Implementasi Support Vector Regression (SVR) dan Convolutional Neural Network (CNN) untuk Sistem Prediksi Turbiditas Air Berbasis Citra Ponsel = Implementation of Support Vector Regression (SVR) and Convolutional Neural Network (CNN) for Mobile Image-based Water Turbidity Prediction System

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Abstrak

Turbiditas merupakan salah satu indikator yang dapat digunakan untuk menilai kualitas air. Turbiditas dapat diukur menggunakan instrumen konvensional seperti turbidimeter, spektrofotometer, dan nefelometri visual. Namun, semua instrumen tersebut memiliki kekurangannya masing-masing, seperti biaya yang relatif tinggi dan kurang efisien. Pada penelitian ini diusulkan metode pengukuran yang lebih terjangkau dan efisien dengan memanfaatkan kamera ponsel, serta model regresi support vector regression dan EfficientNet-B0 berbasis convolutional neural network sebagai instrumen pengukuran. Akuisisi citra dilakukan di dua lingkungan. Lingkungan 1 didefinisikan sebagai lingkungan dengan cahaya langsung yang menyinari sampel, mengikuti prinsip turbidimetri, sedangkan lingkungan 2 didefinisikan sebagai lingkungan dengan pencahayaan yang bergantung hanya kepada cahaya sekitar dengan intensitas cahaya yang tak tentu. Citra yang telah diakuisisi oleh ponsel melalui berbagai proses prapengolahan data seperti segmentasi, augmentasi, penerapan filter Gaussian, dan ekstraksi fitur saturasi dan tekstur sebelum diteruskan ke model regresi. Dari hasil evaluasi didapatkan kesimpulan bahwa model EfficientNet-B0 lebih unggul dibandingkan dengan support vector regresssion dengan fitur saturasi, tekstur maupun gabungan. Model EfficientNet-B0 mendapatkan nilai R2 sebesar 0.992, MAE sebesar 2.474 dan MSE sebesar 10.669 untuk citra lingkungan 1, dan nilai R2 sebesar 0.97, MAE sebesar 3.333 dan MSE sebesar 29.137 untuk citra lingkungan 2.
.....Turbidity is an indicator that can be used to assess water quality. Turbidity can be measured using conventional instruments such as turbidimeter, spectrophotometer, and visual nephelometry. However, all of these instruments have their respective drawbacks, such as relatively high costs and inefficient. In this study, a more affordable and efficient measurement method is proposed by utilizing a cellphone camera, as well as a support vector regression and EfficientNet-B0 model based on convolutional neural network as a measurement instrument. Image acquisition will be carried out in two environments. Environment 1 is defined as an environment with direct light shining on the sample, following the principle of turbidimetry, while environment 2 is defined as an environment in which the illumination depends on the ambient light with an indeterminate light intensity. The image that has been acquired by the cellphone will go through various data preprocessing processes such as segmentation, augmentation, application of Gaussian filters, and extraction of saturation and texture features before being forwarded to the regression model. From the evaluation results, it can be concluded that the EfficientNet-B0 model is superior to the support vector regression with saturation, texture, or combined features. The EfficientNet-B0 model gets an R2 value of 0.992, an MAE of 2.474 and an MSE of 10,669 for environment 1 image, and an R2 value of 0.97, an MAE of 3.333 and an MSE of 29,137 for environment 2 image.