TETRA TECH RPS ENERGY | TRAINING

N596: Advanced Machine Learning for Subsurface Applications

Instructor(s): Deepak Devegowda

Format and Duration

Classroom - 5 Days
Virtual - 10 Sessions

Summary

Business impact: Participants on this course will develop machine learning skills that can be immediately applied to streamline and accelerate their subsurface workflows. Participants will work on in-class projects to rapidly gain experience with data processing, analyses, and interpretation. There will be emphasis on the classical machine learning tools (supervised and unsupervised learning) as well as time-series analyses. Time-series analyses is becoming a routine aspect of production data analyses and predictive analytics in the E&P industry.

Learning Outcomes

Participants will learn to:

1. Summarize the modes of machine learning.
2. Explain the key machine learning principles, such as dealing with inadequate data, model generalization, validating, and ensemble methods.
3. Process data through data cleaning, feature scaling, and transformation pipelines.
4. Apply supervised methods for classification and regression.
5. Develop a structured approach to unsupervised clustering and cluster evaluation.
6. Critically evaluate the various machine learning algorithms.

Training Method

A classroom or virtual classroom course. Each topic begins with a lecture to provide the introduction, mathematical foundations, and theory, followed by examples and Python-based practical exercises.

Software and Datasets: Jupyter and Google Colab notebooks written in Python will be provided to participants with real field datasets. Participants will execute specific tasks in Python to aid in their learning experience.

Who Should Attend

This course is aimed at subsurface data scientists, geoscientists, and engineers with some background in data-driven applications. Participants are expected to have experience of coding in Python and of machine learning or an introductory course on this topic.

Course Content

Modes of Machine Learning

- Supervised and unsupervised learning

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Machine Learning Principles

- Dealing with poor or inadequate data
- Underfitting, overfitting and model generalization
- Testing and validating
- Ensemble methods

Data Processing

- Data cleaning, categorical variables
- Feature scaling and transformation pipelines

Supervised Machine Learning Models

- Linear, polynomial, logistic regression and regularized linear models
- Decision trees for classification and regression
- Ensemble learning, random forests, bagging and boosting for regression and classification
- Support vector machines for regression and classification
- Neural networks for regression and classification
- Introduction to deep neural networks and application to image segmentation
- Time-series analyses, ARMA, ARIMA and survival analyses

Unsupervised Machine Learning Models

- Dimensionality reduction
- Gaussian mixture models
- K-Means and hierarchical clustering
- DBSCAN