LITHOFACIES SEGMENTATION FROM CORE IMAGES USING BAYESIAN NEURAL NETWORKS

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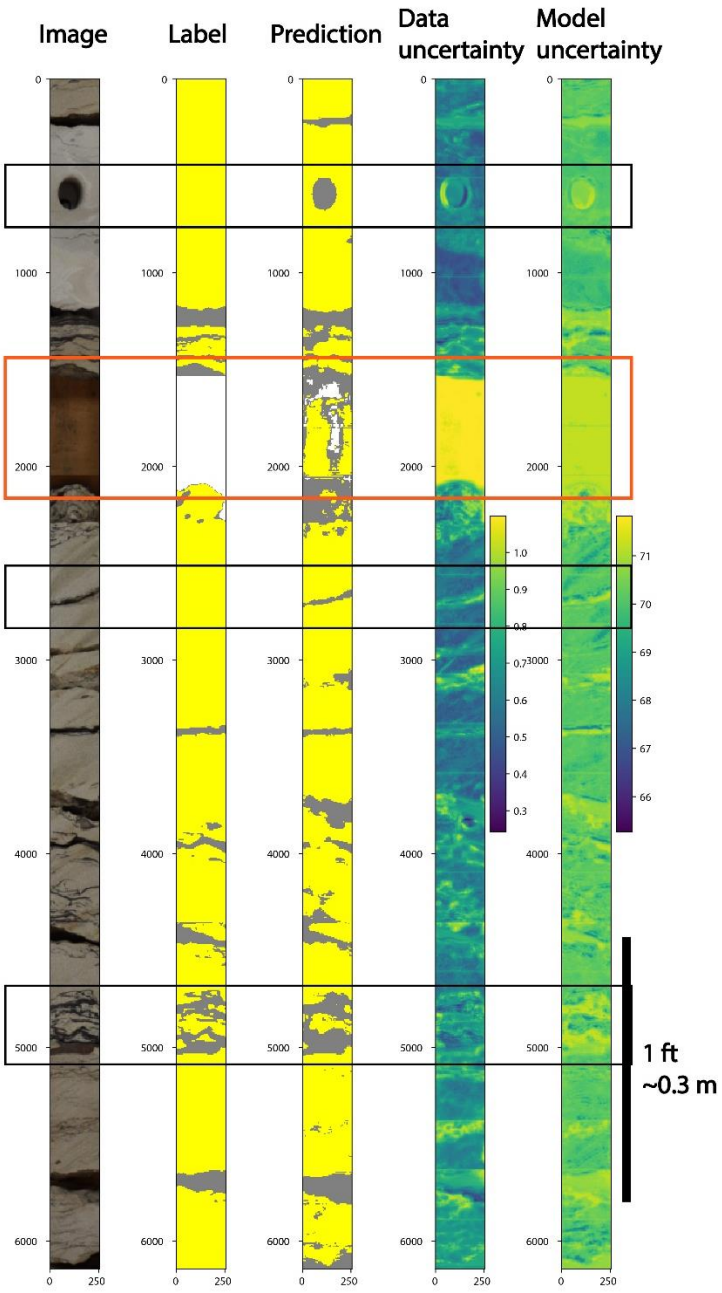
ABSTRACT

Machine learning techniques have gained much interest in reservoir characterization. The use of neural networks provides an opportunity to identify lithofacies of core images. However, the model prediction often lacks interpretability and reliability due to the 'black-box' nature of the neural networks. In this paper, we present a method to identify core lithofacies and measure the uncertainty by U-net based Bayesian Neural Networks. By employing Monte Carlo dropout and maximizing a posterior (MAP) estimate, we can quantify the uncertainties from both the data and model. We applied the method to predict the lithofacies of cores from Wilcox Group, Gulf of Mexico. A prediction accuracy of 85% was obtained, and the associated uncertainties were evaluated. Although our current database is not complex and large enough to mimic the real-world scenario, it demonstrates the importance of understanding the uncertainties from data and model. Such uncertainties improve the data predictions and enhance the model reliability. They can be employed to quality control the training data and improve the performance of the trained model.



An example showing the input image, true labels, prediction, data uncertainty and model uncertainty. The highlighted zones (red and black boxes) are the intervals with high uncertainties due to lack of training data and low-quality input images.