INTISARI

KLASIFIKASI ZONA RESERVOIR HIDROKARBON MENGGUNAKAN MAHAKAM INTEGRATED FLUID INTERPRETATION (MIFI) DAN ARTIFICIAL NEURAL NETWORK (ANN) DARI DATA OPEN-HOLE LOG DAN GAS CHROMATOGRAPH, LAPANGAN "AB", CEKUNGAN SUMATRA SELATAN

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Lapangan "AB" merupakan lapangan tua yang berada di Cekungan Sumatra Selatan dengan sebagian besar target reservoir berada pada Formasi Talang Akar. Litologi penyusun dari formasi ini meliputi serpih karbonatan dengan perselingan batupasir, batulanau, batubara, dan konglomerat pada bagian bawah serta perselingan serpih dan batugamping pada bagian atas. Penelitian diawali dengan melakukan analisis terhadap 5 data sumur dengan menggunakan data *open-hole log*, data *mudlog*, data perforasi, dan data OH-MDT. Penelitian ini berfokus pada penerapan metode *Mahakam Integrated Fluid Interpretation* (MIFI) dalam meningkatkan kemampuan model *machine learning* untuk klasifikasi zona hidrokarbon secara lebih akurat. Metode MIFI yang dihitung terdiri dari 3 modul yaitu *Density-Neutron Separation Value* (DNSV), *Gas Chromatograph Dynamic Baseline* (GWD), dan *Butterfly Effect* (RGBE–RPBE). Algoritma *Artificial Neural Network* (ANN) menggunakan modul *Train Estimation Model* pada Petrel 2020 digunakan untuk membandingkan performa dua skenario input: (1) *triple combo log* saja (sebagai *baseline*) dan (2) *triple combo log* yang diperkaya dengan modul MIFI. Model ANN dilatih menggunakan data berlabel hasil perforasi dan OH-MDT sebagai data aktual untuk kemudian dibandingkan dengan data prediksi dari hasil model *machine learning*. Evaluasi performa model dilakukan menggunakan metrik *accuracy*, *precision*, *recall*, dan *F1-score* untuk membandingkan hasil prediksi antar variasi input. Hasil penelitian pada proses *training* menunjukkan bahwa model ANN dengan input *triple combo log* menghasilkan nilai *accuracy* sebesar 77,71%. Sementara itu, penerapan input yang melibatkan modul MIFI memberikan peningkatan signifikan dengan nilai *accuracy* 98,8%. Hal ini membuktikan bahwa metode MIFI mampu memperkuat model ANN dalam mengenali karakteristik fluida pada Formasi Talang Akar di marker A1-P5, sehingga menghasilkan prediksi yang sangat mendekati kondisi aktual dari data perforasi dan OH-MDT.

Kata kunci: *Artificial Neural Network*, petrofisika, MIFI, klasifikasi fluida.

ABSTRACT

HYDROCARBON RESERVOIR ZONE CLASSIFICATION USING MAHAKAM INTEGRATED FLUID INTERPRETATION (MIFI) AND ARTIFICIAL NEURAL NETWORK (ANN) FROM OPEN HOLE-LOG AND GAS CHROMATOGRAPH DATA, "AB" FIELD, SOUTH SUMATRA BASIN

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The "AB" field is a mature hydrocarbon field located in the South Sumatra Basin, where most of the primary reservoir targets are found within the Talang Akar Formation. The lithology of this formation predominantly consists of carbonate-rich shale interbedded with sandstone, siltstone, coal, and conglomerate in the lower section, as well as shale and limestone alternations in the upper section. This study begins with the analysis of 5 well datasets utilizing open-hole log, mudlog, perforation, and OH-MDT data. The main objective of this research is to evaluate the implementation of the Mahakam Integrated Fluid Interpretation (MIFI) method to enhance the performance of machine learning models for more accurate hydrocarbon zone classification. The MIFI method employed in this study comprises three analytical modules, which are Density–Neutron Separation Value (DNSV), Gas Chromatograph Dynamic Baseline (GWD), and Butterfly Effect (RGBE–RPBE). Artificial Neural Network (ANN) algorithm using Train Estimation Model in Petrel 2020 is used to compare the performance between two input configurations: (1) triple combo log (as the baseline), and (2) the triple combo log enriched with MIFI modules. The ANN model was trained using labeled datasets from perforation and OH-MDT results as ground-truth data and compared to the machine learning model as the prediction data. Model performances were evaluated using metrics, including accuracy, precision, recall, and f1-score to assess predictive improvements across input variations. The training results show that the ANN model utilizing the triple combo log achieved an accuracy of 77,71%. In contrast, the integration of MIFI modules yielded a remarkable performance improvement, with accuracy 98,8%. *These results demonstrate that the incorporation of MIFI significantly enhances the sensitivity of the ANN model in identifying fluid characteristics within the Talang Akar Formation at the A1–P5 marker, producing predictions that closely match with the actual conditions from perforation and OH-MDT data. Overall, the integration of ANN and MIFI presents a robust and data-driven framework for fluid classification in geologically complex reservoirs, particularly within mature hydrocarbon fields such as the "AB" Field in the South Sumatra Basin.*

Keywords: *Artificial Neural Network, petrophysics, MIFI, fluid classification*