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GPOP: Multivariate time series forecasting in binary cycle geothermal power plants

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ABSTRACT:

Future power outputs of geothermal power plants are not trivial to forecast. Declining flow rates, reservoir cooling, scaling buildup in pipelines, operational changes, environmental factors are all factors that govern production efficiency of geothermal power plants.

GPOP is a web-based tool, built as a proof-of-concept and as a showcase of ML (Machine Learning) use cases in renewable energy sector: Developed with the intention to assist engineers and decision makers in predicting future behavior of power generation in binary cycle geothermal systems. We explored Tree based ML architectures, combined with time series methodologies to get accurate short-term and long-term prediction results. Short-term forecast pipeline ingests feature windows of 24 hours to get “Next day” production shapes that are essentially multivariate, multi-step predictions; Long-term forecast pipeline uses a simpler XGBoost regression model that optionally ingests extrapolated features as inputs to simulate long-term production. The latter includes tweakable feature exptrapolations intended for testing “What if” scenarios, as well as dynamic make-up well simulations that follow extrapolation parameters.

The project files include a Streamlit web application, experimental scripts and experiment results as well as training and inference logic along with an inference-ready model trained on 4 years of hourly sensor readings from an operational ORC geothermal plant in Türkiye.