

## Workshop#3

**Mr. Roozbeh Koochak, Dr. Ali Nadian Ghomsheh**

### **Generating complex geological realizations of Petroleum reservoirs using Generative Adversarial Networks**

Geological or reservoir modelling is an intricate task requiring multiple sources of information to be combined. The modelling process usually involves the characterization of reservoir properties in extended areas using hard data from few locations. However, these models can never fully describe the reservoir since some properties of the geological system will be unknown or uncertain. Understanding uncertainty in reservoir models usually involves generating multiple realizations of the geological model that are both geologically sound and statistically faithful. Current methods used for generating geological realizations are stochastic simulation methods and/or Multiple-point statistic methods. Recently generative models have shown great potential and success in developing geological realizations while maintaining statistical features. In this workshop, we begin by a review of the history of the current methods, and we investigate their pros and cons. Next, Generative Adversarial Networks (GAN) are presented along with the application of GANs in generating realizations of a synthetic binary channelized fluvial deposition system. Finally, Mode collapse in GANs and its effect on spatial bias in the results is discussed.

#### **Content:**

1. History of geostatistical methods in petroleum applications and their limitations (15 mins)
2. Conditioning to hard data and inversion of geo-models (15 mins)
3. GAN applications in generating geological realizations (20 mins)
4. Introduction to generative models (15 mins)
5. Review of Generative Adversarial Models (15 mins)
6. Implementation of GANs using TensorFlow libraries (20 mins)
7. Controlling mode collapse in GANs and its applications to Generating complex geological realizations of Petroleum reservoirs (20 mins)

Roozbeh Koochak is an experienced reservoir engineer with over 14 years of experience in upstream oil and gas industries. He joined China national logging corp. in 2006 and later Baker Hughes as senior engineer in 2012. During this period he has held assignments in the Middle East, Australia, China, and managed field operations. He is currently a PhD Candidate in Petroleum Engineering at The University of Adelaide, working on adapting Machine learning methods to subsurface application. Roozbeh has a Bachelor of Electronics Engineering from Shahid Chamran University of Ahvaz. His research interests are Reservoir modelling and simulation, Petrophysics, Uncertainty analysis, Production optimization and History matching.



Ali Nadian-Ghomsheh received the BS degree from Shahid Chamran University in 2005, MSc degree from Shahid Beheshti University Iran in 2007, and later the Ph.D. degree from the same university in 2012. He is currently an assistant prof. in the department of Cyber Space research inst. At Shahid Beheshti University. His current research interests include assistive technologies, vision based human centric systems, and virtual reality.



Skyroom Link: <https://www.skyroom.online/ch/mvip2022/workshop>

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1PM-3PM {22 February 2022 (3th of Esfand 1400)}