



Energy A.I. 2025 5th Annual Hackathon Introduction

Dr. Michael Pyrcz and Dr. John Foster
Energy A.I. 2021-2024 Hackathon Hosts
Hildebrand Department of Petroleum and Geosystems Engineering

Dr. Matt Balhoff
Sponsor and Advisor
Chair of the Hildebrand Department of Petroleum and Geosystems Engineering

Ahmed Merzoug and Elnara Rustamzade
Hackathon Architects and Mentors, Graduate students in PGE

Rowan Halliday, Heba Abdel-Rahim, Gabby Banales, Jaime Haider and Stacia Miller
Coordinators of Chaos



Appreciation

Appreciation to the student participants, the hackers!

Thank you for your enthusiasm!



None of this would be possible without our sponsors. Thank you for supporting Energy Data Science Education!

Thank You to Our Sponsors

Platinum



Silver



Bronze





Who's Running this Show?

Professor Michael Pyrcz (aka GeostatsGuy)
Hackathon Host



Michael Pyrcz
@GeostatsGuy

Assoc. #Prof @UTAustin @CockrellSchool @txgeosciences @daytum_io |
#geostatistics #DataAnalytics #DataScience #MachineLearning #author #dad
#github #YouTube



John Foster
@johntfoster



Professor John T. Foster
Hackathon Host



Ahmed Merzoug, PhD Candidate PGE
Hackathon Architect



Elnara Rustamzade, PhD Candidate PGE
Hackathon Architect, Volunteer



Appreciation

Rowan Halliday
Coordination



Stacia Miller
Communication, Promotion,
Photography



Jaime Haider
Organizing, Student Engagement

Professor Matt Balhoff
PGE Chair
Strong support and engagement



Heba Abdel-Rahim
Business Development, Student Support



Gabby Banales
Organizing, Student Engagement





Welcome Message



Professor Matt Balhoff
Chair of the Hildebrand Department of Petroleum and Geosystems Engineering



Petroleum / Mining / Spatial Engineering and Science Leadership in the Fourth Paradigm

'We are the original data-driven science, we have been big data long before tech learned about big data!'

1930-1940s

1950-1960s

1980-1990s

>1990s

Probability and
Stationarity
Kolmogorov

Volume
Variance in
Mining
Kriging

Geostatistics
Mathematical
Morphology
Matheron

Applications in Oil
and Gas,
Environmental
Journal, Verly, Deutsch

Spatial Statistics, Big
Data Analytics and
Machine Learning

'Complicated, heterogeneous, sparsely sampled, vast systems with complicated physics and high value decisions.'



What is a Hackathon?

'an event in which a large number of people meet to engage in collaborative computer programming.'

Dictionary.com

'The goal of a hackathon is to create functioning software or hardware by the end of the event'

Wikipedia



Mentors

Anahita Pourjabbar
Alena Grechishnikova
Eduardo Maldonado-
Cruz
Jose Salazar
Julio De La Colina
Reece Wooten
Sarah McDonnell
Shane Prochnow
Tao Sun



Tyrel Krohn
Vrishank Jannu



Eric Qian



Travis Salomaki



Sercan Gul



Jesus Ochoa



Marcelo Jimenez

Amy Rueve



Ricardo Lara Orozco



Charles (Cheolkyun) Jeong



Judges

Jeff Stewart

Vice President
Engineering



Philip T Mantaring

HR Advisor, Academic and
Technical Programs



Andy Flowers

Manager, Enterprise AI



David Schuab

Senior AI Engineer



Susan Howe

President



Hector Martinez

Data Analytics Supervisor





Who is Here to Build? Longhorns from all over the 40 acres!

Teams, from UT Austin Cockrell, Jackson, Natural Sciences, McCombs, Liberal Arts, etc.

Including:

TBD

TBD

Petroleum and Geosystems Engineering, Operations Research, Mechanical Engineering, Geological Sciences, Materials Science Engineering, Electrical and Computer Engineering, Data Science, Computer Science, Aerospace Engineering, Mathematics, McCombs, Math, Physics, Economics, Neuroscience,



The Hackathon Rules

Submit to GitHub by 12:00 noon, January 21st:

1. Well-documented Python workflow in a Jupyter Notebook. **See template in resources folder.**
2. Results as a .csv DataFrame ESPs (fail in 30 days = 1, otherwise = 0).
Named: solution.csv, **use the file in data folder.**
3. Short presentation with executive summary, goals workflow choices and defense, results and discussion. **Novel data analytics and data viz!**
Every team member participates in the presentation. **Use template in resources.**

Participation: All team members contribute to the above products. There are various roles! Participate in sessions.

Coding: Use only open source and methods / workflows developed during the hackathon. Provide code for testing and scoring. All code submitted in Jupyter Notebook. **Readable code!**



The Hackathon Rules

Our academic staff have volunteered to assist over the weekend.

- **Please let them know that we appreciate. Please treat them with great respect.**
- **Let's all do house keeping, clean up and disposal of recycling and waste in your work area and general areas, as we go. Take out the trash.**
- **Share contacts within your team in case you get locked out. PGE student can open external door if locked.**



The Hackathon Rules

Participate in the Scheduled Workshops and Working Sessions

Treat All other Hackers, Hosts, Mentors, Judges, Coordinators with the utmost respect.

Use code from others, but cite all code used from other sources in your workflows and presentations, e.g. figure captions.

Pyrcz, M.J. (2020) GeostatsPy 0.0.19 [Source code]. <https://github.com/GeostatsGuy/GeostatsPy>

Foster, J.T., (2015) 1DPDpy 1.0 [source code]. <http://dx.doi.org/10.5281/zenodo.15795>

Work Hard, Learn and Have Fun!



The Hackathon Rules

The data has been sanitized. Do not attempt to hack the source!

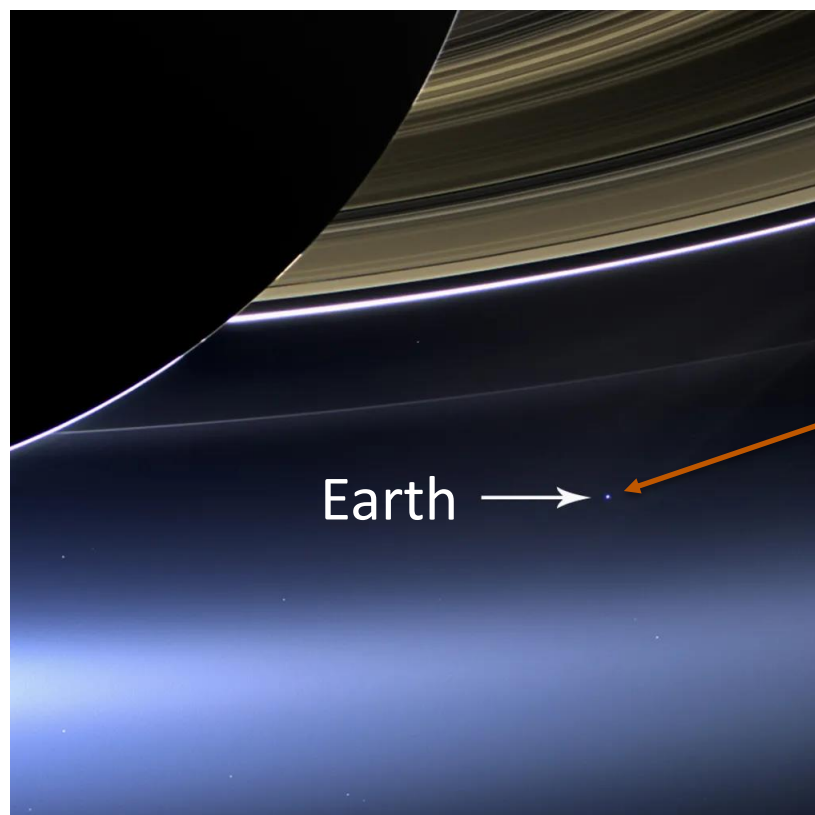
But, here's a hint...



The Hackathon Rules

The data has been sanitized. Do not attempt to hack the source!

We can provide the following general location of the data set.



Our problem

Earth →



Hackathon Team Scoring

Results: 75% - Results, Results, Results!

- Average of rank transform of accuracy error measure and uncertainty model goodness over all groups.

Presentation: 20% - and We Must Be Able to Communicate Our Work!

- Executive summary, project goals, workflow description, results and discussion, **novel data analytics, and data and model viz**, finish on time

Workflow: 5% - Others Must Understand our Work for Adoption!

- Scoring metrics: readable code, efficient code, documentation of steps

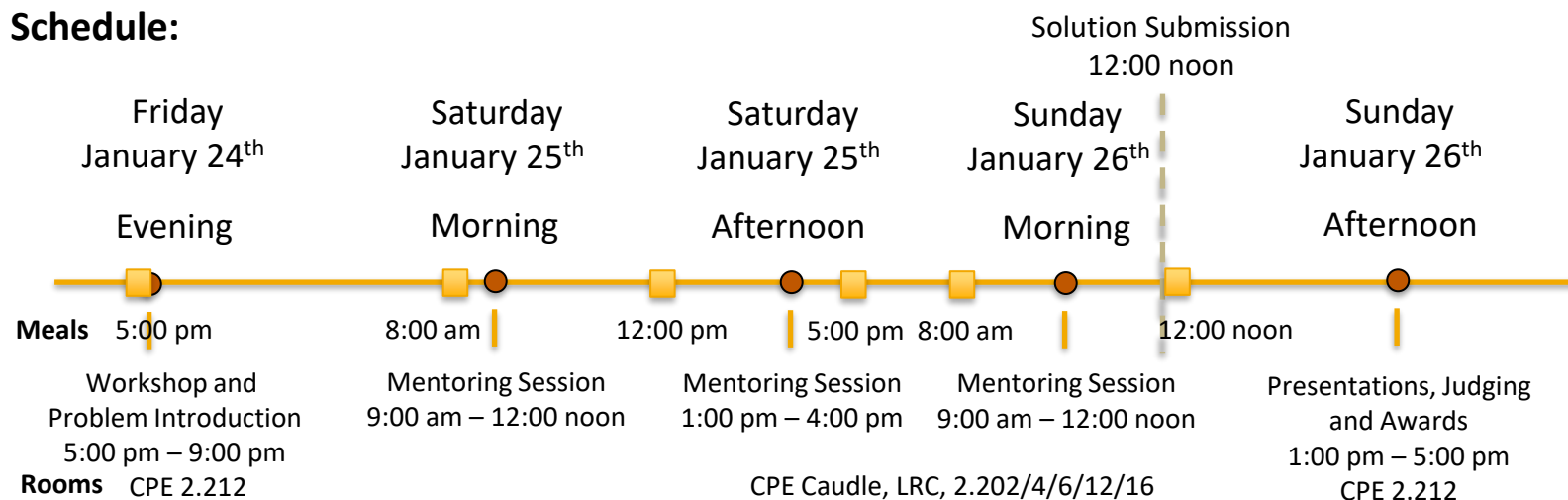
Use the provided templates for results, workflow and presentation. Follow the submission guidelines and submit on time.



The Plan at 30,000 ft



Schedule:



Enhance Learning



Promote collaboration & data-driven science



Inspire Innovation

Teams:

Register teams of 3-4, which can include students from other departments and schools (UT EID required), but one student must be a UT PGE student and one 1 undergraduate student per team (could be the same student).

Awards:

Winners of the A.I. Hackathon will be awarded bragging rights and \$5,000 for first place, \$2,500 for second place, \$1,000 for third place and \$500 for fourth place teams.



The Plan for Today's Workshop

DAY 1 / Jan. 24th - Energy A.I. Hackathon 2025 Workshop Schedule

5 pm – 5:15 pm: Hackathon Welcome, Introduction and Review Plan and Rules, Prof. Balhoff / Prof. Pyrcz

5:15-6:30 pm: Essential Energy Data Science, Numpy, Pandas, Git - Prof. Foster

6:30 – 7:00 pm: Feature Importance, Engineering and Selection, Multivariate Analysis and Shapley Values
Prof. Pyrcz

7:00 – 7:30 pm: Uncertainty Models – Prof. Pyrcz

7:30 – 8:00 pm: Machine Learning Basics, Train and Tune Overview of Methods - Prof. Pyrcz

8:00 – 8:30 pm: Machine Learning in Python, scikit-learn and TensorFlow Packages – Prof. Foster

8:30 – 9:00 pm: Introduce the Energy A.I. Hackathon Problem and Mystery Data Set – Prof. Pyrcz / Prof. Foster

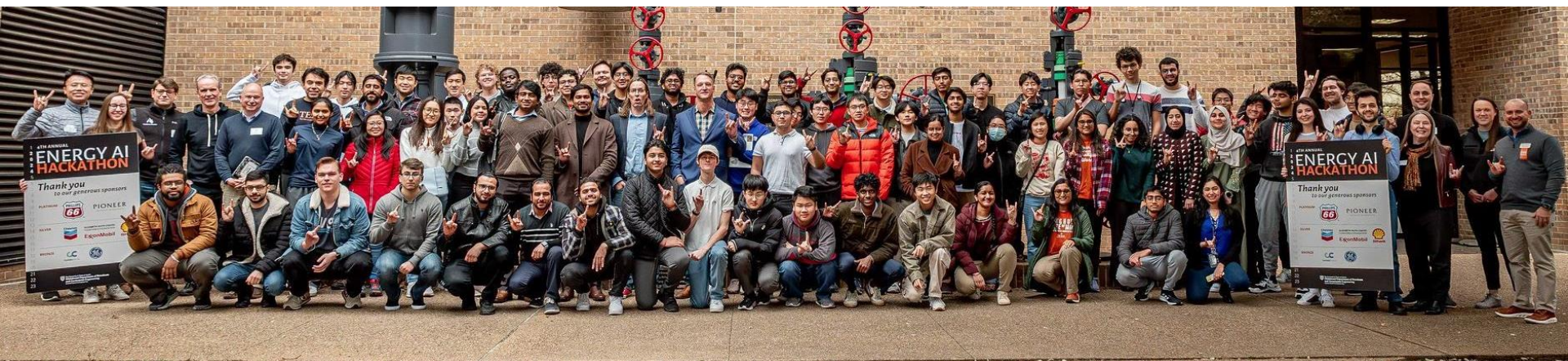
9:00 pm - : Teams Break-out for Initial Data Review and Planning



The Plan for Today's Workshop

DAY 1 / Jan. 24th - Energy A.I. Hackathon 2025 Workshop Schedule

It is a lot of work, stick with it, it will be worth it!



Hackathon Finish photo from 2024.



Top Teams from Last Year

Data Derricks, First Place

Faraz Rahman, Matthew Heichel,
Nurul Hisham, Viren Govin,
Saffat Reza



EnergPT, Second Place

Ahmed Merzoug, Erica Orona,
Lei Liu, Mohamed Awad



Don't Jump to Complexity



Deep learning generated image of Professor Pyrcz.



Deep learning generated image of Professor Foster.