

INSTRUCTOR BIO

Data-Driven Methods for Petroleum Engineering and Geosciences

Sid Misra

Associate Professor, Texas A&M University

Dr. Siddharth Misra is an Associate Professor in the Harold Vance Department of Petroleum Engineering at Texas A&M University, College Station. Dr. Misra recently published a book titled “Machine Learning for Subsurface Characterization” and has more than 55 publications in peer-reviewed journals and as part of the conference proceedings. In 2015, he graduated with a Ph.D. in Petroleum Engineering from the University of Texas at Austin. From 2015 to 2019, he was an Assistant Professor at the University of Oklahoma. 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. 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 Funding
- American Chemical Society New Investigator Award with 2-Year Research Funding
- SPE Mid-Continent Formation Evaluation Award



Recent Book

Machine Learning for Subsurface Characterization

<https://www.elsevier.com/books/machine-learning-for-subsurface-characterization/misra/978-0-12-817736-5>

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

Google Scholar: <https://scholar.google.com/citations?user=aWt67tcAAAAJ&hl=en>

COURSE DESCRIPTION

Data-Driven Methods for Petroleum Engineering and Geosciences

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Background

This course will provide working knowledge about common machine learning techniques and data-driven methods suitable for engineers and geoscientists. Emphasis will be on the use of supervised learning, classification, clustering, regression, transformations, and neural networks using open-source Python 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 simple case studies on the use of machine learning in oil and gas.

Learning Outcomes

1. Participants will be able to assemble open-source machine learning and data mining workflows in Python 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 regression and classification tasks.

Pre-requisites (Knowledge/Experience/Education Required)

1. Basic/Introductory computer programming in any language
2. Basic knowledge of numerical methods
3. Familiarity with basic statistics, probability, regression, interpolation, and curve fitting

AGENDA

Data-Driven Methods for Petroleum Engineering and Geosciences

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Day 1

TIME	ACTIVITY
8:00 a.m. - 9:45 a.m.	Computer Setup; Intro; ML Basics
9:45 a.m. - 10:00 a.m.	Break
10:00 a.m. - 12:00 p.m.	ML Application 101
12:00 p.m. - 1:00 p.m.	Lunch
1:00 p.m. - 2:45 p.m.	Supervised Learning – Classification; Case Study #1 – Rock Type
2:45 p.m. - 3:00 p.m.	Break
3:00 p.m. - 5:00 p.m.	Supervised Learning – Regression; Case Study #2 – Saturation

Day 2

TIME	ACTIVITY
8:00 a.m. - 9:45 a.m.	Case Study #2 – Saturation; Case Study #3 - Image
9:45 a.m. - 10:00 a.m.	Break
10:00 a.m. - 12:00 p.m.	Cross Validation; Hyper-parameter Selection; Case Study #4 – Sonic Traveltime
12:00 p.m. - 1:00 p.m.	Lunch
1:00 p.m. - 2:45 p.m.	Unsupervised Learning – Transformation; Feature Engineering
2:45 p.m. - 3:00 p.m.	Break
3:00 p.m. - 5:00 p.m.	Neural Networks