



DEEP-LEARNING-BASED AUTOMATED SEDIMENTARY GEOMETRY CHARACTERIZATION FROM BOREHOLE IMAGES

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Abstract:

Sedimentary geometry on borehole images usually summarizes the arrangement of bed boundaries, erosive surfaces, cross bedding, sedimentary dip, and/or deformed beds. The interpretation, very often manual, requires a good level of expertise, is time consuming, can suffer from user bias, and become very challenging when dealing with highly deviated wells. Bedform geometry interpretation from crossbed data is rarely completed from a borehole image. The purpose of this study is to develop an automated method to interpret sedimentary structures, including the bedform geometry, from borehole images.

Automation is achieved in this unique interpretation methodology using deep learning. The first task comprised the creation of a training dataset of 2D borehole images. This library of images was then used to train machine learning (ML) models. Testing different architectures of convolutional neural networks (CNN) showed the ResNet architecture to give the best performance for the classification of the different sedimentary structures. The validation accuracy was very high, in the range of 93–96%.

To test the developed method, additional logs of synthetic data were created as sequences of different sedimentary structures (i.e., classes) associated with different well deviations, with addition of gaps. The model was able to predict the proper class and highlight the transitions accurately.

Bio:

Marie Lefranc is a program manager and senior research scientist at Schlumberger. She joined Schlumberger in 2007 as a geologist in petrotechnical consulting in Southeast Asia before joining the Schlumberger-Doll Research (SDR) center in Cambridge, Massachusetts, in 2015. She has an international experience (Malaysia, Vietnam, Algeria, Middle East, Thailand, USA). She is currently managing a team of geology domain and machine learning experts, working on the automation and data integration for 3D stratigraphy modeling. She holds a master's degree from the French Petroleum Institute and a PhD in geostatistics/geology from the French School of Mines of Paris.