A Short Course for the Oil & Gas Industry Professionals

INSTRUCTOR:
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PRODUCTION OPTIMIZATION

Using State-of-the-Art in Artificial Intelligence & Data Mining (AI&DM)

*A Comprehensive Course Designed for Petroleum Professionals focusing on oil and gas production optimization using the latest techniques and algorithms in **Artificial Intelligence & Data Mining (AI&DM),** offering an alternative approach to addressing dynamic and complex upstream problems.*

With Applications, examples and hands-on exercises in Smart Wells and Smart Fields via Real-Time Reservoir Management, Real-Time Surveillance, Production Monitoring & Well Management, Top-Down Reservoir Simulation & Modeling, Best Practices Analysis, Production Data Analysis, Well Completion, Candidate Well selection, Surface Facility Modeling and Optimization, ...

Course Description:

This short course will cover the fundamentals of artificial intelligence and data mining (AI&DM) and will provide the theoretical background for its most used components such as artificial neural networks, genetic optimization and fuzzy logic.

The short course will provide insight on the type of problems that can be solved using AI&DM techniques. The larger part of the short course is devoted to field applications of these tools in production optimization.

INTELLIGENT SOLUTIONS, INC.

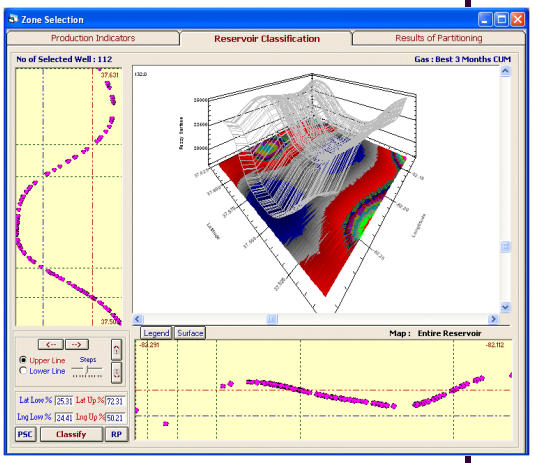
Artificial Intelligence is a collection of several analytical tools that attempts to mimic life. These tools (include but are not limited to, artificial neural networks, genetic optimization and fuzzy logic) are being used in many commercial products. They are an integrated part of many new cars such as Honda and Mitsubishi. They are used to provide smooth rides in subway systems and prevent fraud in use of credit cards. They are extensively used in the financial market to predict chaotic stock market behavior, or optimize financial portfolios. Their application in the oil and gas industry is fairly new. A handful of researchers and practitioners have concentrated their efforts on providing intelligent tools for the petroleum industry. Artificial intelligence and data mining tools have been used to Optimize Hydraulic Fracture Designs, Characterize oil and gas reservoirs, Optimize drilling operations, Interpret well logs, Generate synthetic magnetic resonance logs, Optimize new well placement, Select candidate wells for treatments and Predict post fracture deliverability.

Experience:

This short course has been taught successfully, numerous times as in-house training to national oil companies and to audiences from many major oil companies.

As a participants in the short course you are encouraged to bring:

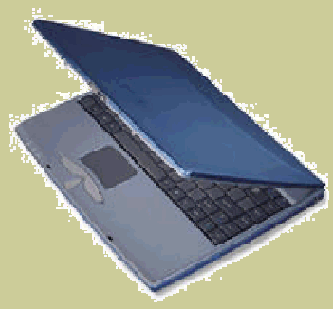
- Your laptop computer for hands-on practice of algorithms.
- Your own data. If you have data that you are currently working with, this is a great opportunity to bring your data to the class and practice with these algorithms on your own data instead of using data that is furnished as part of the course material. Please contact ISI for data format.



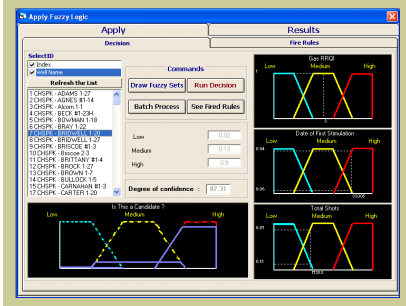
Fuzzy pattern recognition applied to production data analysis in order to identify the remaining reserves in mature fields, application: Mid Continent US.

Every participant in the short course will receive:

- A Course Manual including all the slides used during the presentation of the short course.
- An electronic copy of all the slides.
- Electronic copy of technical material as support for the topics covered in the short course. This technical material takes you beyond the summarized slides and help you review in detail all you have learned in the short course.
- A copy (full features with limited time license) of IDEA™ suite of software applications, the most comprehensive AI&DM tool for the Oil & Gas industry. During the short course you will learn how to work with IDEA™ suite of software applications.



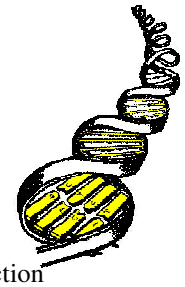
Please do not forget to bring your laptop computer with you to the course. This short course includes several hands on exercises.



Fuzzy decision support system for restimulation candidate selection, application: Rockies, Green River Basin and Austin Chalk.

Course Outline:

Part One: Artificial Intelligence & Data Mining (AI&DM); Theoretical Background.



Introduction
State-of-the-art in Artificial Intelligence and Data Mining (AI&DM)

Artificial Neural Networks
General Overview
Biological Background
Learning algorithms
Transfer Functions
Training, Testing and Verification data sets
Dos and Don'ts of Neural Network Practices

Evolutionary Computing
General Overview
Biological Background
Genetic Algorithms
Fitness Function
Genetic Operation
Convergence

Fuzzy Logic
General Overview
Fuzzy Set Theory
Fuzzy Membership Function
Fuzzy Decision Support Systems
Fuzzy Rules
Fuzzy Inference Engines
Defuzzifications

Hybrid Intelligent Systems
Integrating Neural Networks, Genetic Algorithms and Fuzzy Logic

Part Two: AI&DM Upstream Applications & Hands On Exercises

Surrogate Reservoir Models

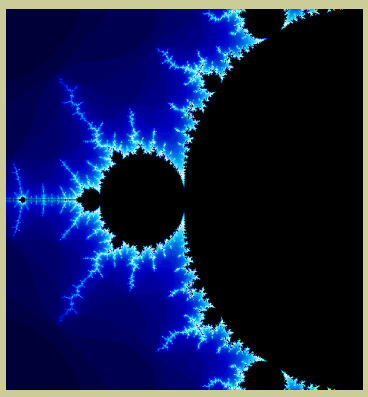
Surrogate Reservoir Models (SRM) are accurate replicas of full field simulation models that run in real-time. Using latest AI&DM tools, SRMs are built to mimic the behavior of complex and dynamic simulation models that are built in ECLIPSE™, CMG™, VIP™, … and produce accurate results in fraction of a second. SRMs are used in the context of smart fields where real-time reservoir analysis and management is an absolute necessity. Furthermore, SRM are used in the context of reservoir analysis and management where full exploration of solutions space is required for identifying optimum (or near optimum) field development strategies.

Surrogate Reservoir Models are used for quantification of uncertainties associated with the geologic models used in the reservoir simulation. Given their fast (real-time) response to static and dynamic modifications of the parameters in the field, SRMs can provide probability distribution functions representing potential well responses to uncertain reservoir characteristics. By clearly identifying the Key Performance Indicators (KPI) SRM can serve as an effective computer assisted history matching tool, significantly reducing the time required for history matching.

Surface Facility Simulation & Modeling

Building surface facility models based on pressure, temperature and rate at key locations in the facility without the need for detail modeling of every pipe and small components present in the facility. Focusing on the major separation facilities and compression stations fully dynamic models are developed that can be used for:

- De-bottlenecking the surface facility.
- Optimize production from the subsurface by identifying the best settings at the surface facility.
- Calibration and validation of conventional surface facility modeling tools.



Who Should Attend?

This course is designed for completion, production and reservoir engineers of operating companies as well as service company personnel involved with planning, completion and operating wells.

Part Two: AI&DM Upstream Applications & Hands On Exercises (Continue)

Top-Down Full Field Simulation & Modeling

Conventional reservoir simulation and modeling is a bottom-up approach that starts with modeling the geology of the reservoir and is followed by adding petrophysical and geophysical information in order to reach at a relatively complete geological perception of the reservoir.

Top-Down full field simulation and modeling approaches the reservoir simulation and modeling from an opposite angle and direction when compared to conventional process by attempting to build a realization of the reservoir starting with well production behavior (history). The production history is augmented by core, log, well test and seismic data in order to increase the accuracy of the Top-Down modeling technique. This innovative and novel approach to reservoir simulation and modeling can substitute (at a fraction of the cost) conventional reservoir simulation and modeling in cases where performing conventional modeling is cost (and man-power) prohibitive. In cases where a conventional simulation and model of a reservoir (field) already exists, Top-Down modeling is considered as a complement to, rather than a competition for the conventional technique. It provides an independent look at the data coming from the reservoir/wells in order to identify optimum development strategy and recovery enhancement. It includes:

Automatic Decline Curve Analysis (DCA)
Computer Assisted Type Curve Matching (TCM)
History Matching (HM) using Single-Well Radial Numerical Reservoir Simulation
Volumetric Reserve Calculation (VRC)
Recovery Factor Calculation (RF)
Fuzzy Pattern Recognition & Predictive Modeling for:
- Sweet Spot Detection with Time. Optimum Infill Location in the field.
- Field Development Strategies. Tracking Remaining Reserve with Time.
- Estimating New Well Performance.
- Identification of Underperformer Wells

Intelligent Candidate Selection

Model Building & Analysis
Constrained Genetic Optimization
Fuzzy Decision Support System & Ranking the Selected Candidates

Intelligent Best Practices Analysis

Descriptive Best Practices Analysis, Existing Practices.
Predictive Best Practices Analysis,
- Full Field Analysis, Groups of Wells Analysis, Individual Well Analysis.
- Single Parameter Analysis, Combinatorial Analysis.

About the Instructor

Dr. Shahab D. Mohaghegh is professor of Petroleum & Natural Gas Engineering at West Virginia University and founder and president of Intelligent Solutions, Inc., the leading company in providing the oil and gas industry with solutions based on artificial intelligence & data mining (AI & DM).

With more than 16 years of experience, Dr. Mohaghegh has been a pioneer in the application of "AI&DM" in petroleum industry, applying hybrid forms of neural networks, genetic optimization and fuzzy logic to smart wells, smart completions, and smart fields as well as to drilling, completion, well stimulation, surface facility optimization, formation evaluation, seismic inversion, reservoir characterization, reservoir simulation and reservoir management.

He has published more than 100 technical papers during his career and has been a technical editor/reviewer for various SPE journals as well as other petroleum-related publications such as Oil, Gas and Coal Technology, Journal of Petroleum Science and Engineering, Computers & Geosciences, Geophysics, and Energy & Fuels. His technical articles on the application of "AI&DM" in the oil and gas industry and their recent developments have appeared in the Distinguished Author Series of SPE's Journal of Petroleum Technology during September, October and November of 2000 as well as the April 2005. He is a SPE Distinguished Lecturer for 2007-2008. He is an associate editor of SPE Reservoir Evaluation and Engineering Journal 97-99, & 2007- present. He has also served as discussion leader and technical presenter in SPE forums and has served as a steering committee member in SPE Applied Technical Workshops. He has been a panelist in several international conference discussing topics related to "AI&DM" and smart fields.

Shahab D. Mohaghegh holds B.S. and M.S. degrees in Natural Gas Engineering from Texas A&I University and Ph.D. in Petroleum & Natural Gas Engineering from The Pennsylvania State University.

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