

ABSTRAK

IDENTIFIKASI *SEAM* BATUBARA BERBASIS *CONVOLUTIONAL NEURAL NETWORK* MENGGUNAKAN DATA *WELL LOGGING* PADA LAPANGAN SAMARINDA

Oleh

Daniel Kuncoro Pangestu

NIM: 115220065

(Program Studi Sarjana Teknik Geofisika)

Identifikasi *seam* batubara merupakan tahapan penting dalam kegiatan eksplorasi dan evaluasi sumber daya batubara, namun interpretasi data *well logging* secara manual memerlukan waktu yang relatif lama dan bergantung pada pengalaman interpreter. Penelitian ini bertujuan menerapkan metode *Convolutional Neural Network* (CNN) untuk mengidentifikasi *seam* batubara berdasarkan data *well logging* pada Lapangan Samarinda, Formasi Balikpapan, Cekungan Kutai. Data yang digunakan terdiri atas sembilan sumur dengan parameter *Gamma Ray* (GR) dan *Density* (RHOB) yang telah dilengkapi label litologi hasil interpretasi *cutting* dan *coring*. Data diproses melalui tahapan pembersihan, normalisasi, pelabelan litologi, dan segmentasi menggunakan metode *sliding window* sebelum digunakan sebagai masukan model CNN. Evaluasi dilakukan menggunakan metode *Leave-One-Well-Out* (LOWO), yaitu delapan sumur sebagai data latih dan satu sumur sebagai data uji secara bergantian. Hasil penelitian menunjukkan bahwa model CNN mampu mengklasifikasikan litologi batulempung, batupasir, serpih karbonan, dan batubara dengan nilai akurasi sebesar 70,26–91,68% dan *weighted F1-score* sebesar 70,78–91,42%. Litologi batubara menunjukkan performa terbaik dengan nilai *F1-score* hingga 0,9812. Selain itu, model berhasil mengidentifikasi seluruh *seam* batubara utama pada sembilan sumur uji dengan perbedaan ketebalan *seam* berkisar antara -0,58 m hingga 0,39 m terhadap data aktual. Hasil penelitian menunjukkan bahwa CNN memiliki potensi sebagai alat bantu interpretasi yang efektif dan konsisten untuk identifikasi *seam* batubara berdasarkan data *well logging*.

Kata Kunci: *Convolutional Neural Network* (CNN), *density log*, *gamma ray log*, identifikasi *seam* batubara, *well logging*

ABSTRACT

COAL SEAM IDENTIFICATION USING A CONVOLUTIONAL NEURAL NETWORK BASED ON WELL LOGGING DATA IN THE SAMARINDA FIELD

By

Daniel Kuncoro Pangestu

NIM: 115220065

(Geophysical Engineering Undergraduated Program)

Coal seam identification is an important stage in coal exploration and resource evaluation; however, manual interpretation of well logging data is time-consuming and highly dependent on interpreter experience. This study aims to apply a Convolutional Neural Network (CNN) to identify coal seams using well logging data from the Samarinda Field, Balikpapan Formation, Kutai Basin. The dataset consists of nine wells with Gamma Ray (GR) and Density (RHOB) logs, complemented by lithology labels derived from cutting and coring interpretations. Data preprocessing includes cleaning, normalization, lithology labeling, and segmentation using a sliding window approach before being used as input for the CNN model. Model evaluation is conducted using the Leave-One-Well-Out (LOWO) method, where eight wells are used for training and one well for testing in each iteration. The results show that the CNN model successfully classified claystone, sandstone, coaly shale, and coal lithologies, achieving accuracy values ranging from 70.26% to 91.68% and weighted F1-scores ranging from 70.78% to 91.42%. Coal exhibits the best classification performance, with F1-scores reaching 0.9812. Furthermore, the model successfully identified all major coal seams in the nine test wells, with coal seam thickness differences ranging from -0.58 m to 0.39 m compared to the reference data. These findings indicate that CNN has strong potential as an effective and consistent interpretation aid for coal seam identification based on well logging data.

Keywords: coal seam identification, Convolutional Neural Network (CNN), density log, gamma ray log, well logging