

2 Weeks Practical Training Applied Machine Learning & Data Science for Reservoir Engineering



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ABOUT THIS TRAINING

- Our intensive Machine Learning training for reservoir engineering domain will covers all the basics about ML implementation in reservoir engineering and surveillance with hands on project to implement the typical ML tasks: Clustering, Time Production Analysis, Regression, Classifications
- This training is designed by an oil and gas professional for professionals likewise, where real oil and gas data are used in the training with diversity in data sets.

SKILLS GAINED

-  Get started with Python and Machine Learning
-  Learn Basics of Python as an ML tool
-  Data Manipulation, Filtering, visualization and processing
-  Machine Learning Implementation
-  Work with actual Oil and Gas Data
-  Learn from an instructor with 11 years' experience in programming, technology and Upstream Industry





AUDIENCE

-  Reservoir engineers
-  Production engineers
-  Drilling engineers
-  Geologists and petrophysics
-  AL and workover engineers
-  Graduate students (PhD, MScs.)

PREREQUISITE

- No knowledge is required
- A working laptop with Windows 10 OS, MacOS or GNU Linux Distro

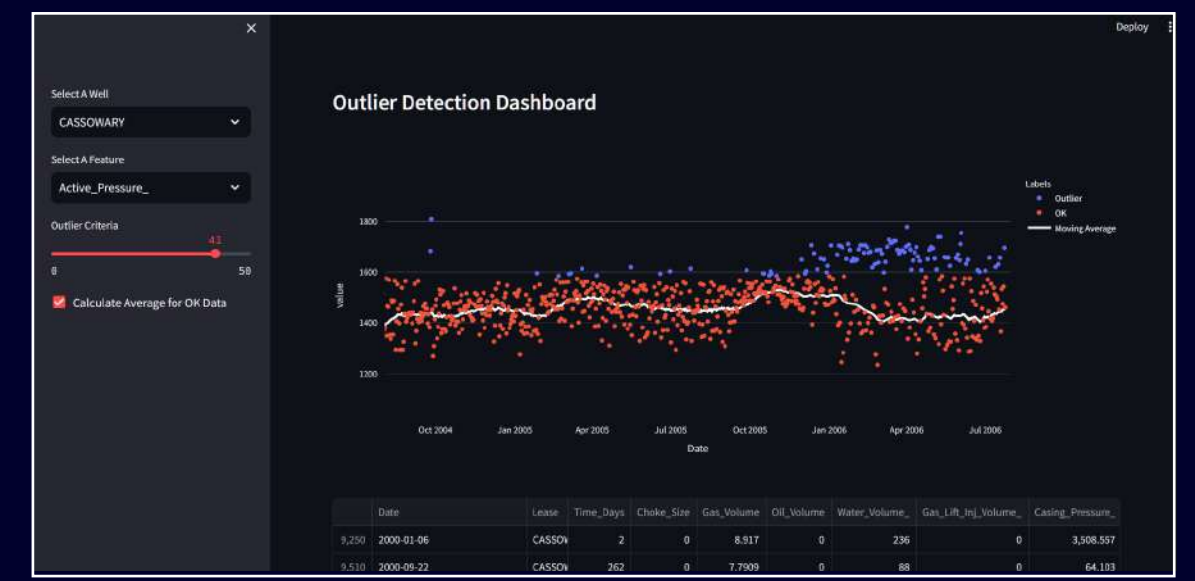
WHAT YOU WILL GET FROM JOINING

-  Access to Video Recordings daily
-  Study materials ppt, pdf
-  Many Oil and Gas Datasets.
-  Learn Python through anaconda package

MODULE 1

TOPICS

- Introduction to Data Science and related Methodologies
- A gentle introduction to Python Programming Language
- Introduction to Python Environment and Ecosystem
- Data types and Structures in Python
- Introduction to Data Visualization
- Working with Tabulated Data using Pandas
- Basics of Data Cleaning and Transformation using Pandas
- Creating Calculations and Data Exports
- Linking Excel, CSV, TXT to Python



EXERCISES

- Oil and Gas Data Reading and excel connection to python
- Simple Reservoir Data Visualization
- Filtering Reservoir Data based on Wells (single or Multiple)
- Cleaning and organizing historical data, with proper datetime conversion

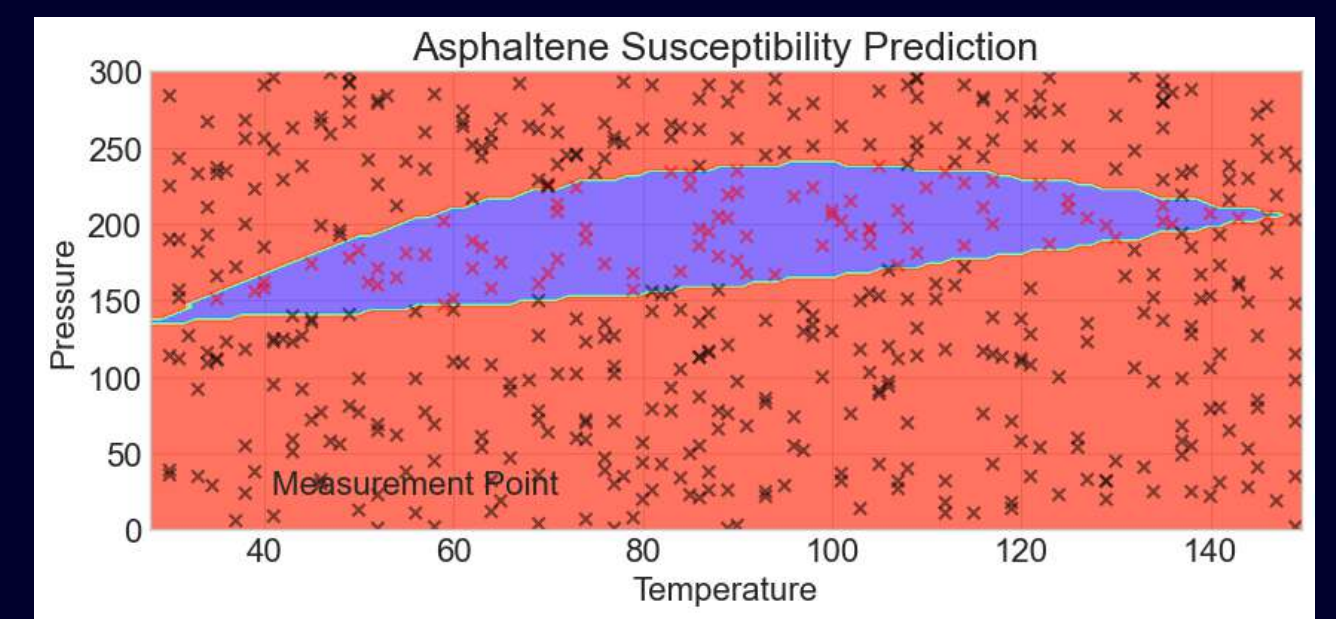
WHAT YOU WILL LEARN

- **Understand the Basics of Python Programming:** Gain a foundational understanding of the Python programming language, including its syntax, structure, and common uses.
- **Navigate the Python Environment and Ecosystem:** Familiarize yourself with the Python environment, including IDEs, libraries, and tools that form the Python ecosystem.
- **Identify and Utilize Python Data Types and Structures:** Learn to work with various data types and structures in Python, such as lists, dictionaries, tuples, and sets, for efficient data management.
- **Create Basic Data Visualizations:** Explore fundamental data visualization techniques using Python to represent data graphically.
- **Manipulate and Analyze Tabular Data Using Pandas,** in any form for production, reservoir and petrophysical parameters
- **Perform Basic Data Cleaning and Transformation:** Learn essential data cleaning techniques, including handling missing data, filtering, and transforming datasets with Pandas.
- **Create Calculations and Export Data:** Develop skills to perform calculations and export the processed data into various formats.

MODULE 2

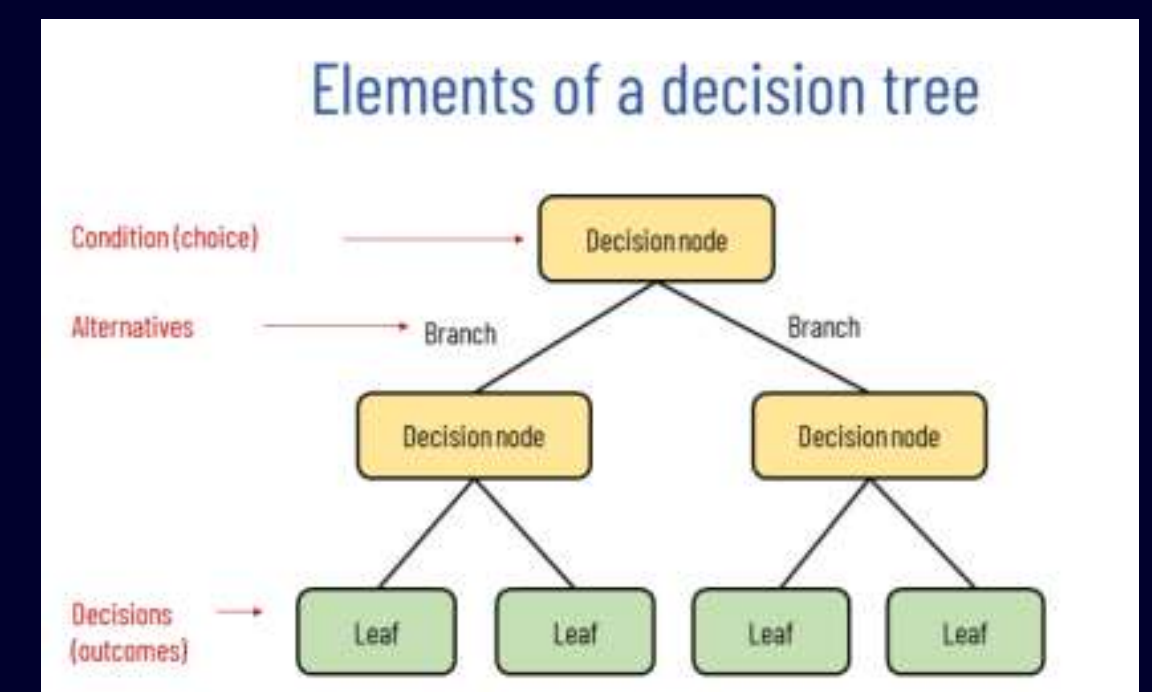
TOPICS

- Introduction to Unsupervised Learning Methods
- Introduction to the Concept of Clustering.
- Introduction distance metrics
- Introduction to sci-kit learn library for ML
- Introduction fundamental Python Expressions and functions
- Introduction to Anomaly Detection
- Advantages and Limitation of Anomaly Methods.
- Introduction to Local Outlier Factor with Time Window.



EXERCISES

- Clustering Petrophysical Data.
- Detecting Anomaly in Production Data
- Anomaly Detection by cross validating with Moving Average.
- Dashboarding for Clustering and Opportunity identification



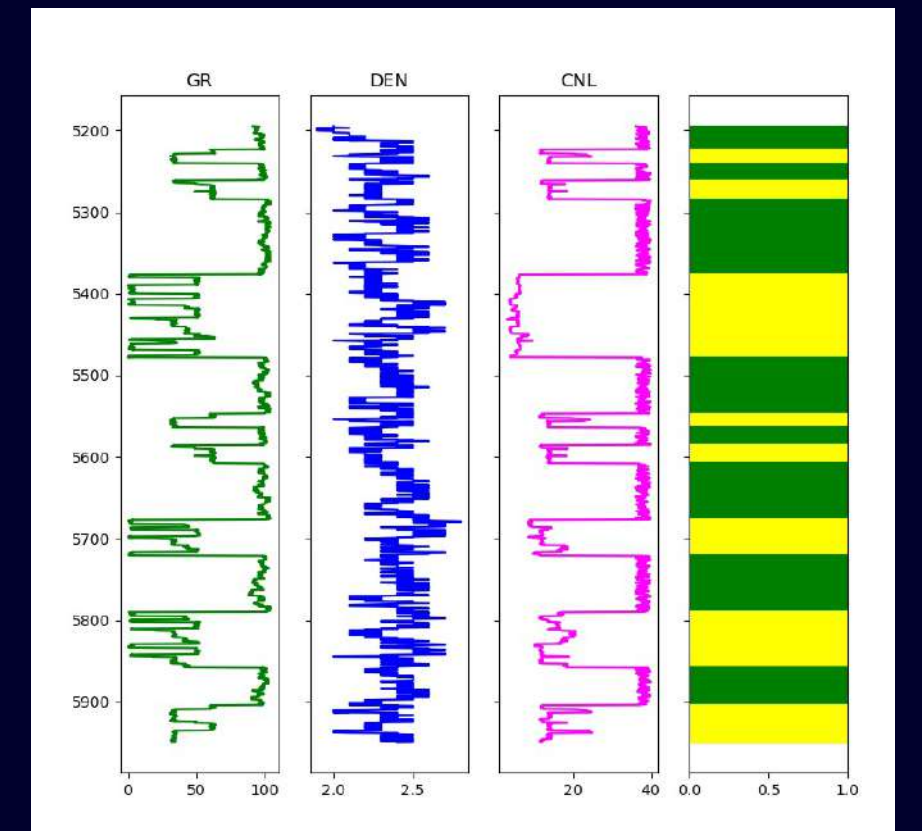
WHAT YOU WILL LEARN

- Gain an introductory understanding of unsupervised learning techniques and their applications in data analysis.
- Explore the Concept of Clustering: Learn the basics of clustering, including how to group similar data points together.
- Understand the role of distance metrics in clustering and how they influence the grouping of data.
- Utilize the scikit-learn Library for Machine Learning: Get introduced to the scikit-learn library and learn how to implement machine learning algorithms using it.
- Detect Anomalies in Data: Learn how to identify anomalies in datasets, focusing on methods and tools used for anomaly detection.
- Evaluate the Advantages and Limitations of Anomaly Detection Methods: Understand the strengths and weaknesses of various anomaly detection techniques.
- Implement Local Outlier Factor with Time Windows: Get introduced to the Local Outlier Factor method, including its application with time window analysis for detecting outliers.
- Solidify your understanding and knowledge by applying all above on oil and gas datasets.

MODULE 3

TOPICS

- Introduction to Supervised Learning
- Introduction to Data types and it's classification (A Statistics Approach)
- Labels and Events in Oil and Gas Industry
- Introduction to Labeled Data and the concept of Classification
- Introduction to Decision Trees and Related Algorithms
- Introduction to Pandas Tabular Data Frames
- Introduction Binary Classification and One-V-Rest technique
- Introduction to Multiclass classification
- Evaluating the Classification using Metrics
- Decision Boundary Plotting (Decision Maps)



EXERCISES

- Classifying formation Layers (Shale, Sand, Lime St.) using well Logs | Rock Type Identification
- Predicting Asphaltting Deposition Possibility (Binary Classification Approach)
- Rock Type Identification Using Mineral Analysis

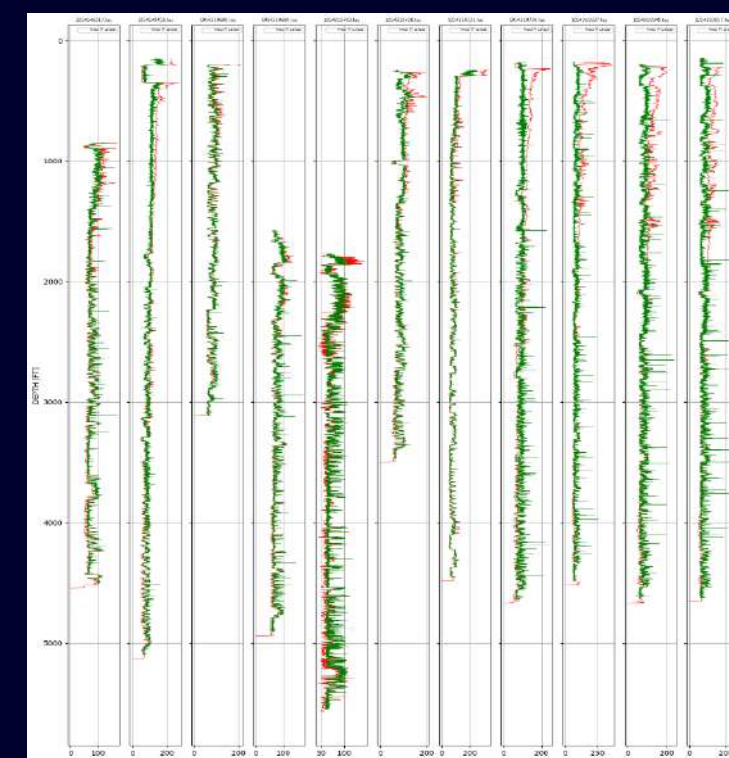
WHAT YOU WILL LEARN

- Supervised Learning Fundamentals: Understand how machines learn from labeled data.
- Data Types and Classification: Explore data types and their classification through a statistical approach tailored for the oil and gas sector.
- Industry-Specific Labels and Events: Learn how to define and use labels and events within the oil and gas industry.
- Introduction to Classification: Grasp the concept of classification and its importance in data analysis.
- Decision Trees and Algorithms: Get introduced to decision trees and related algorithms for predictive modeling.
- Working with Pandas Data Frames: Learn to manage and analyze structured data using Pandas Tabular Data Frames.
- Gain an Understanding of Binary and Multiclass Classification implement binary classification and the One-Vs-Rest technique, along with multiclass classification.
- Model Evaluation: Learn to evaluate classification models using various metrics.
- Decision Boundary Plotting: Gain skills in plotting decision boundaries (decision maps) to visualize model predictions.

MODULE 4

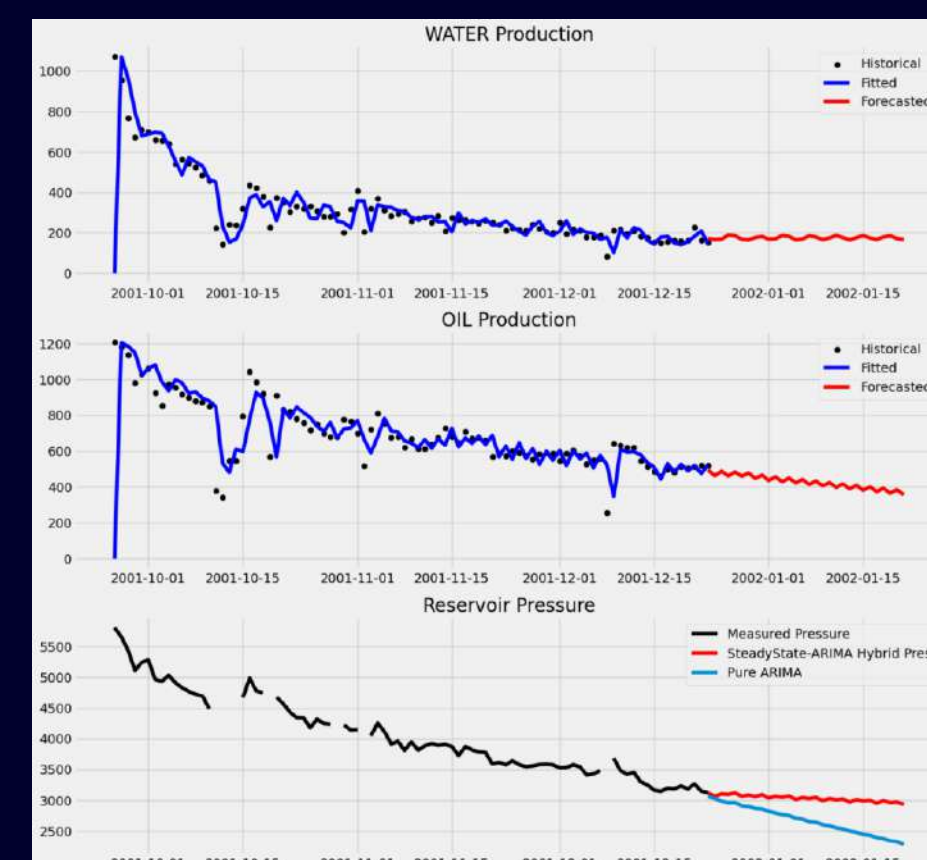
TOPICS

- Introduction to Continuous Data and Corresponding Relationships
- Introduction to Correlations.
- Introduction Linear Data Relationship
- Introduction to relationship visualization and Correlation Matrix
- Introduction to Regression Analysis
- Introduction to Linear Regression
- Introduction to Support Vector Regression
- Introduction to Xtreme Gradient Regression (XGBoost Library)



EXERCISES

- Training ML to Behave Like Numerical Simulator (with Saturation and Reservoir Pressures as outcomes)
- Predicting PVT Properties using Lab Reports and ML
- Identifying the Effect of Well Pair Interconnectivity.
- Predicting Water cut based on other Production KPIs
- Predicting Petrophysical Properties based on LAS files



WHAT YOU WILL LEARN

- **Continuous Data and Relationships:** Understand continuous data and explore the relationships between different variables.
- **Correlation Concepts:** Learn the basics of correlations and how they indicate relationships between data points.
- **Linear Data Relationships:** Get introduced to linear relationships in data, a fundamental concept in statistical analysis.
- **Relationship Visualization:** Discover how to visualize data relationships and interpret correlation matrices.
- **Gain insights into regression analysis** as a tool for modeling and predicting data trends.
- **Linear Regression:** Learn the fundamentals of linear regression and its applications.
- **Support Vector Regression:** Explore the basics of Support Vector Regression (SVR) for handling complex data relationships.
- **XGBoost for Regression:** Get introduced to Xtreme Gradient Regression using the XGBoost library, a powerful tool for predictive modeling based on reservoir production data

MODULE 5

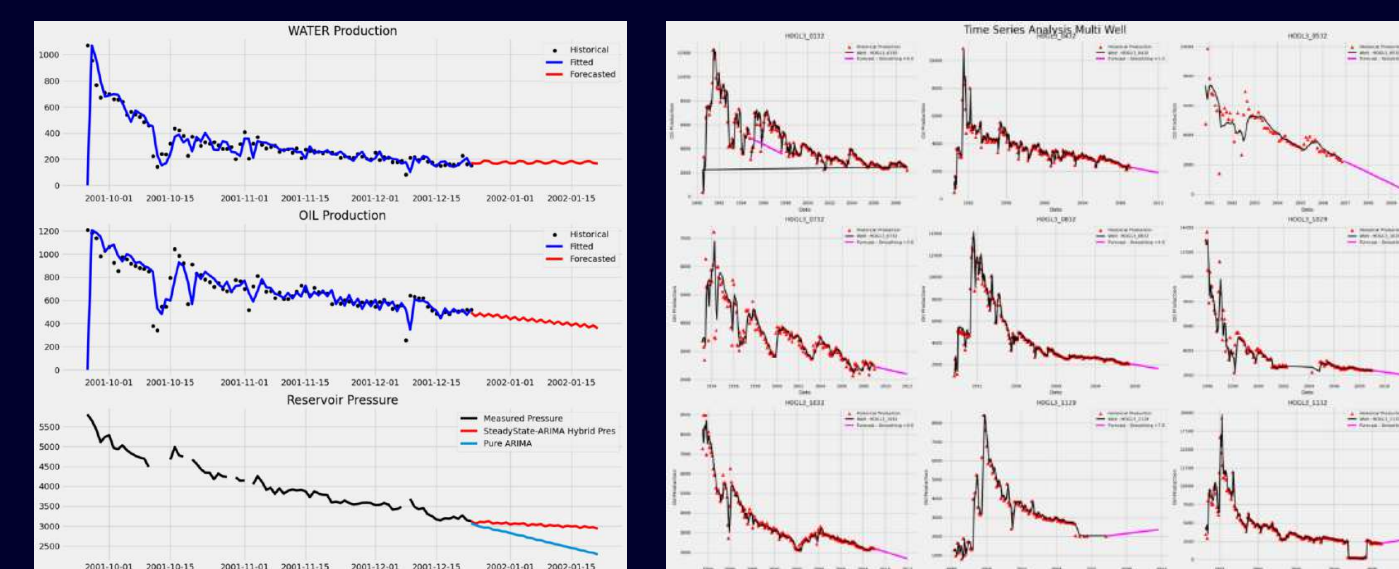
TOPICS

- Introduction to Time Bounded Data in Oil and Gas Industry
- Introduction to Typical Decline Curve Analysis and Limitations
- Introduction to Time Series Analysis.
- Introduction to Time Series Data Patterns and Components
- Comparing DCA to Time Series Analysis.
- Short Term Production Prediction using TSA.
- Introduction to Simple Moving Average and Exponential Moving Average
- Introduction Autoregressive Models
- Introduction to ARIMA Models.



EXERCISES

- Predicting Oil Decline using Auto Regression Models.
- Predicting Water cut based on WHP and Oil Rate
- Introduction to Multi-well Data Fitting and Autoregressive Analysis
- Predicting Reservoir Pressure By Forecasting Liquid Rate and Bottomhole Pressure



WHAT YOU WILL LEARN

- Understand the relevance and application of time-bounded data in the oil and gas sector.
- Explore the basics of Decline Curve Analysis (DCA), including its limitations and how it compares to other methods.
- Learn the principles of time series analysis for handling and interpreting sequential data.
- Data Patterns and Components: Identify patterns and components in time series data to better understand underlying trends.
- Comparative Analysis: Compare Decline Curve Analysis with time series analysis to evaluate their effectiveness in different contexts.
- Short-Term Forecasting: Apply time series analysis techniques for short-term production predictions.
- Gain knowledge of Simple Moving Average (SMA) and Exponential Moving Average (EMA) for data smoothing and trend analysis.
- Learn about Autoregressive (AR) models and their use in predicting future values based on historical data.
- Discover how ARIMA models are used for time series forecasting and prediction.
- Use Autoregressive models to forecast oil decline trends effectively.
- Predict water cut levels based on wellhead pressure (WHP) and oil rate.
- Apply Autoregressive techniques to fit and analyze data from multiple wells.
- Reservoir Pressure Forecasting: Forecast reservoir pressure by analyzing liquid rate and bottomhole pressure data.