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!

Energy A.I. Hackathon

Hosted by PGE's Resident A.I. Experts
Dr. John Foster and **Dr. Michael Pyrcz**
@johntfoster @GeostatsGuy

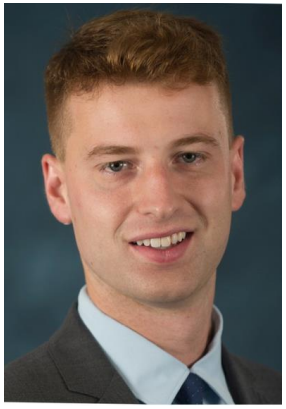
Appreciation

Professor Jon Olson
PGE Chair
Strong support and engagement

Gabby Banales
Organizing, Student Engagement

Sara Hernando
Business Development, Student Support

Elnara Rustamzade
PhD Candidate PGE
Hackathon Architect, Volunteer



Trevor Oxley
Coordination

Ruoyu Wang
PhD Candidate PGE
Hackathon Architect

Samantha Robinowitz
Coordination

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 of 1992

Gold

ComboCurve™

Silver

PIONEER NATURAL RESOURCES

Bronze

Chevron

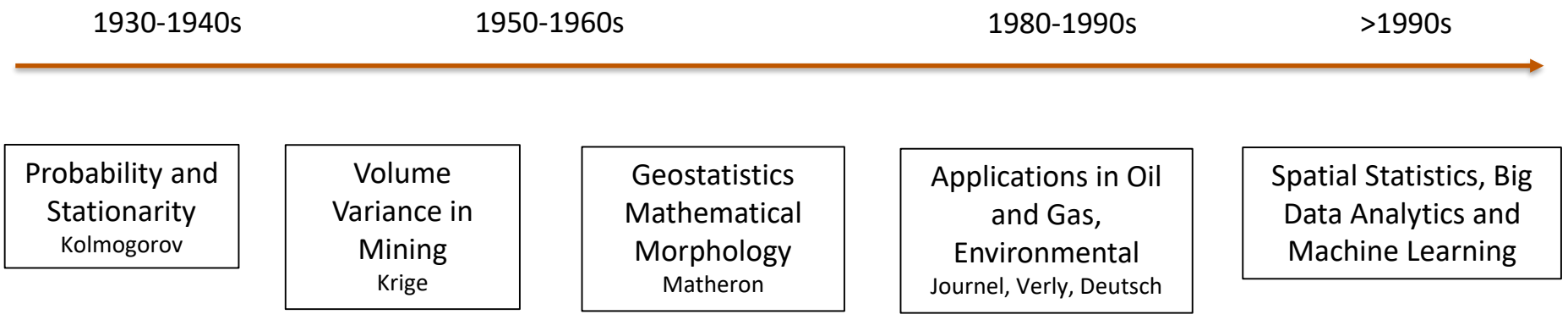
Baker Hughes

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!'



'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.'

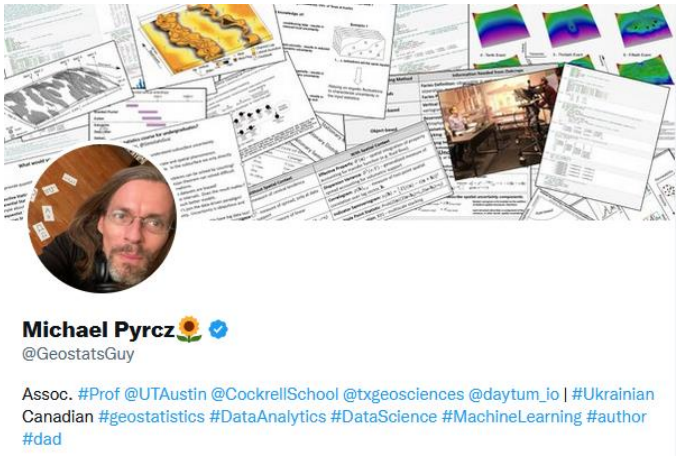
Dictionary.com

'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



Professor John T. Foster
Hackathon Host

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

Ruoyu Wang
M.Sc. Candidate PGE
Hackathon Architect

The University of Texas at Austin
Hildebrand Department of Petroleum and Geosystems Engineering
Cockrell School of Engineering

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Mentors

Eric Qian — Pioneer Natural Resources

Sercan Gul — Pioneer Natural Resources; The University of Texas at Austin, Hildebrand Department of Petroleum and Geosystems Engineering, Cockrell School of Engineering

Amy Rueve — Pioneer Natural Resources; The University of Texas at Austin, Hildebrand Department of Petroleum and Geosystems Engineering, Cockrell School of Engineering

Thatcher Thornberry — bp

Shane Prochnow — Chevron

Guillaume Dulac — Chevron

Ali Downard — Chevron

Alena Grechishnikova — Chevron

Travis Salomaki — ComboCurve

Nkem Egboga — sparkcognition; The University of Texas at Austin, Hildebrand Department of Petroleum and Geosystems Engineering, Cockrell School of Engineering

Alireza Haghighat — S&P Global

Fabien Laugier — Chevron

Matthias Imhof — ExxonMobil

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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

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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,

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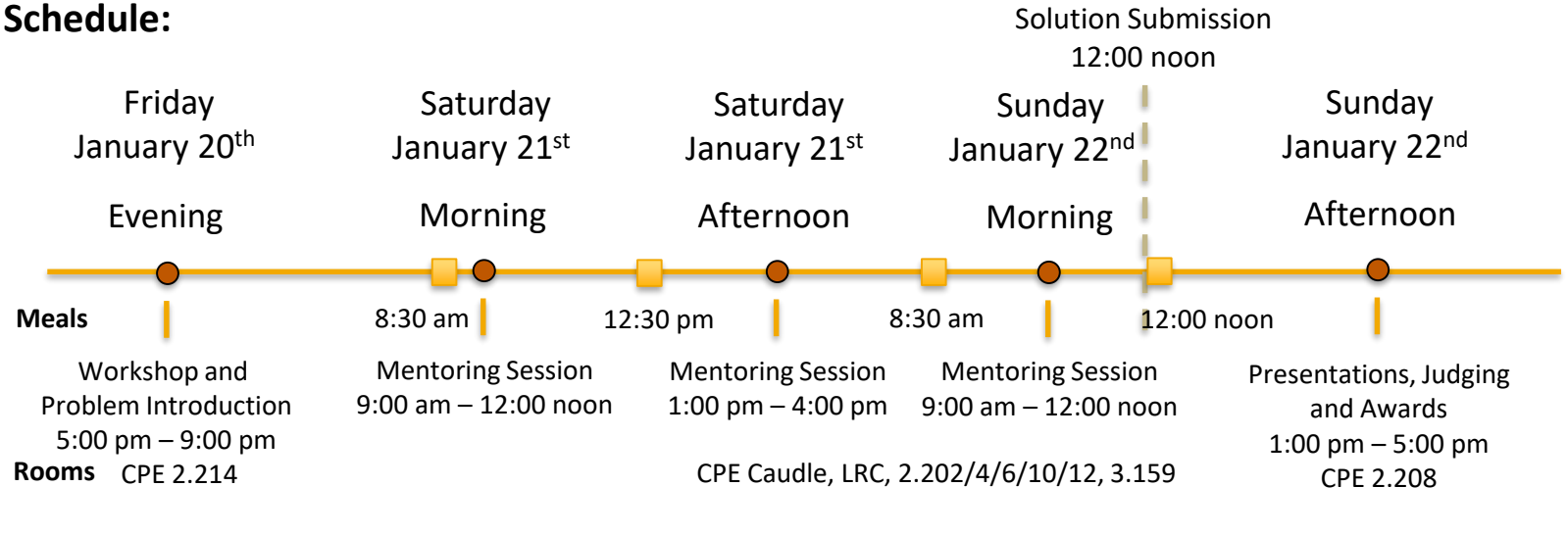
The Plan at 30,000 ft

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 .cvs 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

Participate in the Scheduled Workshops and Working Sessions

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

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

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!

Hackathon Team Scoring

Results: 75% - Results, Results, Results!

- **Accuracy** of 40 ESP predictions
- Score = $\frac{prop(correct)-0.5}{0.5}$, 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

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We are looking forward to a great event.