Rancang Bangun Framework Pendeteksi Tumor Otak Berbasis Gelombang Mikro dengan Pengembangan Rekonstruksi Citra Low-Rank Compressive Sensing = Design of Microwaves-based Brain Tumor Detection Framework with The Development of Low-Rank Compressive Sensing Image Reconstruction.

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Abstrak

ABSTRAK
Kanker adalah salah satu penyebab kematian terbanyak dan otak termasuk salah satu organ yang rentan terkena kanker. Deteksi dini tumor otak dapat mengurangi resiko terkena kanker. Scanner seperti Computed Tomography (CT) Scan dan Magnetic Resonance Imaging (MRI) adalah alat yang digunakan deteksi dini dan diagnosis tumor otak. Namun, modalitas tersebut berbiaya tinggi, berukuran besar, dan memiliki efek samping terhadap kesehatan. Pencitraan gelombang mikro menawarkan metode pemindaian tumor untuk deteksi dini dengan biaya rendah, ukuran kecil, dan risiko rendah terhadap kesehatan. Compressive Sensing (CS) memungkinkan rekonstruksi citra gelombang mikro dengan data yang sparse. Penelitian ini mengusulkan pengembangan Compressive Sensing dengan Low-Rank Compressive Sensing. Penelitian menunjukkan bahwa metode Low-Rank CS dapat memberikan hasil rekonstruksi yang sama, bahkan lebih baik secara kualitatif dan kuantitatif dibandingkan dengan metode Simultaneous Algebraic Reconstruction Technique (SART), CS murni, maupun CS dengan regularisasi Total Variation (TV). Parameter kualitatif diukur dengan perbandingan visual dan kontur aktif dari citra yang direkonstruksi, sedangkan parameter kuantitatif diukur dengan MSE dan SSIM. Penelitian ini juga telah merancang dan membuat sebuah framework yang mengemas metode Low-Rank CS. Framework tersebut merupakan komponen controller dan image reconstructor untuk produk pendeteksi tumor otak portabel berbasis gelombang mikro yang bersifat open source dan universal (multi-plartform).
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ABSTRACT
Cancer is one of the leading causes of death and the brain is one of the organs vulnerable to cancer. Early detection of brain tumors can reduce the risk of cancer. Scanners such as Computed Tomography (CT) Scan and Magnetic Resonance Imaging (MRI) are tools for early detection of brain tumors. However, those modalities are high cost, big size, and has a side effect risk to health. Microwave imaging offers a novel cancer scanning method for early detection with low cost, small size, and low risk to health. The Compressive Sensing (CS) enables the reconstruction of microwave images with a sparse data. This research proposes the development of Compressive Sensing with Low-Rank Compressive Sensing. Experiment shows that the Low-Rank CS method can give the same, even better qualitatively and quantitatively reconstruction results compared to the Simultaneous Algebraic Reconstruction Technique (SART), pure CS, as well as CS with Total Variation (TV) regularization. Qualitative parameters are measured by visual comparison and active contours of the reconstructed image, while quantitative parameters are measured by MSE and SSIM. This research also designed and created a framework that packs the Low-Rank CS methods. The framework is a component of the controller and image reconstructor for a portable

microwave-based brain tumor detector products that are open source and multi-platform.