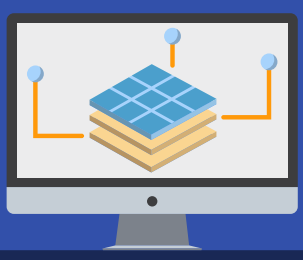
Evaluating Data-Driven Site Characterization Methods for Subsurface Modeling through Benchmarking

Data-driven site characterization (DDSC) methods generate three-dimensional digital models of subsurface environments

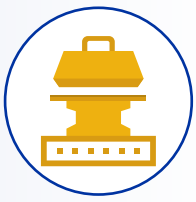
These digital models can assist geotechnical engineers in making informed decisions for planning and executing engineering projects



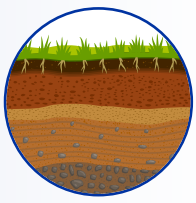
- **The purpose of benchmarking is well known in the machine learning community**
- **It is to play a competitive "contest" with clear rules so that different algorithms can compete to see which one is "better"**

Papers in a new ASCE Special Collection assess the performance of DDSC techniques using standard benchmarks

"Contest" tasks



Identify soil type distribution (or soil layer distribution)



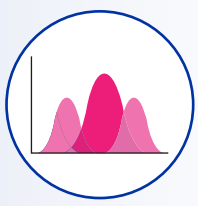
Estimate soil property in each soil layer (e.g., estimate soil strength or compressibility in each soil layer)

The rule of the game is to use a fixed set of data and then use the trained algorithm to predict a fixed set of answers

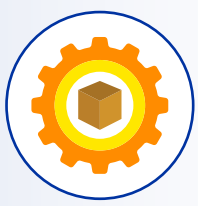
✓ Accuracy is defined by a fixed set of performance metrics

Performance metrics

Accuracy
Closeness of the model's predictions to the actual values



Uncertainty
Degree of variability in the model's predictions



Robustness
Capacity to maintain desirable performance

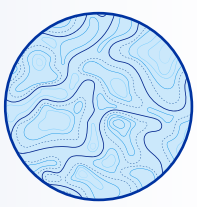
Computational efficiency
Speed and resource requirements

✓ Benchmarking offers a systematic way to evaluate the performance of DDSC methods

Capabilities of DDSC methods

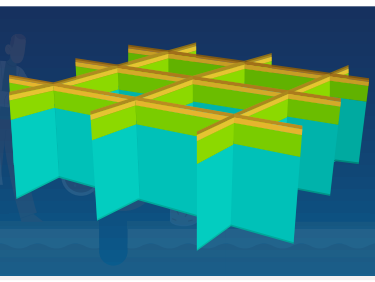
Generates high-resolution 3D random field samples from sparse measurements

Estimates cone penetration test parameters and their interdependencies from uncertain data



Captures spatial variability of geological data across the site

✓ DDSC fills in the gaps and provides valuable information about the subsurface environment



Benchmarking provides insights into the real-world applicability and performance of DDSC methods for modeling the subsurface

Special Collection on Benchmarking Data-Driven Site Characterization
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