

# Machine learning for Facies (MLF)

## Introduction

The course introduces how Machine Learning (ML) is used in Facies classification and clustering along a well-bore. It will provide an understanding of the “workflows” used in ML. The used algorithms can be studied separately using references. Power-point presentations and videos will introduce various aspects of ML, but the emphasis is on computer-based exercises using open-source software (Weka, TensorFlow).

## Topics covered

The lectures and exercises deal with pre-conditioning the datasets (balancing the input classes, standardization & normalization of data) and applying several methods to classify the data: Bayes, Logistic, Multilayer Perceptron, Support Vector, Nearest Neighbour, AdaBoost, Trees. Non-linear Regression is used to predict porosity. Use will be made of an open-source package called Weka. The reason is that it is a user-friendly package with most relevant Machine learning algorithms, except truly Deep Learning. This suffices for most exploratory applications, where we like to learn the workflows and applications of Machine learning. In addition, I have included an introduction to Google Colab for the use of TensorFlow. This runs on the Cloud and allows use of a GPU. It is “the way” to learn using a whole range of open-source Machine Learning algorithms. In an exercise you will get acquainted with using interactive python notebooks, how to get algorithms using Scikit-Learn (sklearn) and if you restrain yourself from using it “in earnest” on large datasets, it is free.

## Learning methods and tools

At the end of the course participants will have a clear idea how Machine learning, being part of Artificial Intelligence will impact the future of Geosciences. This will be evident from the examples of Machine Learning discussed and applied to the case of predicting the facies along a well-bore.

## Intended Audience

All those interested in understanding the impact Machine Learning will have on the Geosciences, shown by the application on well log data. Hence, geologists, geophysicists, and engineers, involved in exploration and development of hydrocarbon or mineral resources.

## Pre-requisites

A basic understanding of Geophysics and Statistics

<b>Part 1</b>	<b>Introduction</b> 1. Biography	<b>Presentation</b> 2. ML Intro 3. Moodle 4. Weka	<b>Presentation</b> 5. Classification 6. Supervised	<b>Exercise</b> 7. Ex_Classification	
	<b>Video</b> 8. ML & Serendipity	<b>Exercise</b> 9. Ex_Attribute Filters	<b>Exercise</b> 10. Ex_Attribute Selection		
<b>Part 2</b>	<b>Presentation</b> 1. Clustering 2. Artificial NN	<b>Presentation</b> 3. Semi-supervised 4. Regression	<b>Presentation</b> 5. Ensemble	<b>Presentation</b> 6. Deep NN	
	<b>Exercise</b> 7. Ex_Clustering	<b>Exercise</b> 8. Ex_Regression	<b>Exercise</b> 9. Ex_Ensemble		<b>Quiz</b> Quiz 1
<b>Part 3</b>	<b>Presentation</b> 1. Over & underfitting	<b>Presentation</b> 2. Forward, Backward	<b>Presentation</b> 3. Activation Functions	<b>Presentation</b> 4. SVM	
	<b>Exercise</b> 5. Ex_Hyper parameters	<b>Exercise</b> 6. Ex_Comparing Algorithms	<b>Exercise</b> 7. Ex_ML Models		
<b>Part 4</b>	<b>Presentation</b> 1. Future ML in Geophysics 2. Boolean Logics	<b>Presentation</b> 3. Assist Acq & Proc	<b>Presentation</b> 4. Ex_KnowledgeFlow	<b>Demo</b> 4. Google Colab	
	<b>Exercise</b> 5. Ex_SVM	<b>Exercise</b> 6. Ex_Randomness	<b>Video</b> 7. Inv vs ML	<b>Exercise</b> 8. OneWell	<b>Quiz</b> Quiz 2
<b>Part 5</b>	<b>Project: Clustering &amp; Classification</b>			<b>Q&amp;A</b>	