



# Energy A.I. Hackathon Introduction

Dr. Michael Pyrcz and Dr. John Foster

Energy A.I. 2021 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

Honggeun Jo and Mingyuan Yang

Hackathon Architects and Mentors, Graduate students in PGE

Gabby Banales and Sara Hernando

Coordinators



## Appreciation

*Appreciation to the student participants, the hackers!*

*Thank you for your enthusiasm!*



## Appreciation



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

Hildebrand Seed Fund  
Sponsorship

Professor Jon Olson  
PGE Chair

Strong support and engagement



Gabby Banales  
Organizing, Student Engagement



Sara Hernando  
Organizing, Student Engagement





## 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

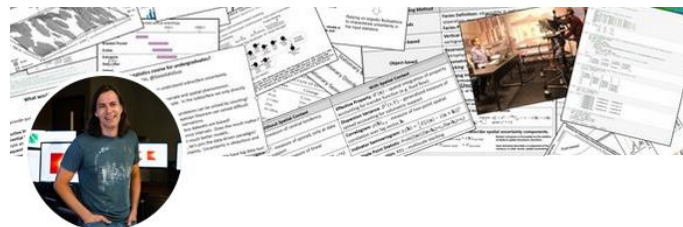
*'The goal of a hackathon is to create functioning software or hardware by the end of the event'*

Wikipedia



## Who's Running this Show?

Professor Michael Pyrcz (aka GeostatsGuy)  
Hackathon Host



**Michael Pyrcz**

@GeostatsGuy

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



**John Foster**

@johntfoster



Professor John T. Foster  
Hackathon Host

Mingyuan Yang, PhD Candidate PGE  
Hackathon Architect, Mentor



**Honggeun Jo**

@HonggeunJ Follows you



Honggeun Jo, PhD Candidate PGE  
Hackathon Architect, Mentor,  
Volunteer



Gabby Banales  
Coordinator



## Mentors

Lukas Mosser



Fabian Laugier



Zoltan Sylvester



Shane Prochnow



Matthias Imhof



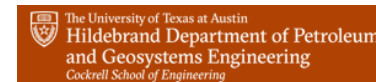
Obiajulu Isebor



Chiranth Hedge



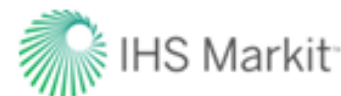
Nkem Egboga



Michael Harty



Alireza Haghighat







## Judges

**Ben Amaba**

CTO Cloud & Cognition



**Kumar Lakshmipathi**

Principal Architect



**Graham Ganssle**

Head of Data Science



**Jesse Pisel**

Professor of Practice,  
Energy Analytics



**David Holmes**

CTO Energy



**Sarita Salunke**

Team Leader





## Who is Here to Build?

21 Teams, from UT Austin Cockrell, Jackson and Natural Sciences

**404 Not Found**

**A Bunch of Nonsense**

**Anticline**

**BAY**

**Carpe Datum**

**Darcy Analytics**

**GitHub Heroes**

**HARRR**

**hatodogmen**

**Low Risk High Return**

**Moar Drilling**

**NaN**

**PetroGeoElectric**

**PumpJack Inc.**

**Sherlock H.**

**smarthorns**

**Spectral Team**

**The 4 locos**

**The Roaring Kitties**

**The Three Muscovites**

**Yolo**

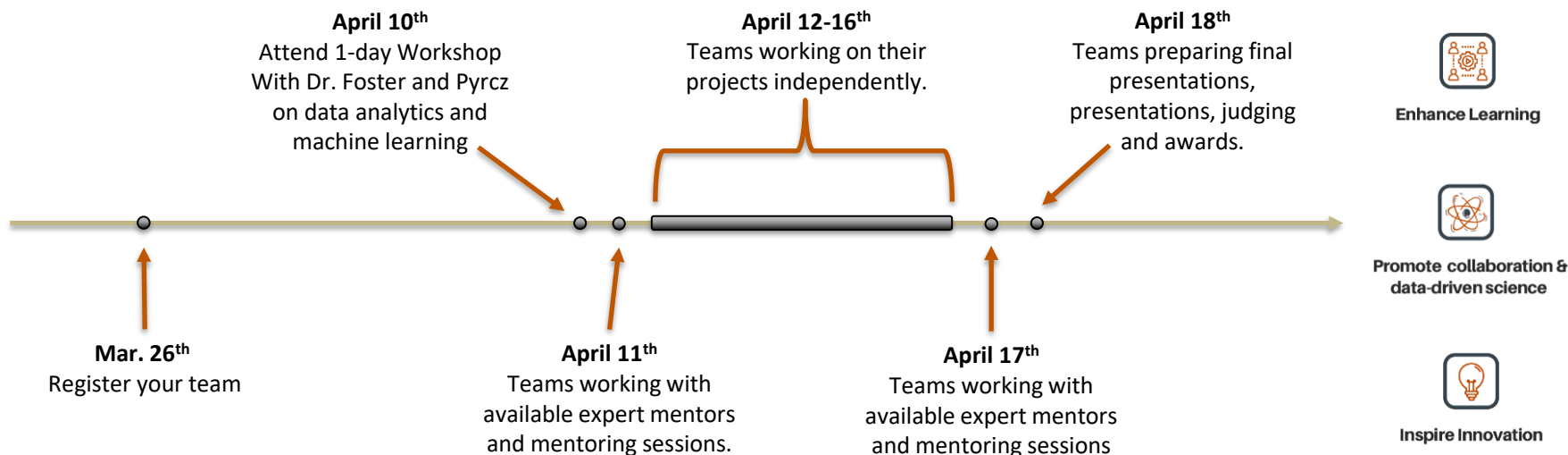
Petroleum and Geosystems Engineering, Operations Research, Mechanical Engineering, Geological Sciences, Materials Science Engineering, Electrical and Computer Engineering, Data Science, Computer Science, Aerospace Engineering, Mathematics,



## The Plan of 30,000 ft



### Schedule:



### 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. No more than 1 graduate student per team.

### 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

### **Produce this by Noon April 18<sup>th</sup>:**

1. Well-documented Python workflow in a Jupyter Notebook
2. Results as a .csv DataFrame with estimates and realizations for your uncertainty model
3. Short presentation with executive summary, goals workflow choices and defense, results and discussion. Every team member presents.

**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 by during the hackathon. Provide code for testing and scoring. All code in Python, 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>

**Work Hard, Learn and Have Fun!**



## The Hackathon Team Scoring

### **Results: 50% - Results Matter!**

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

### **Workflow: 25% - Others Must Understand our Work for Adoption!**

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

### **Presentation: 25% - and We Must Be Able to Communicate Our Work!**

- Executive summary, project goals, workflow description, results and discussion, finish on time

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 / April 10th - Energy A.I. Hackathon 2021 Workshop Schedule

8 am – 8:15 am: Hackathon Welcome, Introduction and Review Plan and Rules, Prof. Olson / Prof. Pyrcz

8:15-10 am: Essential Energy Data Science, Numpy, Pandas, Git - Prof. Foster

10 – 11:30 am: Feature Importance, Engineering and Selection, Multivariate Analysis and Shapley Values  
Prof. Pyrcz

11:30 am – 12:30 am: Lunch Break

12:30 – 1:30 pm: Machine Learning Basics, Train and Tune Overview of Methods - Prof. Pyrcz

1:30 – 2:30 pm: Machine Learning in Python, scikit-learn and TensorFlow Packages – Prof. Foster

2:30 – 3:30: Model QC, Uncertainty Modeling and Checking – Prof. Pyrcz

3:30 – 4:30: Introduce the Energy A.I. Hackathon Problem and Mystery Data Set – Prof. Pyrcz / Prof. Foster

4:30 - : Teams Break-out for Initial Data Review and Planning



We are looking forward to a great event.