

Petrophysics - Machine Learning Techniques & Data QA/QC

Target Audience

E&P Management, Petrophysicists, Reservoir Engineers, Geoscientists and others who are interested in petrophysics and data QA/QC issues.

Learning Objectives

- 1.- Rapidly QA/QC multiple LAS files at a single go and tabulate the findings for field wide / sectoral analysis.
- 2.- Conduct Exploratory Data Analysis (EDA) and 2D/3D visualizations to provide insights into petrophysical data (LAS and other formats).
- 3.- Create maps showing well surface locations using geographic coordinates.
- 4.- Create detailed statistical (html) reports of LAS files to provide an audit trail of petrophysical data analysis.
- 5.- Conduct a variety of Python based machine learning (ML) techniques
- 6.- Apply Conformal Prediction (CP) regression techniques to estimate prediction intervals (for example, P90-P50-P10) as opposed to just generating predictions points.
- 7.- Establish linear and polynomial regression relationships between petrophysical properties



Day 1, Session 1 (Multi Well Exploratory Data Analysis)

- Generate interactive statistical HTML reports of LAS files for exploratory data analysis (EDA).
- Read multiple LAS files into a project and QA/QC all well
- Import multiple LAS files and merge them using Python and exporting them to CSV and XLSX formats for field wide or sectoral analysis.
- Rapid visualization of well log data coverage, log curves and log correlation matrices.
- Automate petrophysical log calculations.

Day 1, Session 2 (Individual Well Exploratory Data Analysis)

- Conduct Exploratory Data Analysis (EDA) of individual well LAS files.
- Read individual LAS file and QA/QC well data using the following workflow:
- Rapid visualization of well log data coverage, distribution, log curves and log correlation matrices.
- Conduct linear regression of log curve properties.
- Use an EDA tool to capture differences between two LAS versions of the same well.

Day 2, Session 1 (Core Data Poro-Perm)

- Core data poro-perm distribution.
- Create 2D and 3D scatter plot of poro-perm data.
- Conduct regression analysis between porosity and permeability and extract individual OLS trendlines for each core.
- Extract regression equations to calculate the permeability log from the porosity log.
- Cross-plot core poro-perm data versus calculated well poro-perm.
- Create an interactive plot of all well curves exported as a HTML file.
- Impute partially missing core data values using ML techniques.
- Generate conformal predictions to yield P90-P50-P10 regression trend lines that honour actual data.

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Day 2, Session 2 (Supervised Machine Learning for Log Curve Prediction – Binary Classification)

- Conduct supervised ML binary classification to predict unseen log curves.
- Data visualization using Seaborn and Plotly.
- Split data into train and test sets based on selected well names.
- Set up the classification environment and create the best model by tuning.
- Analyze the model and predict the missing log curve.
- Finalize the model and predict on unseen/blind well.
- Run metrics on the blind well and save the final model.

Day 3, Session 1 (Supervised Machine Learning for Multi-Class Facies Classification)

- Conduct supervised Machine Learning.
- Split data into train and test sets based on well names.
- Set up the classification environment and create the best model(s) by tuning.
- Analyze model and predict on test set.
- Finalize the model and predict on unseen/blind well.
- Run metrics on a blind well and save the final model.

Day 3, Session 2 (Supervised Machine Learning for Missing Log Prediction using Regression)

- Conduct supervised Machine Learning.
- Data visualization using Seaborn and Plotly.
- Split data into train and test sets based on well names.
- Set up the classification environment.
- Analyze model and predict on test set.
- Finalize the model and predict on unseen/blind well.
- Run metrics on a blind well and save the final model.



Day, 4 Session 1 (Unsupervised Machine Learning (Clustering) for Lithology Prediction)

- Introduce unsupervised Machine Learning via Clustering.
- Data visualization using Seaborn and Plotly.
- Split data into train and test sets.
- Initialize the clustering environment and create models.
- Assign models and visualize various clustering models for comparison. Predict on test (unseen) data and discuss strengths/weaknesses.

Day, 4 Session 2 (Unsupervised Machine Learning for Outliers / Anomaly Detection)

- Use statistical and visual tools to inspect potential data outliers.
- Conduct unsupervised anomaly ML to predict data outliers/anomalies.
- Set up the anomaly environment.
- Analyze some models and identify data outliers.
- Visualize data outliers in 2D, 3D and scatter plots for subjective disqualification.

Progress Tracking

Full course administration is included in the package and can be tailored to meet specific client requirements. Weekly progress updates are provided, giving your organisation clear visibility into participation, engagement, and overall progress.

Queries

Connect with enquiries@apes-energyevolution.com