

# **Machine Learning Assisted Fracture Characterization with Borehole Image Logs in Geothermal Wells**

Chicheng Xu

Aramco Houston Research Center

## **Abstract**

Fracture characterization and modeling plays a critical role in developing and stimulating an enhanced geothermal system. Borehole image logs acquired in geothermal wells are often used for fracture characterization purpose. However, manual interpretation of borehole image logs is time consuming and often subjective to human recognition bias. We implemented and tested a machine learning assisted characterization workflow using borehole image log data from three wells in the UTAH FORGE project to predict profiles of fracture aperture and fracture intensity. In the pilot well where fractures can be observed from multiple sources of data, we build a convolutional neural network model and train it with the labeled results from borehole image log. The model was then applied to a second well that has both borehole image log and expert interpretation for validation. After being validated, the model is then applied to other wells in the same field. The workflow delivers continuous profiles of fracture aperture and intensity in all wells that have borehole image log in a field, which is useful for building a computer-based fracture model that can be used to guide geothermal resource development.