SPWLA TRAINING COURSE ANNOUNCEMENT
SPWLA FRANK S. MILLARD Training Center, Houston, TX
8866 Gulf Freeway, Suite 320, Houston, TX 77017
December 5-7, 2018

Course Title: Machine Learning Techniques for Engineering and Characterization

Course Description This course will present an overview of common machine learning techniques suitable for deployment in reservoir characterization and engineering. Emphasis will be on the use of supervised learning, classification, clustering, regression, and neural networks using Python and Tensorflow computational platforms. Engineers, researchers, geoscientists and other attendees will learn to assemble machine learning workflows and apply them on various types of the data. The hands-on nature of the course facilitates understanding the basics of machine learning, data science, and data analysis. Attendees will get to work on few simple case studies on the use of machine learning in oil and gas. (Students are to bring personal laptop with charger)

Level of Difficulty

1. Basic computer programming using VBA, C++, Python, JAVA, or R
2. Numerical Methods or Numerical Analysis course
3. Familiarity with basic statistics, probability, regression, interpolation and curve fitting

Objectives

1. Participants will be able to assemble open-source machine learning and data mining workflows in Python and Tensorflow to solve complex data science problems.
2. Participants will be proficient in exploratory data analysis on datasets containing numerical, time-series, and categorical data.
3. Participants will be proficient in using Decision Tree, Nearest Neighbor, Random Forest, Gradient Boosting, and Support Vector Machine classification techniques.
4. Participants will be proficient in using K-Means, DBSCAN, Hierarchical, Gaussian Mixture, and Self Organizing Map clustering techniques.
5. Participants will be able to construct training, testing, cross validation, feature elimination, feature ranking, parameter selection, and anomaly detection tasks.
6. Participants will be skilled in supervised regression using ElasticNet, Support Vector, Nearest Neighbor, Neural Network, and MARS regressors.
7. Participants will be able to construct deep neural networks for time-series analysis and classification tasks.

Agenda

Day 1

TIME	ACTIVITY
8:00 a.m. - 10 a.m.	Exploratory Data Analysis
10 a.m. - 10:15 a.m.	Break
10:15 a.m. - 12:15 p.m.	Supervised Learning - Regression
12:15 p.m. - 1:30 p.m.	Lunch
1:30 p.m. - 3:30 p.m.	Supervised Learning - Classification
3:30 p.m. - 3:45 p.m.	Break
3:45 p.m. - 5 p.m.	Unsupervised Learning - Clustering

Day 2

TIME	ACTIVITY
8:00 a.m. - 10 a.m.	Unsupervised Transformations
10 a.m. - 10:15 a.m.	Break
10:15 a.m. - 12:15 p.m.	Categorical Data, Cross Validation, & Model Scores
12:15 p.m. - 1:30 p.m.	Lunch
1:30 p.m. - 3:30 p.m.	Feature Extraction & Feature Ranking
3:30 p.m. - 3:45 p.m.	Break
3:45 p.m. - 5 p.m.	Parameter Selection & Anomaly Detection

Day 3

TIME	ACTIVITY
8:00 a.m. - 10 a.m.	Advanced Regression & Classification
10 a.m. - 10:15 a.m.	Break
10:15 a.m. - 12:15 p.m.	Advanced Clustering
12:15 p.m. - 1:30 p.m.	Lunch
1:30 p.m. - 3:30 p.m.	Neural Networks & Deep Learning using Tensorflow
3:30 p.m. - 3:45 p.m.	Break
3:45 p.m. - 5 p.m.	Petroleum Case Studies: Handling Missing Data, Synthesizing Logs, and Rock Typing

Target Audience

Engineers, Geoscientists, Petrophysicists, and Geologists who need to get started with Machine Learning applications and those who want to understand the best practices in designing robust and scalable workflows.

Course Prerequisites - Knowledge/Experience/Education Required)

1. Basic computer programming using VBA, C++, Python, JAVA, or R
2. Numerical Methods or Numerical Analysis course
3. Familiarity with basic statistics, probability, regression, interpolation, and curve fitting

Teaching Methods

1. Lecturing
2. Demonstrations of machine learning codes and their performance under various scenarios
3. Participant collaboration tasks
4. Learning by Doing: Participants will compile and execute machine learning workflows
5. Active learning: Hands-on exercises on data analysis and predictive modeling(Students **MUST** bring their own laptops with charger)

Course Schedule

Three (3) full days of classroom.

Are handouts provided?

All material will be in electronic format. Machine learning workflows will be python/tensorflow format accessible through Jupyter Notebooks and relevant data will be in txt, xls, or csv format. After the course, participants can use the machine learning modules shared with them as Jupyter Notebooks to automate/process their own data-driven modeling tasks.

Reference Publications

Li, H., He, J., & Misra, S. (2018, September). Data-Driven In-Situ Geomechanical Characterization in Shale Reservoirs. In SPE Annual Technical Conference and Exhibition. Society of Petroleum Engineers.

Li, H., & Misra, S. (2017). Prediction of subsurface NMR T2 distributions in a shale petroleum system using variational autoencoder-based neural networks. IEEE Geoscience and Remote Sensing Letters, 14(12), 2395-2397.

Li, H., & Misra, S. (2018). Assessment of miscible light-hydrocarbon-injection recovery efficiency in Bakken shale formation using wireline-log-derived indices. Marine and Petroleum Geology, 89, 585-593.

Tathed, P., Han, Y., & Misra, S. (2018). Hydrocarbon saturation in upper Wolfcamp shale formation. Fuel, 219, 375-388.

Tathed, P., Han, Y., & Misra, S. (2018). Hydrocarbon saturation in Bakken Petroleum System based on joint inversion of resistivity and dielectric dispersion logs. Fuel, 233, 45-55.

Course: Date: December 5-7, 2018
Course Fee: MEMBER FEE $1600.00, NON-MEMBER $2100.00, STUDENT $375.00
Course Location: SPWLA Frank S. Millard Training Center, Houston, Texas

Instructor Bio

Dr. Siddharth Misra is an Assistant Professor in the Mewbourne College of Earth and Energy at the University of Oklahoma, USA. He graduated with a Ph.D. in Petroleum Engineering from the University of Texas at Austin. Prior to doctoral studies, he worked as a Wireline Field Engineer in Saudi Arabia, Egypt, and USA with Halliburton from 2007 to 2010. He received Bachelor of Technology in Electrical Engineering from Indian Institute of Technology, Bombay. Dr. Misra has more than 45 publications in peer-reviewed journals and as part of the conference proceedings. He is serving as an associate editor of the SPE Reservoir Evaluation and Engineering Journal. He has 8 provisional patent applications related to subsurface and geomaterial characterization. Misra's research interests include petrophysics, formation evaluation, electromagnetic sensing, inverse problems, rate/pressure transient analysis, and machine learning applications. He is an active member of Society of Petroleum Engineering, Society of Exploration Geophysicists, and Society of Petrophysicists and Well Log Analysts contributing to the technical efforts as committee member and technical editor.

Recent Accomplishments

- Department of Energy Early Career Award with 5-Year Research Fun
- American Chemical Society New Investigator Award with 2-Year Research Fu
- SPE Mid-Continent Formation Evaluation Awar

Recent Press Release

- https://www.energy.gov/articles/department-energy-selects-84-scientists-receive-early-career-research-program-funding
- http://www.ou.edu/mcee/MCEE_News/Misra_DOE_Award

Website: http://www.ou.edu/mcee/mpge/people/misra
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