Studi awal prediksi kerma udara dan half value layer dengan citra phantom computed tomography scan berbasis artificial neural network untuk SPECT/CT siemens symbiac = Preliminary study on air kerma and half value layer predictions using computed tomography scan phantom image with artificial neural network for siemens symbiac SPECT-CT scan

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Abstrak

Tujuan penelitian ini adalah melakukan studi awal guna memprediksi nilai kerma udara dan half value layer (HVL) pesawat CT scan berdasarkan citra fantom homogen. Penelitian ini dilakukan dengan menggunakan citra homogen dari fantom standar CT scan yang dilakukan ekstraksi fitur GLCM (Gray Level Co-occurence Matrix), dengan data tambahan berupa nilai kVp pengambilan citra. Sebagai label output adalah hasil pengukuran kerma udara dan HVL. Model yang digunakan berbasis artificial neural network, dengan hyperparameter ditentukan berdasarkan teknik hyperparameter tuning dengan menggunakan Teknik Gridsearch. Pencarian hyperparameter berupa fungsi aktivasi, jumlah hidden layer, jumlah hidden unit, kernel initializer, dan optimizer dilakukan dengan Analisa performa hasil. Kualitas performa klasifikasi model artificial neural network menggunakan confusion matrix menunjukkan akurasi sebesar 84,4% pada model yang dilatih menggunakan input fitur GLCM, sedangkan pada model artificial neural network yang menggunakan input fitur GLCM dan kVp menunjukkan akurasi sebesar 100%. Hasil ini menunjukkan bahwa fitur GLCM mampu menghasilkan akurasi yang baik untuk melakukan prediksi kerma udara dan HVL. Namun, jika disertai dengan fitur kVp sebagai input, maka proses training akan menghasilkan akurasi yang sangat baik, dengan gejala dominasi fitur kVp terhadap fitur GLCM.
.....The goals of this research is to do preliminary study to predict air kerma and half value layer (HVL) of CT scan base on phantom image which has homogeneous characteristic. This research starts with GLCM (Gray Level Co-occurence Matrix) feature extraction process from the phantom image, the kVp value also extracted from the phantom image dicom information. While the target during training is air kerma and HVL measurement resulted from the dosimeter and solid state device. Machine learning model used for this research is artificial neural network (ANN) base Machine Learning model. However, the hyperparameter have not yet been found. Thus, this problem could be solved by using Hyperparameter tuning technique, specifically using Gridsearch with variety of activation function, hidden layers, hidden units, kernel initializer, and optimizer as the parameter guideline. The performance of classification model is measured using confusion matrix technique. The classification performance show that the model which trained using GLCM feature only has 84.4% accuracy to predict air kerma and HVL. While, the classification performance show that the model which trained using GLCM feature and kVp that extracted from the dicom information has 100% accuracy to predict air kerma and HVL. Although, the model that train using GLCM feature and kVp can predict much better than the model which trained using GLCM feature only, it shows that GLCM feature is dominated by kVp feature that extracted from the dicom information.