



Energy A.I. 2023 3rd Annual Hackathon Introduction

Dr. Michael Pyrcz and Dr. John Foster
Energy A.I. 2021-2023 Hackathon Hosts
Hildebrand Department of Petroleum and Geosystems Engineering

Dr. Jon Olson
Sponsor and Advisor
Chair of the Hildebrand Department of Petroleum and Geosystems Engineering

Elnara Rustamzade and Ruoyu Wang
Hackathon Architects and Mentors, Graduate students in PGE

Gabby Banales, Trevor Oxley, Samatha Ribinowitz and Stacia Miller
Coordinators



Appreciation

Appreciation to the student participants, the hackers!

Thank you for your enthusiasm!



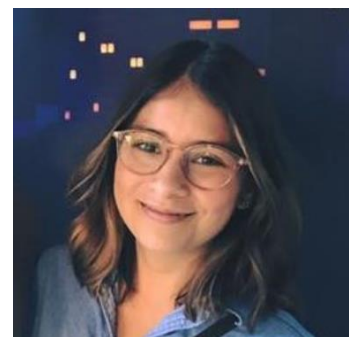
Appreciation



Gabby Banales
Organizing, Student Engagement



Professor Jon Olson
PGE Chair
Strong support and engagement



Sara Hernando
Business Development, Student Support



Trevor Oxley
Coordination



Ruoyu Wang
PhD Candidate PGE
Hackathon Architect



Samantha Robinowitz
Coordination

Elnara Rustamzade
PhD Candidate PGE
Hackathon Architect, Volunteer



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

Thank You to Our Sponsors

Underwriter

**Elizabeth Huth Coates
Charitable Foundation
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Gold



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Baker Hughes™



Welcome Message



Professor Jon Olson
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

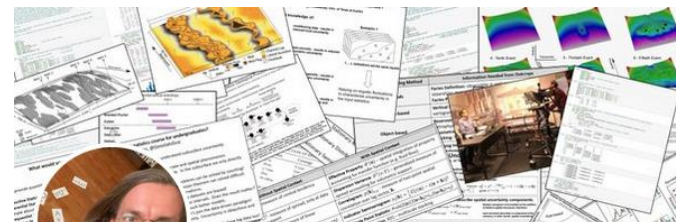
'The goal of a hackathon is to create functioning software or hardware by the end of the event'

Wikipedia



Who's Running this Show?

Professor Michael Pyrcz (aka GeostatsGuy)
Hackathon Host



Michael Pyrcz 🌻
@GeostatsGuy

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



John Foster
@johnnfoster

Associate Professor - @ut_pge, @UTAerospace, @OdenInstitute
Co-founder and CTO - @daytum_io
Views my own.

Professor John T. Foster
Hackathon Host

Elnara Rustamzade
Ph.D. Candidate PGE
Hackathon Architect, Volunteer



Elnara Rustamzade
@E_Rustamzade Follows you

University of Texas at Austin 🍷❤️



Ruoyu Wang · 2nd
Graduate Research Assistant at University of Texas at Austin
Austin, Texas, United States · [Contact info](#)

Ruoyu Wang
M.Sc. Candidate PGE
Hackathon Architect



Mentors

Eric Qian



Sercan Gul



Amy Rueve



Thatcher Thornberry



Shane Prochnow



Guillaume Dulac



Ali Downard



Alena Grechishnikova



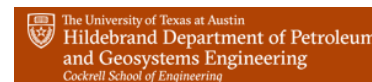
Travis Salomaki



Nkem Egboga



Alireza Haghighat



Fabien Laugier



Matthias Imhof





Judges

Matt Duke

General Manager
Geology Department
Chevron Technology



Kumar Lakshmipathi

Principal Solutions Architect



Yavuz Kadioglu

Senior Director
NAM Digital Product
Operations



Vikram Jayaram

Head of Data Science
R&D Program Managers



Doug

McMaster

VP Product





Who is Here to Build?

20 Teams, from UT Austin Cockrell, Jackson and Natural Sciences
Including:

TexasBBQ	#TheFantasticFour	Drillpy
Trevor!	Team Beta	Hack'em
Hackalopes	Hmmm	
Banana Ducks	NFL = No Free Lunch	
Anticline	The Robber Barons	
Gas	Deep Well Dynamics	
Underdogs	BevoBuccaneers	
Googly Eyes	Fractals	
Bayesian Baddies	Hack Daniels	

Petroleum and Geosystems Engineering, Operations Research, Mechanical Engineering, Geological Sciences, Materials Science Engineering, Electrical and Computer Engineering, Data Science, Computer Science, Aerospace Engineering, Mathematics,

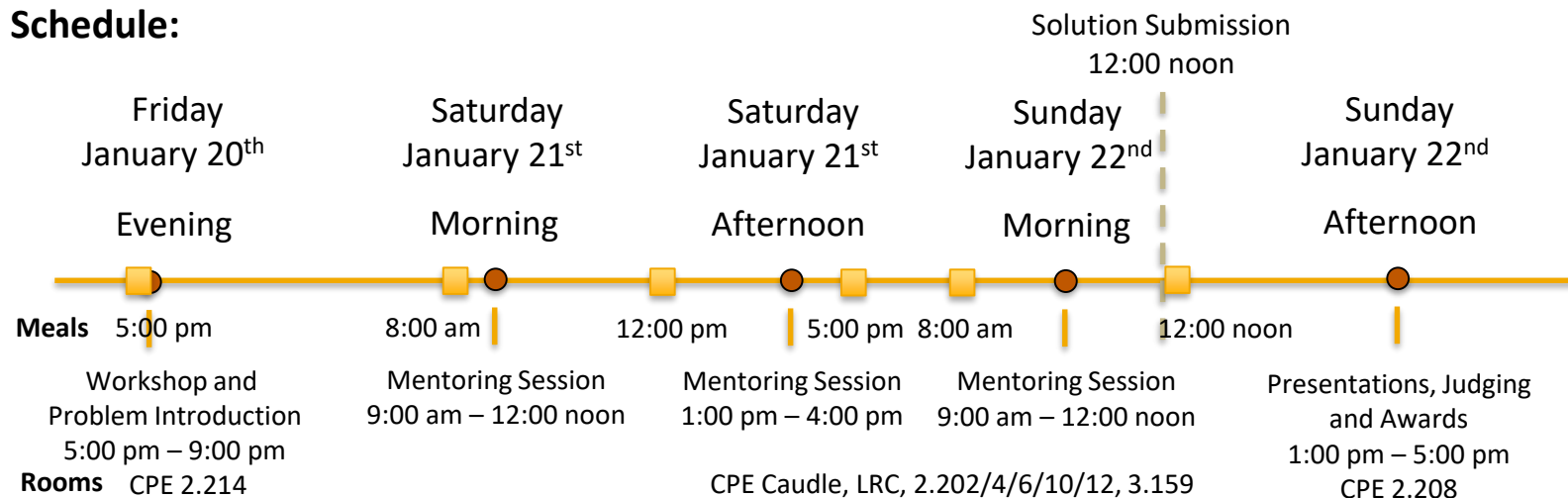


The Plan at 30,000 ft

Apply Data-driven Solutions with Data Analytics and Machine Learning



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 Hackathon Rules

Submit to GitHub by 12:00 noon, January 22nd:

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. 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.**
- **Let's all pitch in for house keeping, clean up and disposal of recycling and waste, as we go.**



The Hackathon Rules

Participate in the Scheduled Workshops and Working Sessions

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

Cite all code used from other sources in your workflows.

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!



Hackathon Team Scoring

Results: 75% - Results, Results, Results!

- **Accuracy** of 40 ESP predictions
- $\text{Score} = \frac{\text{prop}(\text{correct}) - 0.5}{0.5}$, because 50% expected by random selection!

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

- Executive summary, project goals, workflow description, results and discussion, 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 for Today's Workshop

DAY 1 / March 25th - Energy A.I. Hackathon 2022 Workshop Schedule

5 pm – 5:15 pm: Hackathon Welcome, Introduction and Review Plan and Rules, Prof. Olson / 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: Time Series Analysis, Temporal Data Analytics – 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



We are looking forward to a great event.