MEWBOURNE COLLEGE OF EARTH AND ENERGY
RONNIE K. IRANI
CENTER FOR ENERGY SOLUTIONS
The UNIVERSITY *of* OKLAHOMA

Machine Learning for Petroleum Engineers and Geoscientists

Intermediate-Advanced

OBJECTIVES

This hands-on course is designed for participants seeking to incorporate machine learning tools in their E&P workflows. It is expected that participants be familiar with the mathematical and statistical foundations of machine learning algorithms as well as Python and its common libraries. In this course, participants will make the transition from classroom instruction to practical problem solving with several use cases from the industry. This course enables participants to understand the characteristics of different algorithms, their impact on model performance, and to select appropriate machine learning workflows to solve specific E&P-related problems.

TRAINING METHOD

The course begins with a comprehensive discussion of use cases of machine learning in the E&P industry. This is followed by practical, hands-on examples dealing with several, real-world problems in petroleum engineering and geosciences. The hands-on examples are preceded by a short lecture to introduce participants to the problem and the expected outcomes.

ABOUT THE INSTRUCTOR

Deepak Devegowda, Ph.D.

Associate Professor in the Mewbourne School of Petroleum and Geological Engineering at the University of Oklahoma. His research interests lie in the areas of machine learning and predictive analytics for subsurface applications, modeling and management of unconventional oil and gas reservoirs, enhanced oil recovery in unconventional shales and high-resolution reservoir description. He earned his Ph.D. degree and M.S degree, both in Petroleum Engineering at Texas A&M University. His funding sources include federally funded grants and industry consortia as well as industry projects.

PARTICIPANTS WILL LEARN

The course design is largely assignment-based and very hands-on and will provide participants with:

1. A thorough discussion of machine learning for subsurface applications.
2. Data clean-up, normalization and visualization
3. Structured approach to unsupervised clustering and cluster evaluation
4. Supervised methods for classification and regression
5. Comparison of various machine learning algorithms

COURSE CONTENT

1. Discussion of subsurface applications of machine learning

a. Reservoir characterization (using core, well-log and 3D seismic attributes)
b. Interpretation of surface drilling data for reservoir characterization (fracture placement, rocktype identification)
c. SEM image classification and segmentation
d. Predictive analytics for drilling and artificial lift monitoring
e. Production forecasting

2. Case studies

a. Facies/lithology identification with core data
b. Extending core-derived rocktypes to uncored wells using well logs for 3D geomodel building
c. Use of 3D seismic attributes to predict seismic facies for large-scale reservoir characterization
d. Interpreting surface drilling data to predict log-derived electrofacies for near real-time reservoir characterization
e. Analyses of surface drilling data to identify geomechanical facies and optimal hydraulic fracture locations
f. Regression to predict decline curve parameters from production data
g. Parametric and non-parametric regression to predict sonic velocity from triple combo logs for 3D seismic ties

SOFTWARE AND DATASETS

Software: Code specifically designed to demonstrate the application of various machine learning algorithms to field datasets will be provided to participants as practice exercises. All code is written in Python.

Datasets: All participants will be provided with open-source datasets to test various algorithms as a part of the learning experience.

CONTACT

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