Screening dan Asesmen RBI (Risk Based Inspection) Pada Sistem Perpipaan Minyak dan Gas di Indonesia Untuk Menunjang Keamanan Produksi Menggunakan Machine Learning dan Deep Learning = Screening and Assessment RBI (Risk Based Inspection) on Oil and Gas Pipeline System in Indonesia to Support Production Excellence using Machine Learning and Deep Learning

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Abstrak

Peningkatan keselamatan dan efisiensi dalam industri minyak dan gas bumi di Indonesia masih memerlukan pendekatan yang canggih untuk memelihara sistem perpipaan yang ada. Disertasi ini membahas penerapan metode Risk Based Inspection (RBI) dengan dukungan teknologi machine learning (ML) dan deep learning (DL) untuk mengembangkan model yang mampu mengidentifikasi akar permasalahan dan solusi untuk menanggulangi kegagalan tersebut. Penelitian dilakukan pada sampel ex-spool berdiameter 16’’ melalui pengujian metalografi dan penggunaan algoritma AdaBoost, Random Forests, dan Gradient Boosting. Metode klasifikasi masalah dilakukan berdasarkan prinsip K-Means Clustering dan Gaussian Mixture Model dan penelitian divalidasi menggunakan metode k-fold cross-validation. Model yang dihasilkan mampu mengidentifikasi dan mengklasifikasikan jenis kegagalan ke dalam 3 kelompok sesuai jenis risikonya masing-masing serta memberikan beragam metode pemeliharaan material yang lebih ekonomis. Program artificial intelligence ini diharapkan mampu meningkatkan keselamatan dan keandalan operasi perpipaan minyak dan gas di Indonesia melalui penerapan berbagai metode pemeliharaan pipa di masa depan.
.....Improving safety and efficiency in the oil and gas industry in Indonesia still requires a sophisticated approach to maintain the existing piping systems. This dissertation discusses the application of the risk-based inspection (RBI) method with the support of machine learning (ML) and deep learning (DL) technology to develop a model that is able to identify the potential root-cause and its solutions to overcome these failures. The research was carried out on a 16" diameter ex-spool sample through metallographic testing and the use of AdaBoost, Random Forests, and Gradient Boosting algorithms. The problem classification method was carried out based on the principles of K-means clustering and the Gaussian Mixture Model, while the research was validated using the k-fold cross-validation method. The resulting model is able to identify and classify types of failure into three groups according to each type of risk and provides a variety of more economical material maintenance solutions. It is hoped that this artificial intelligence program can support efforts to increase the safety and reliability of oil and gas pipeline operations in Indonesia through the application of various pipeline maintenance methods in the future.