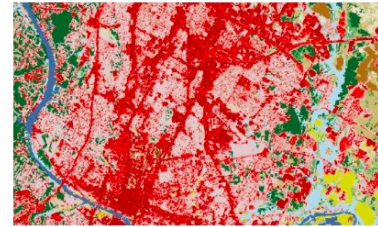


July 8-29, 2024

Machine Learning DeepLearn2024 Hackathon Competition



Sergei Gleyzer, University of Alabama

Welcome everyone!



College of
Arts & Sciences

Prof. Sergei Gleyzer
University of Alabama
Hackathon Chair

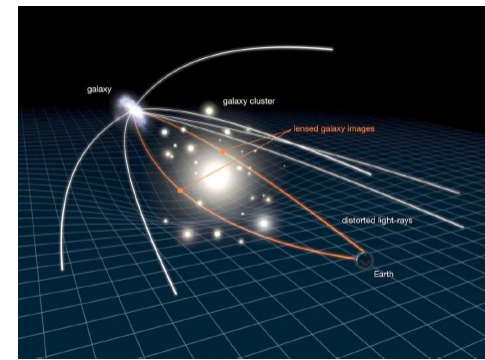
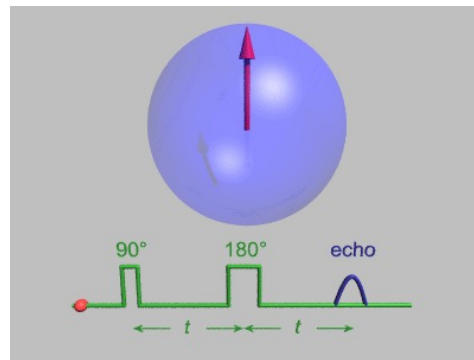
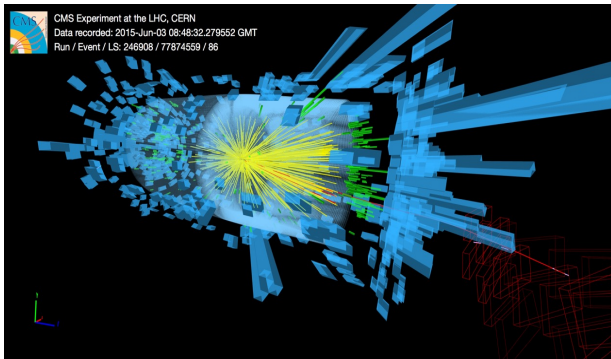


Prof. Carlos Martín Vide
Rovira I Virgili University
DeepLearn Program Chair

DeepLearn Hackathon

Goal: apply machine learning algorithms to real data

- Can use any algorithm or approach
- New machine learning ideas welcome
 - **Can form teams (3 people max)**

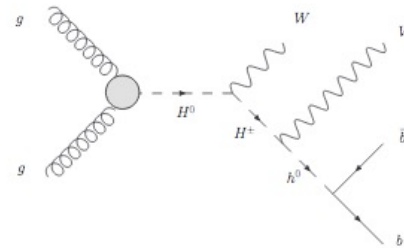


General ML Topics

- **Classification (binary and multi-class)**
- **Regression (multi-target)**
- **Anomaly Detection**
- **Computer Vision**
- **Natural Language Processing**
- **Quantum Machine Learning**
- **and others**

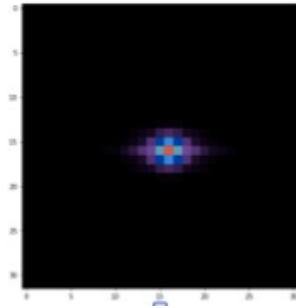
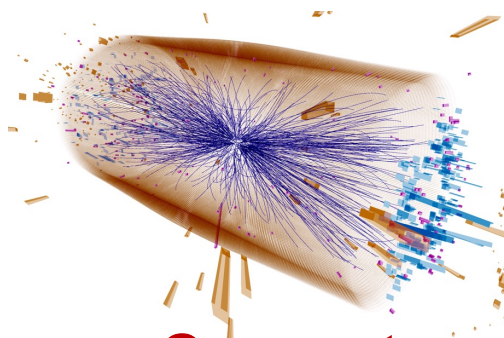
Seven challenges

1) Identifying the Higgs Boson



General Classification

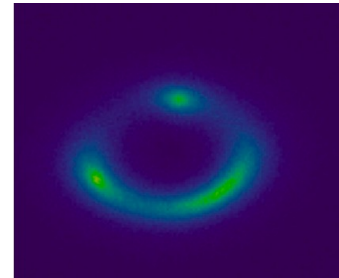
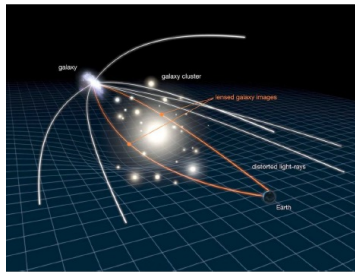
2) Classification of Particle Images



Computer vision

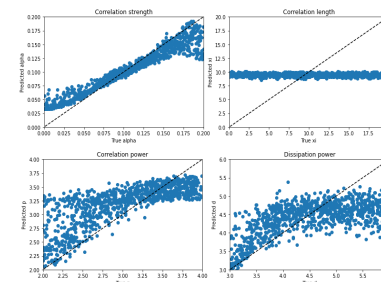
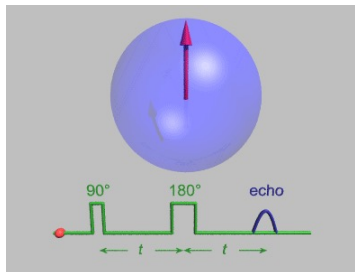
Seven challenges

3) Strong Gravitational Lensing



Computer Vision: Super-Resolution

4) NMR: Prediction Challenge



General Multi-target Regression

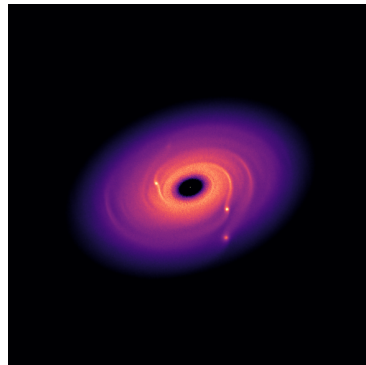
Seven challenges

5) RenAissance: NLP Challenge



**Natural Language
Processing**

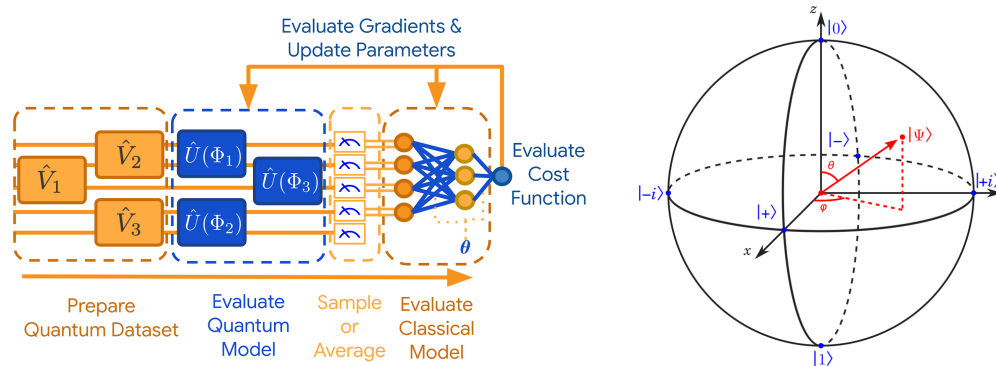
6) Exoplanet Discovery Challenge



**Search for
exoplanets**

Seven challenges

7) Quantum Machine Learning



QML: Anomaly Detection

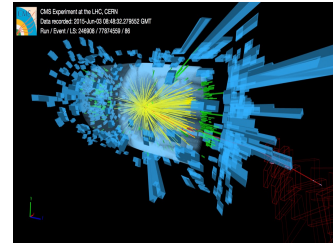
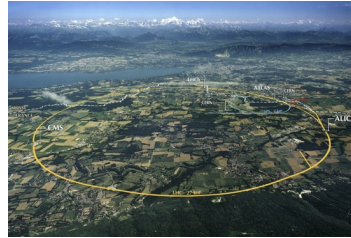
Hackathon Github

<https://github.com/ML4SCI/DeepLearnHackathon>

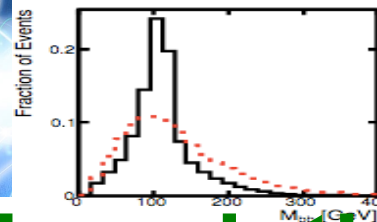
Contains all the challenge instructions

1) Higgs Boson Challenge

Dataset:



- <https://archive.ics.uci.edu/ml/datasets/HIGGS>



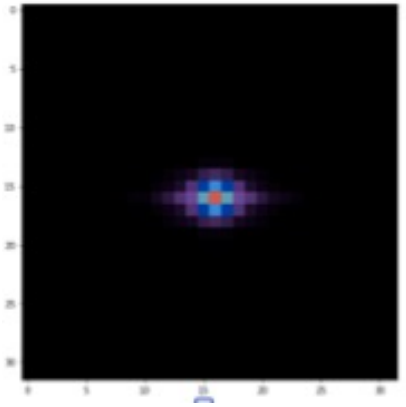
Paper with detailed description

- <https://arxiv.org/pdf/1402.4735.pdf>
- Classify Higgs Boson signal from similar-looking background

2) Particle Images

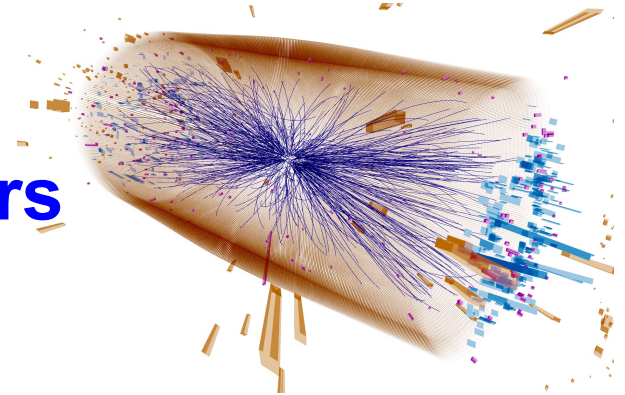
Dataset:

- Detector as a “camera”
- 32x32 energy matrices

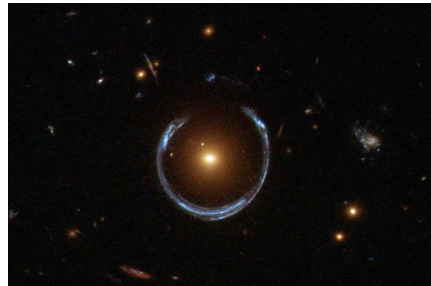
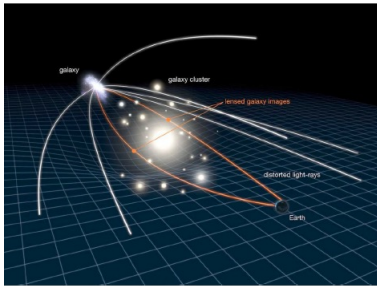


Identify electrons from photons:

- Using any CV algorithm
 - CNNs, Vision Transformers



3) Gravitational Lensing



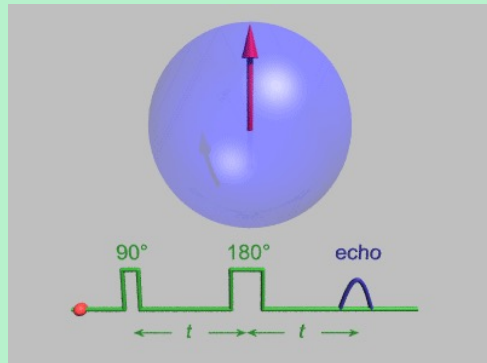
Dataset:

- **Lensing images**
- **Two tasks:**
 - **Classify possible types of dark matter**
 - **Super-resolution**

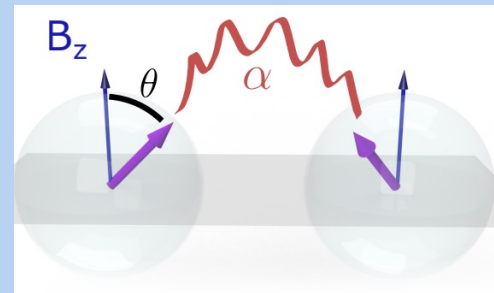
4) NMR Challenge

GOAL: Predict the strength and shape of interactions between spins from simulated time-dependent curves

Given (inputs):
Time-dependent
Magnetization



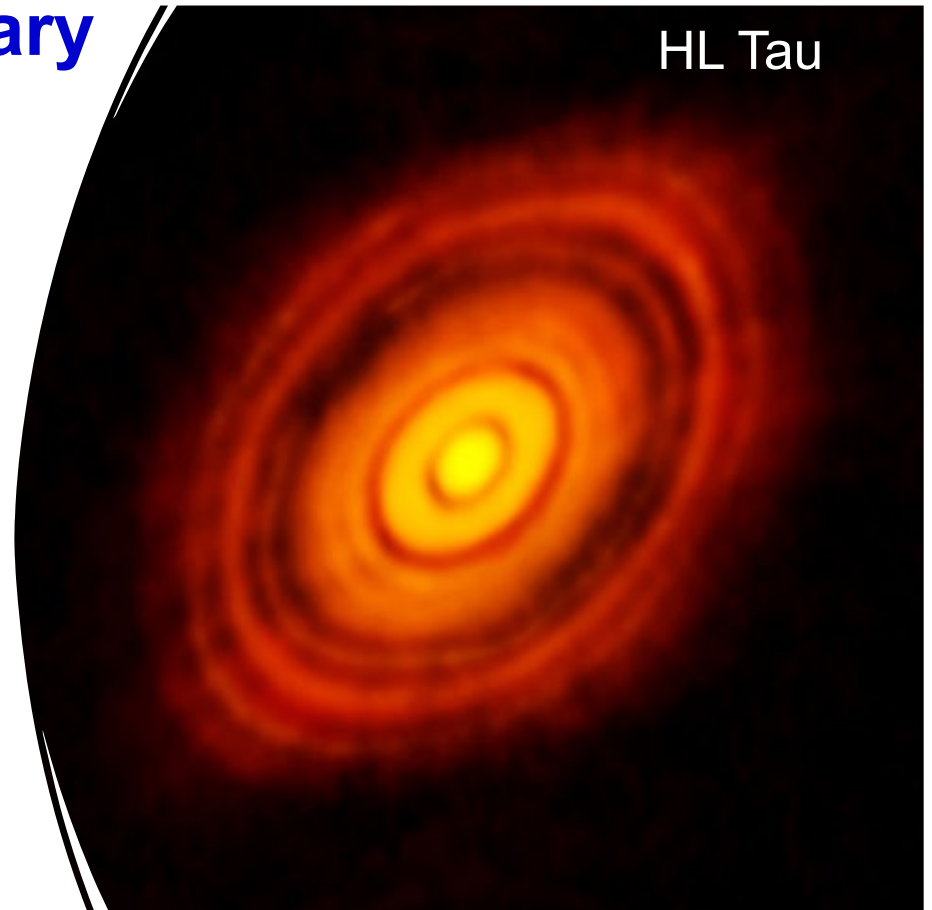
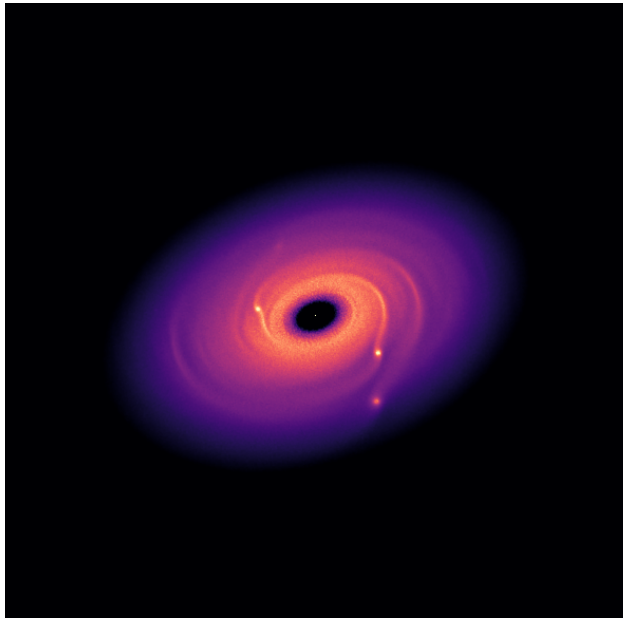
Learn (outputs):
 α : Interaction Strength
 θ : Pulse Angle



Multi-target Regression

5) Exoplanet Search

Classify protoplanetary disks as containing planets (or not)

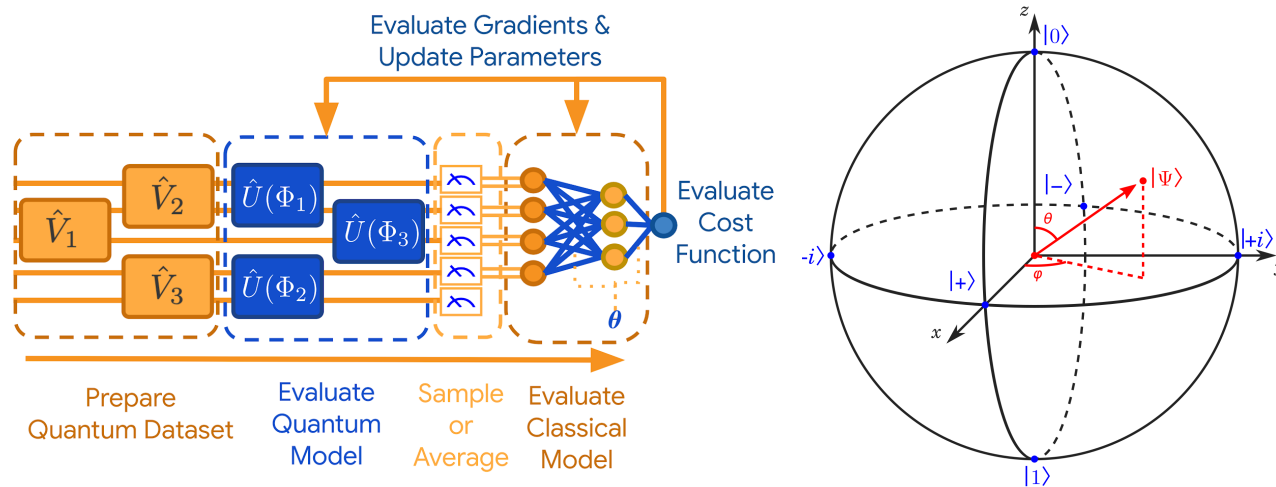


6) Renaissance Challenge

- Transcribe 17th century printed sources with Machine Learning
- Dataset: 31 scanned pages from centuries-old texts
- 25 with transcriptions, the rest are a challenge



7) Quantum ML Challenge



Use quantum machine learning algorithms to perform anomaly detection, compare to classical ML

Practical

- **Can use any algorithm, machine learning framework or resource**
- **Github contains Jupyter notebook examples**
 - **Visualize data and run benchmarks**
- **Train on Google colab**



Schedule Highlights

- **Today**
 - Detailed overview of each challenge in break-outs
- **Hackathon Office Hours:**
 - Thursday, July 11, 16:00 CET
- **Full Hackathon Schedule:**
 - <https://indico.cern.ch/event/1432069/>

Competition

- Today: **virtual kick-off**
- Next Monday: **in-person**
- Solutions due July 29, 18:00 CET
by email:
deeplearnhackathon@gmail.com
- See each challenge for submission instructions and evaluation metrics

Assessment Survey

- Takes **~3 minutes** to complete
- **Required** for participation
 - Today and again upon submission
 - Will help us improve the hackathon experience
- **Pre-Hackathon survey:**
 - <https://bit.ly/3xYXluZ>



More questions?

- **Slack channel:**

- <https://bit.ly/3VQK2t2>



- **Email:**

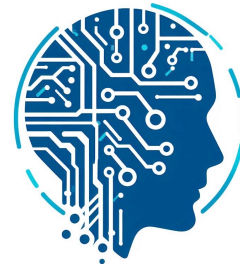
- sgleyzer@ua.edu

- **Zoom office hours on Thursday**

Thank you to all facilitators

Dr. Axel Buchot Perraguin, Krishna Chaitanya Rao Kathala, Gopal Ramesh Dahale, Prof. Xabier Granja, Arsh Khan, Dr. Marco Knipfer, Tom Magorsch, Prof. Harrison Meadows, Utsav Rai, Pranath Reddy, Eric Reinhardt, Shashank Shekar Singh, Dr. Jason Terry, Prof. Emanuele Usai, Yukinori Yamamoto

ML4SCI



HumanAI

Winners

- **Announced after results analyzed**
- **Monetary Prizes 😊 Good Luck!**

