Interdisciplinary Geosciences

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IG - Interdisciplinary Geosciences Poster Session

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Assessment of the Effectiveness of a Convolutional Autoencoder for Digital Image-based Automated Core Logging

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VIEW ABSTRACT

Widely applicable convolutional neural network (CNN)-based lithology classification models are limited to interpret soundness of a trained model and require high computational cost. This study proposes a convolutional autoencoder (CAE)-based classification model to improve the efficiency of rock-core-logging analysis based on digital rock-core images (CAE model I) and suggest a more understandable classification model by extracting the lithological feature information from the network structure of the model. Moreover, input digital-image data transformation using the Canny edge-detection algorithm was implemented (CAE model II). The applicability of the developed models is validated by comparing them with a CNN model and the model proposed by the previous study (RGBE model). While implementing the proposed model, digital images of 85-m-long cores were used, which were acquired from the Satyr 5 well in the Northern Carnarvon Basin, Western Australia. It was found that CAE models I and II showed classification accuracy comparable to the CNN model (CAE model I: 96.4%, CAE model II: 94.9%, CNN model: 97.5%, and RGBE model: 94.4%). The extracted features of the trained CAE models are effective in interpreting the trained network structure. In addition, in terms of computational efficiency and training time, the CAE-based models are significantly better than the CNN model (CAE model I: 7 min 21 s, CAE model II: 7 min 34 s, CNN model: 12 min 6 s, and RGBE model: 24 min 35 s). Overall, the results demonstrate the feasibility of the proposed CAE-based models for automated rock-core logging.