Post-Doc Position

Reservoir Surrogate Modeling with Knowledge-based Graph Neural Networks

Supervisors:
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What? We are offering a post-doc position for a data scientist to work on reservoir surrogate modeling using Physical-Informed Neutral Networks (PINNS), and Graph Neural Networks (GNN).

Where? This funded position will be mainly located at SCAI (Sorbonne Center of Artificial Intelligence), Abu Dhabi, United Arab Emirates.

Why? The candidate will work on hot topics (PINNs, GNNs, etc.) applied to real-world use case (geoscience) and will interact with research scientists from SCAI (Sorbonne center for Artificial Intelligence) and Geoscientists from TotalEnergies. A competitive salary will be provided.

When? This is a 1.5 year position, starting from 1 October 2024. The deadline to apply is 15 August 2024.

Interested? Read the requirements below and send your application including:

1) a CV,
2) a cover letter,
3) PhD diploma,
4) and one representative publication related to the position

to abdenour.hadid@sorbonne.ae and Daniel.busby@totalenergies.com

Requirements

- PhD degree in Geoscience, Computer Science or equivalent
- Excellent programing skills especially in Python
- Fluent written and speaking English.
- Good knowledge of Machine and Deep Learning
- Previous experience with TotalEnergies and their programming environment
- Good publication track and experience in disseminating research results.

Work description:

Reservoir modeling is crucial in geoscience applications such as prediction of oil production and well control optimization. Existing methods e.g. based on CNN (Convolutional Neural Networks), GNN (Graph Neural Networks) or PINNs (Physics-Informed Neural Networks) showed promising results in well placement and forecasting key reservoir properties such as pressure and saturation.
However, such methods tend to suffer in accurately predicting reservoir dynamics from few samples, generalizing to unseen realizations or handling discontinuities in reservoir data emerging from geological heterogeneities or temporal variations in well controls. Combining GNNs and PINNs could offer appealing solutions.

The project aims to explore advanced machine learning methods in reservoir modeling and improving the accuracy of forecasting key reservoir properties such as pressure and saturation. The idea is to develop new methods and compare the results against existing models based on GNN and PINNS on real-world data from our industrial partners. Application to real-world data using state-of-the-art workflows for reservoir history-matching (large dimensional inverse problem) or well placement optimization is forsaken.

References:

Abdenour Hadid, Tanujit Chakraborty, and Daniel Busby. **When Geoscience Meets Generative AI and Large Language Models: Foundations, Trends, and Future Challenges**, 2024 https://arxiv.org/pdf/2402.03349.pdf

Zakaria Elabid, Daniel Busby, Abdenour Hadid, **Knowledge-based convolutional neural network for the simulation and prediction of two-phase darcy flows,** 2024 IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2024, https://ieeexplore.ieee.org/document/10448415