

# Artificial Intelligence and Its Applications in the Petroleum Industry

*Short Course with Hands-On Applications on Advanced AI Techniques*

## Course Coordinators:

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## Target Audience:

This course should be of great interest to professionals, in Oil and Gas Industry and related fields, e.g., Petroleum Engineers, Geologists, Geo-physicists, Managers, lab-scientists and Scientists who use/intend to use the latest computer Aided technologies in their fields. This course is also beneficial for those who are involved in data analysis, modeling, simulation, and decision making in the oil and gas industry, including IT Managers, Systems Analysts, and Programmers.

This course assumes no mathematical background, and no background knowledge in AI and data mining concepts. The emphasis is on presenting a set of tools that are useful in a large number of applications, and presenting these tools in an intuitive way.

## Details:

Date: TBA  
Length: Full Day  
Location: To be determined by the Conference Committee

**Fees:** To be determined

This is a new and unique short course on advanced Artificial Intelligence (AI) techniques for the petroleum industry. The applications of AI methods in the petroleum industry has recently become a topic of interest to researchers and professionals and have led to a new generation of computer aided analysis tools for practitioners, scientists, and engineers working in the petroleum industry.

## COURSE DESCRIPTION

This short course provides the audience with the essential information of artificial intelligence, data mining, and soft-computing (SC) needed for many petroleum industry applications. We will briefly discuss the most popular modeling schemes of AI, such as, artificial neural networks, functional networks, fuzzy logic, data classifications, data mining and Knowledge Discovery, adaptive neuro-fuzzy, genetic algorithms, decision theory, information gain, and Bayesian Belief Networks with application examples from Oil and Gas industry. The following are examples of the areas where the AI tools have already demonstrated their numerous benefits to the industry:

- ✓ Permeability and Porosity prediction
- ✓ Characterization of gas reservoirs
- ✓ PVT properties and empirical correlations
- ✓ Rock mechanics properties
- ✓ Optimize drilling operation and hydraulic fracture designs
- ✓ History matching and Gas Storage Management
- ✓ Formation lithology Identification from Well logs
- ✓ Porosity Image from Well Logs,
- ✓ Identification of high porosity reservoir sands from 3D-seismic attributes,
- ✓ Well Drilling and Petroleum Production
- ✓ Intelligent System for Start-up of a Petroleum Offshore Platform
- ✓ Subsurface Simulation Optimization
- ✓ Multiphase Flow Regime
- ✓ Estimate Monthly Production and Production Performance Monitoring Workflow.
- ✓ Inferential sensing and softsensing.

At the end of the short course, we will then provide step-by-step procedure for applying the studied techniques in solving some common real-world problems such as, reservoir characterization, permeability and porosity prediction, geological facies classification, pay-zone prediction, oil pressure/volume/temperature (PVT) report analysis, and multi-phase flow.

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## SHORT COURSE DETAILS

This short course provides the audience with fundamentals of both Computational Intelligence and soft-computing, Artificial Neural Networks and its learning algorithm, Functional Networks and its new features, several optimization techniques including genetic algorithms and least squares criterion, fuzzy logic and adaptive inference systems, decision trees, handling uncertainty using Bayesian Belief networks, information gain, support vector machines. We will go over real-world industry data to utilize these modeling techniques. Most of these utilizations will be done using the stand-alone applications software, which were created by the instructors and their research group with KFUPM and Cornell University, Ithaca, NY, USA, and built-in Matlab toolboxes.

## AI TECHNIQUES TO BE COVERED

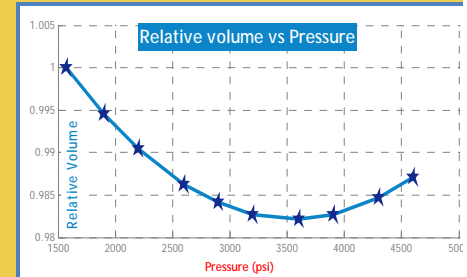
- ✓ Artificial Neural Networks
- ✓ Neuro-Fuzzy Inference Systems
- ✓ Support Vector Machines and Genetic Algorithms
- ✓ Functional Networks
- ✓ Ensemble & Hybrid Techniques
- ✓ Clustering Techniques

## COURSE OUTLINE

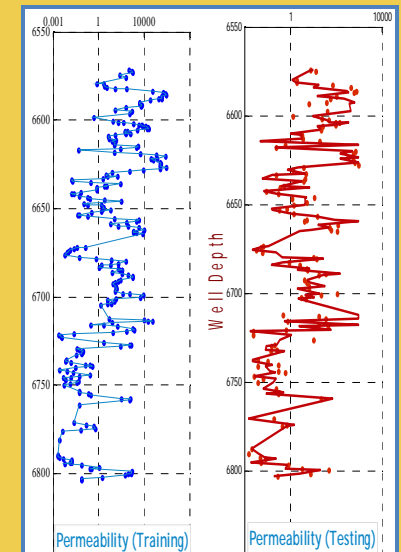
1. Overview of Computational Intelligence
2. Fundamentals of Softcomputing
3. Artificial Neural Networks
4. Functional Networks
5. Genetic Algorithms
6. Fuzzy Logic Inference Systems
7. Practice using Matlab toolboxes for artificial neural networks, genetic algorithms, functional networks, fuzzy logic and adaptive fuzzy inference systems.
8. Real-Industry applications: reservoir characterization, permeability and porosity prediction, geological facieses classification, pay-zone estimation, PVT report analysis, and multi-phase flow.

## Show Cases

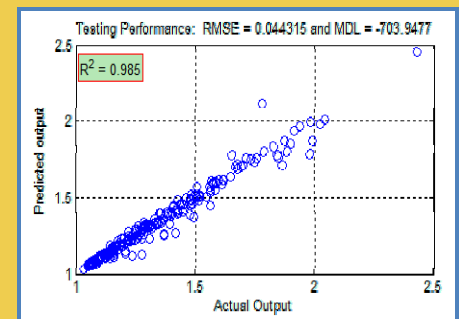
- ❖ Oil Wells Properties Estimation using Artificial Neural Networks



- ❖ Oil Wells Properties using Functional Networks



- ❖ Performance of Test Data in Predicting formation volume factor ( $B_o$ ) Using AI.



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