Yeongju Kim

Postdoctoral Researcher

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SUMMARY

Postdoctoral researcher with hands-on experience in reservoir simulation, numerical modeling, and the integration of machine learning into traditional simulation workflows. Proficient in surrogate modeling, data assimilation, and optimization, with strong coding skills in Python and MATLAB.
Self-motivated and detail-oriented, with a strong interest in interdisciplinary R&D and computational innovation. Eager to contribute to advanced reservoir modeling and data-driven decision-making in subsurface energy applications.

EXPERIENCE

Summer Intern

SLB

2025 Seoul, South Korea

- Development of a chemical reaction database and modeling of CO2 mineralization in basalt formations using IX and PETREL.

Visiting Researcher

MCERI, Texas A&M University

2023 - 2024 College Station, United States

- Integration of Diffusive Time of Flight into a U-Net-based surrogate model for dynamic spatial prediction, resulting in ~80% reduction in simulation cost.
- Achievement of R2 > 0.9 in predicting CO2 saturation and pressure distributions using the surrogate model on the SPE 11C benchmark model.

Researcher

Energy Holdings Group

2022 Seoul, South Korea

- Development of GeoInsight, a web-based visualization platform for asset evaluation in shale basins using Spotfire.

Spring Intern

Codesign and Parallel Processing Lab., Seoul National Univeristy

2018 Seoul, South Korea

- Design of a DL-based region proposal module for small object detection in large images (2048×2048×3).

EDUCATION

Ph.D., Petroleum Engineering

Seoul National University

2019 - 2025

B.S., Computer Science and Engineering

Seoul National University

2014 - 2019

B.S., Energy Resources Engineering

Seoul National University

2014 - 2019

GRANTS

Design of velocity string to revive a deviated well in a Myanmar offshore gas field

POSCO International

2025 - Present

- Sensitivity analysis of velocity string design parameters (size, installation depth, and production strategy) using PIPESIM to prevent liquid loading and erosion throughout the entire production lifecycle (early to late stage, 12yrs).
- Optimization of velocity string design to maximize gas recovery and ensure reliable restart capability following any shut-in events.

GRANTS

Evaluation of short- and long-term coupled properties of rock under disposal conditions at depth

Korea Atomic Energy Research Institute (KAERI)

2021 - Present

- Inversion of hydraulic and mechanical model parameters for buffer material using laboratory swelling test data.
- Development of a numerical model for swelling tests using COMSOL and parameter inversion using a genetic algorithm in MATLAB.
- Long-term safety assessment of the KRS+ disposal system through field-scale simulation in TOUGH-FLAC, including evaluation of water saturation, temperature, and stress distribution based on identified parameters.

Development and commercialization of an intelligent evaluation system for big data of natural gas fields in the North America

Energy Holdings Group

2021 - 2025

- Development of GeoInsight, a web-based visualization platform for asset evaluation in shale basins using Spotfire.
- Design of interactive dashboards for intuitive visualization of static and dynamic data from 12 shale basins in North America.
- Visualization of spatial value maps using EUR predictions from random forest models and time-series forecasts based on early production data.
- LSTM-based forecasting of EUR and future production in six shale basins (Delaware, Midland, Central, etc.).
- Integration of a refracturing detection system into the LSTM model to enhance prediction accuracy using automatically identified refracturing events.

Technology development for ensuring safety of CO2 geological storage

Korea Institute of Geoscience and Mineral Resources (KIGAM)

2022 - 2024

- Assessment of potential halite precipitation and hydrate formation in the East Sea gas field using CMG-GEM.
- Evaluation of porosity and permeability reduction due to halite precipitation, with consideration of uncertainties in reservoir parameters and operational conditions.
- Sensitivity analysis of operating conditions and wellhead equipment to identify configurations that prevent hydrate formation by minimizing cooling effects.

Optimization of horizontal well length in a Myanmar offshore gas field

POSCO International

2020 - 2020

- Pipeline modeling of a horizontal well using field data with PIPESIM and OLGA.
- Evaluation of sand production potential and associated erosional risk.
- Optimization of completion length by balancing erosional risk and cost under uncertainty in reservoir parameters (sand production rate, kv/kh ratio, and skin factor).
- Review of flow assurance issues (slug flow and sand accumulation) under varying water-gas ratios and sand production rates.

The development of evaluating technology based on machine learning for production stability in shale gas well EGR+

Korea Institute of Geoscience and Mineral Resources (KIGAM)

2020 - 2023

- Construction of ML models for rapid prediction of well responses and flow assurance in CO2 EGR operations, using CMG-GEM and OLGA.
- Prediction of production rates and mole fractions from operating conditions (injection period, soaking period, production period, and injection rate).
- Estimation of erosion/corrosion risks using production data (CO2 mole fraction, water mass fraction, and production mass rate).
- Optimization of the CO2 Huff-n-Puff process using the ML models to maximize gas production while accounting for erosion/corrosion risks.

Prediction of sucker rod pump failure and optimization of pump operation

SK E&P Operations America

2020 - 2020

- Proposal of a novel indicator for detecting pump failures using load data measured on the polished rod.
- Optimization of indicator parameters using PSO to improve predictive accuracy.
- Development of a CNN-based DL model for classifying pump anomalies from pump card data.
- Proposal of a fillage-based control framework to identify overpumping and underpumping in rod pumps, enabling long-term pump speed optimization for stable and cost-effective production.
- Deployment of Python-based real-time monitoring software in a North American shale oil field (Plymouth, Nemaha).

GRANTS

Optimization of well operation in a carbonate reservoir using stochastic gradients

Korea Institute of Geoscience and Mineral Resources (KIGAM)

2019 - 2019

- Optimization of well operating conditions to maximize NPV in a conventional carbonate reservoir in the UAE.
- Application of the StoSAG method to efficiently compute gradients and optimize operating conditions.
- Achievement of a 10% increase in NPV by reducing water injection and production costs compared to initial operating conditions.

PEER-REVIEWED PUBLICATIONS

Estimation of CO2 storage capacities in saline aquifers using material balance considering CO2 dissolution trapping

Fuel

2025 https://doi.org/10.1016/j.fuel.2025.136143

Enhanced material balance method for CO2 storage capacity estimation incorporating dissolution trapping, with <3.5% relative error on the Sleipner L9 model.

Learning-based pattern-data-driven forecast approach for predicting future well responses

Journal of Petroleum Exploration and Production Technology

2025 https://doi.org/10.1007/s13202-025-01937-5

Python package for future well response prediction using PCA and a feedforward neural network.

Estimation of CO2 storage capacities in saline aquifers using material balance

Fuel

2024 https://doi.org/10.1016/j.fuel.2024.132411

Prediction of liquid surge volumes and flow rates for gas wells using machine learning

Journal of Natural Gas Science and Engineering

2022 https://doi.org/10.1016/j.jngse.2022.104802

ML model for predicting flow rates, liquid surges, and downhole pressures under various wellhead choke conditions, validated on the Horn River and Rakhine Basin gas fields.

Efficient deep-learning-based history matching for fluvial channel reservoirs

Journal of Petroleum Science and Engineering

2021 https://doi.org/10.1016/j.petrol.2021.109247

DL-based history matching framework for posterior reservoir model generation with geological realism preservation.

Optimization of well operations in a carbonate reservoir using stochastic simplex approximate gradient

Journal of the Korean Society of Mineral and Energy Resources Engineers

2019 https://doi.org/10.32390/ksmer.2021.58.2.119

Optimization of well operating conditions in a carbonate reservoir using StoSAG, with a 10% increase in NPV.

CONFERENCE PRESENTATIONS

Rapid simulation for dynamic spatial data using U-Net and diffusive time of flight

EAGE

2025 Toulouse, France

Inversion of the Barcelona Basic Model parameters for thermo-hydro-mechanical simulation of high-level radioactive waste disposal system

International Geological Congress

2024 Busan, South Korea

Novel learning-based pattern-data-driven forecast approach for predicting future well response

InterPore

2023 Qingdao, China

Building a fracture network model from Utah FORGE microseismic data from hydraulic stimulation

Asia-Pacific Forum on Renewable Energy

2023 Jeju, South Korea

CONFERENCE PRESENTATIONS

Machine-learning-based robust optimization of brine extraction well placement in CCS projects using Fast Marching Method

InterPore

2021 Online

Development of a python package for predicting reservoir performance using machine learning

IAMG

2019 State College, United States

PATENTS

Method and system for predicting failures of sucker rod pumps using scaled load ratios

Publication number: US11898552B2 (USA)

Method and system for predicting rod pump failure using scaled load ratio

Application number: CN115935527A (China)

AWARDS

Third Prize, SPE Geothermal datathon (SPE)

Identification of optimal production well location through microseismic event clustering and fracture plane fitting using MSAC with geological priors, followed by finding optimal well spacing via GeoDT to maximize total power generation.

Grand Prize, Utilization of Geological Data and AI contest (KIGAM)

Prediction of eight undesirable offshore well events using an ML model trained on Petrobras's 3W dataset, with improved accuracy through the integration of a novel flow pattern representation feature.

Third Prize, Utilization of Geological Data and AI contest (KIGAM)

Imputation of DTS logs in the Volve field using 1D ConvLSTM trained on 14 well logs from five boreholes, with enhanced accuracy achieved through the integration of petrophysical interpretation.

Korea Geophysical and Physical Exploration Association Award, Mine-Tech Festa (KOMIR)

Identification of copper prospective zones in the Gawler Craton, South Australia, using a CNN-based ML model trained on geophysical, geochemical, and historical copper deposit data.

TECHNICAL SKILLS

Open-source reservoir simulators

OPM **MRST**

Commercial simulators

Intersect **E100/300** **PETREL** **PIPESIM** **OLGA** **IMEX** **GEM** **STARS** **WINPROP** **CMOST**

Programming Languages

Python **MATLAB** **C/C++**

LANGUAGES

English Proficient **Korean** Native **Japanese** Beginner

CERTIFICATION

1. CCS Simulation (SLB)

2. MEPO Uncertainty and Optimization Fundamentals (SLB)

3. Modelling of Shale, Tight Oil and Gas Reservoirs (CMG)

4. CO2 sequestration and GeoMechanics using GEM (CMG)

5. Introduction CMG Workflow & Modelling of Natural Fracture Reservoir (CMG)