BeicipFranlab
An IFP group company

Internship in Reservoir Engineering and Machine Learning

Summary

- **Length**: 4 to 6 months
- **Location**: 232 Avenue Napoléon Bonaparte, Rueil-Malmaison, 92500, France
- **Reference**: RP-2021-04
- **Starting Date**: March-December 2021
- **Internship paid and compliant with school conventions**

Job Overview

Title of the Internship:
Application of Artificial Neural Network (ANN) as a Surrogate Reservoir Model (SRM)

Intern profile:
Final year student enrolled in a master's degree program with an oil reservoir engineering or applied data science option. A strong taste for programming in Python or R languages and for Machine Learning techniques is required. A good understanding and intuition to represent physical phenomena is needed if the intern has not specifically studied reservoir engineering.

Objectives:
To understand and predict the physical behavior of an oil field, reservoir engineers commonly use numerical simulations models that solve the equations of thermodynamics fluid flow in porous media. These models are based on a cellular grid representing the subsurface geometry of the field and are associated to extensive computational times.

One recent application of Machine Learning techniques aims at building proxy models (SRM) as a substitution or complement to a gridded simulation model. If well calibrated, SRM can yield accurate results in much shorter times as compare to the classical models, enabling the engineers to investigate many more scenarios. Beicip-Franlab initiated in 2020 a first step to build an ANN that reproduces well-wise results of a relatively simple numerical reservoir model: from a reasonable number of numerical simulations covering various combination of (geological) uncertain parameters, an ANN was successfully calibrated to reproduce the simulated well-wise pressure.

The objective of the proposed internship is to further build upon this step and eventually help answer the two following issues:

- What architecture of ANN is relevant to reproduce well-wise results from a classical gridded reservoir model?
- How the trained ANN can be used to faster the history-matching step of the gridded model ?

Main tasks undertaken during the internship:

- Literature review on ANN application to replicate numerical physical models and review of the available work performed in 2020 (R language)
- Application of various architectures of ANN to reproduce well-wise variables simulated from an existing numerical reservoir model on a relatively simple case
- Optimization of uncertain parameters to history-match the ANN-based model and consequently the gridded numerical model
- Application of ANN-based model on more complex numerical reservoir models
- Redaction of a technical note summarizing the best practices to guide the choice of ANN architecture when building a SRM
- Participation to other (shorter) Machine Learning tasks, if any and if deemed relevant

The internship will be supervised by a senior reservoir engineer.

Software used

- Python and/or R
- PumaFlow (numerical reservoir simulator from IFPEN)

Email to **erwan.perfetti@beicip.com / sebastien.charonnat@beicip.com**
Reference: **RP-2021-04**