbaik dicapai oleh Logistic Regression dengan kombinasi fitur Hogeweg, GLCM, dan Gabor yang diimplementasikan PCA yang mampu mencapai nilai 0.734 sensitivity. Dokter spesialis radiologi menilai bahwa beberapa visualisasi model ini cukup baik dalam mengenali lesi TB, namun masih ada beberapa kesalahan dalam mendeteksi area normal sebagai lesi TB.
.....Tuberculosis (TB) is an infectious disease and can be fatal, especially in developing countries. WHO recommends the use of systematic and broad screening, one of which is using chest X-ray images. Unfortunately, the number of radiologists is still lacking and not well distributed in developing countries such as Indonesia. Therefore, this study developed a Computer-Aided Detection (CAD) system to help detect TB using texture analysis. There are three stages in the system, they are automatic segmentation, manual segmentation correction, and TB lesion detection. The final result of the system provides a heatmap visualization based on the probability of TB lesions on a chest X-ray image.
This study focused on the stage of TB lesion detection. Texture analysis was implemented using various combinations of Hogeweg texture features, Gray-Level Co- occurrence matrix (GLCM), and Gabor. In addition, the dimensional reduction method is also implemented to obtain the optimal representation. This texture analysis is applied to the local area of the patch by calculating the probability for the classification of the TB lesion patch and the normal patch. This classification is trained using Logistic Regression, Support Vector Machine (SVM), and Multilayer Perceptron (MLP).
The best result was achieved by Logistic Regression with a combination of Hogeweg, GLCM, and Gabor features implemented by PCA which was able to reach a value of 0.734 sensitivity. Radiology specialists considered that some of the visualizations of this model were quite good in recognizing TB lesions, but there were still some errors in detecting normal areas as TB lesions.