Studi Komparatif Algoritma Machine Learning Pada Prediksi Konsumsi Bahan Bakar Kapal AHTS "X" Penunjang Operasi Hulu Migas = Comparative Study of Machine Learning for Predicting Fuel Consumption of AHTS Ship "X" Supporting Upstream Oil and Gas Operations

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Abstrak

Program pemerintah perihal produksi satu juta barel minyak pada tahun 2030 harus didukung oleh berbagai sarana yang menunjang peningkatan, seperti contohnya kapal AHTS (Anchor Handling Tug & Supply) yang banyak membantu berbagai operasi di hulu migas. Bahan bakar mendapati persentase 50%-70% dari keseluruhan biaya operasional harian, maka dari itu diperlukan upaya untuk memprediksi konsumsi bahan bakar sebagai langkah untuk penghematan biaya. Metode statistik konvensional kurang akurat untuk memprediksi faktor eksternal dalam konsumsi bahan bakar seperti tinggi gelombang dan kecepatan angin saat berlayar. Black box model digunakan untuk memprediksi hal tersebut dan dipilih tiga algoritma machine learning yang banyak digunakan untuk dibandingkan, yaitu Artificial Neural Network (ANN), Extreme Gradient Boost (XGB), Random Forest (RF). Uji Ordinary Least Square (OLS) digunakan untuk mengetahui apakah setiap variabel independen memiliki signifikansi terhadap variabel dependen setelah itu dilakukan normalisasi data dengan metode min max. Data dibagi menjadi data training dan data testing dengan pembagian 70% dan 30%. Dilakukan evaluasi dengan empat matriks evaluasi diantaranya MSE,RMSE,MAE, dan MAPE. Didapati hasil terbaik dari Algoritma Random Forest dengan hasil evaluasi berturut-turut pada data training 0.04; 0.21 ;0.04; dan 0.03%. Sedangkan pada prediksi data testing, yaitu 0.41; 0.64; 0.04; dan 0.11%. Selanjutnya dibuat prototipe program sederhana berbasis Google Spreadsheet untuk memudahkan pengguna memprediksi data.

.....The Indonesia government's program to achieve one million barrels of oil production by 2030 requires support from various facilities that contribute to the enhancement, such as AHTS (Anchor Handling Tug & Supply) essels that play a significant role in various upstream oil and gas operations. As fuel accounts for 50%-70% of the total daily operational costs, efforts are needed to predict fuel consumption as a cost-saving measure. Conventional statistical methods are less accurate in predicting external factors affecting fuel consumption, such as wave height and wind speed during sailing. A black-box model is employed to predict these factors, and three widely used machine learning algorithms, namely Artificial Neural Network (ANN), Extreme Gradient Boost (XGB), and Random Forest (RF), are selected for comparison.Ordinary Least Squares (OLS) test is utilized to determine the significance of each independent variable on the dependent variable, followed by data normalization using the min-max method. The data is divided into training and testing sets, with a distribution of 70% and 30%, respectively. Evaluation is performed using four evaluation metrics: MSE, RMSE, MAE, and MAPE. The best results are obtained from the Random Forest algorithm, with consecutive evaluation results on the training data being 0.04, 0.21, 0.04, and 0.03%. For the testing data prediction, the results are 0.41, 0.64, 0.04, and 0.11%. Subsequently, a simple program prototype based on Google Spreadsheet is developed to facilitate users in predicting data.