Beyond Petrophysical Classical Models: Formation Lithology Classification Using ML

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Objective

- Perform litho-facies classification using 8 Well Logs in Hugoton and Panoma Fields, North America
- Compare Machine Learning Methods
  - K-Nearest Neighbors (KNN)
  - Support Vector Machine (SVM)
  - Random Forrest
  - Neural Networks (In Progress)

Well Logs Description

Continuous record of rock formation properties with respect to depth

Features

- Gamma Ray
- Resistivity
- Neutron Porosity
- Density
- Sonic P, Sonic S

Facies Target

- Sandstone
- Coarse Siltstone
- Fine Siltstone
- Siltstone, Shale
- Mudstone
- Wackestone
- Dolomite
- Packstone
- Bafflestone

Industry Impacts

- Add easy visualization tool and user friendly
- Add the ultimate goal to make a product include Geology and Machine Learning to commercialize the product
- Ability to handle and load BIGDATA using SQL Data base

Results

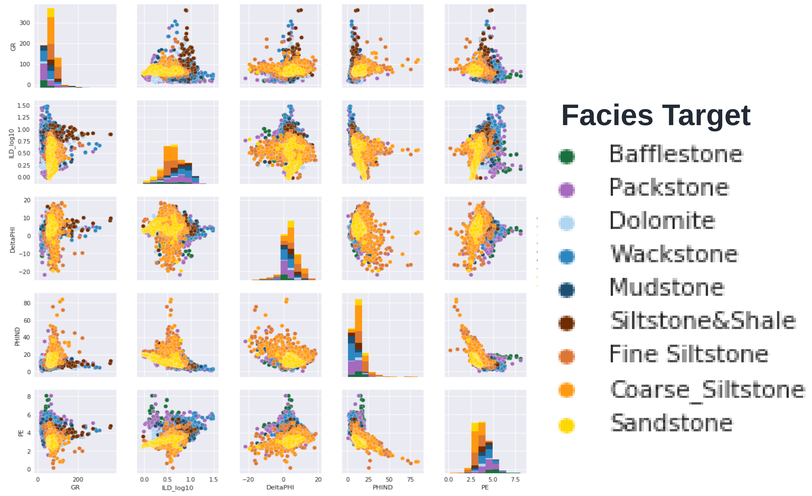

Figure 1. Scatter Matrix Cross Plot

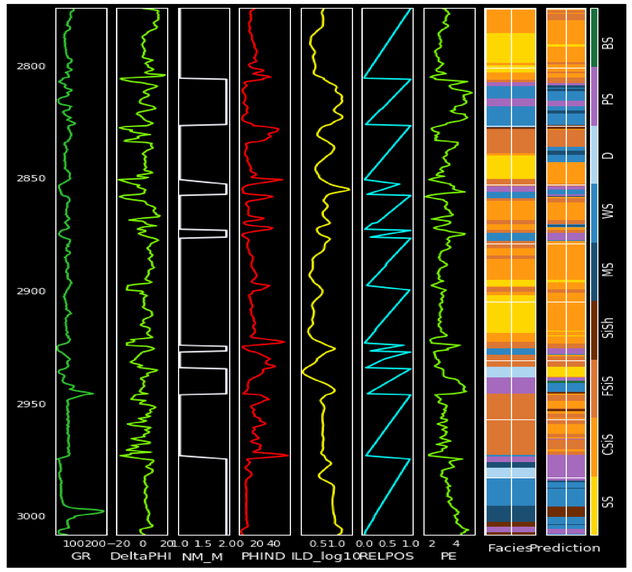

Figure 2. Blind Test Well Predicted Facies (Log 9) and Actual Facies (Log 8)

Table 1. Summary of Classifier Performance for Blind Well

Classifier	KNN	SVM	Random Forrest
Facies Accuracy	48 %	48 %	42 %
Adj. Facies Accuracy	89 %	89 %	86 %

Workflow

Understand Objective and Problem

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Get the Data
Load to SQL Data Base/ Analyze & Visualize the data

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Select Model and Perform Training

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QC and Fine-Tune the Model

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Present, Launch, Monitor

Future Work

- Compare results between different Machine Learning methods
- Further develop code by analyzing larger scale heterogeneous datasets to be implemented to other types of reservoir rock formations
- Introduce seismic data into workflow

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