

July 8-29, 2024

Machine Learning DeepLearn2024

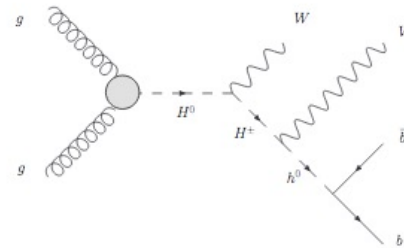


Hackathon Competition

Sergei Gleyzer, University of Alabama

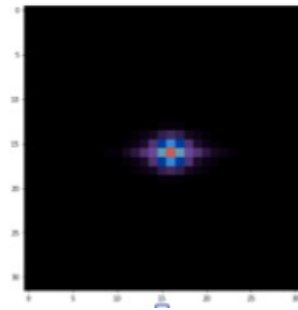
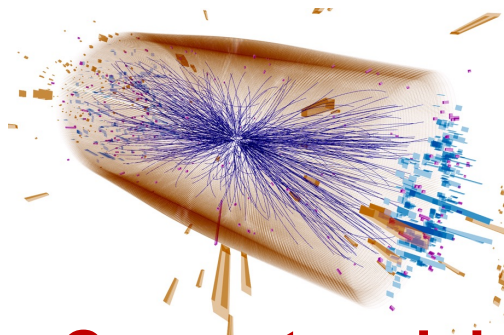
Seven challenges

1) Identifying the Higgs Boson



General Classification

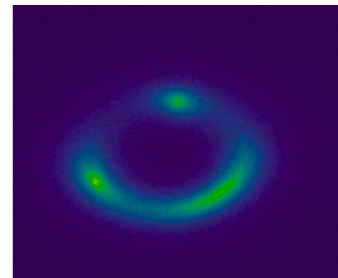
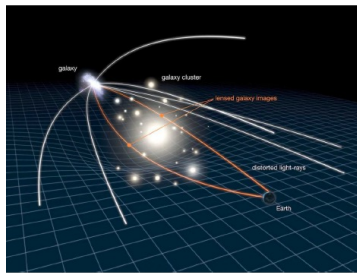
2) Classification of Particle Images



Computer vision

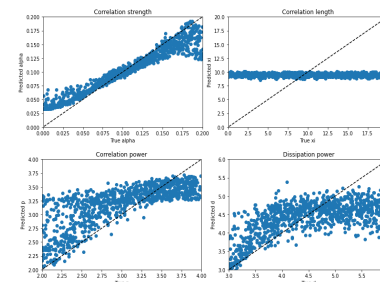
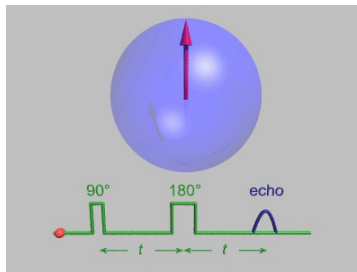
Seven challenges

3) Strong Gravitational Lensing



Computer Vision: Super-Resolution

4) NMR: Prediction Challenge



General Multi-target Regression

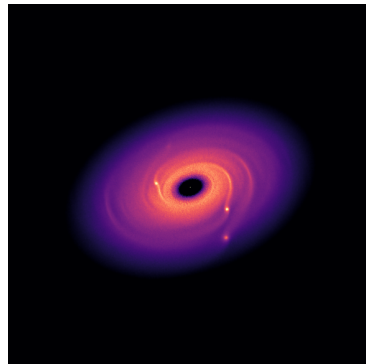
Seven challenges

5) RenAissance: NLP Challenge



**Natural Language
Processing**

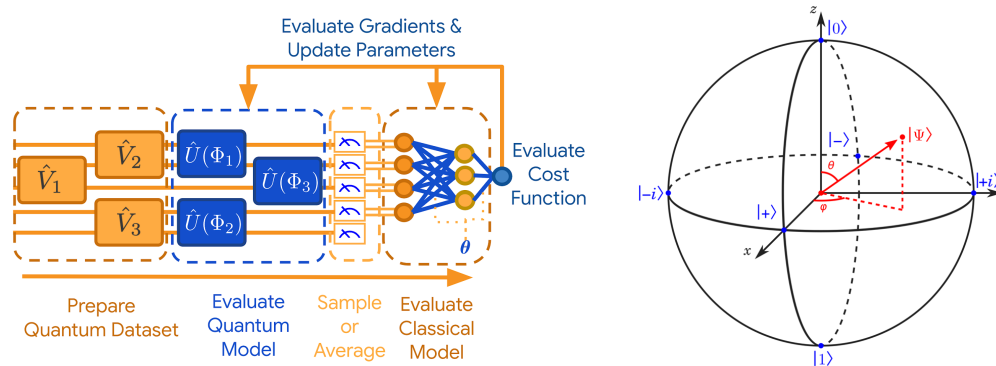
6) Exoplanet Discovery Challenge



**Search for
exoplanets**

Seven challenges

7) Quantum Machine Learning



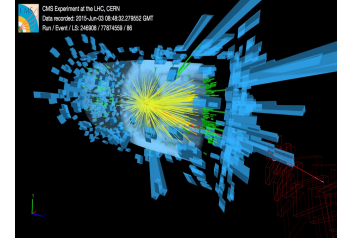
QML: Anomaly Detection

ML4SCI Competition

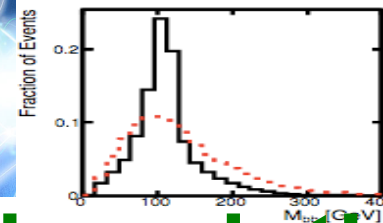
- **Many creative solutions**
- **Today we'll congratulate the winners and go over some of the results/solutions**

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

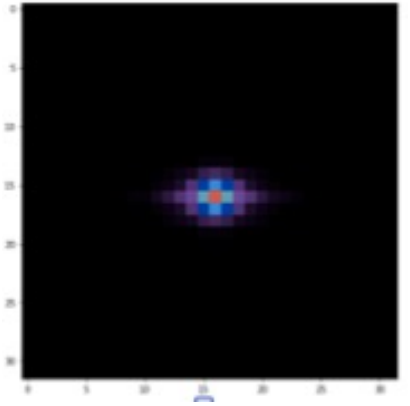
1) Higgs Results

Team	Metric (auc)
1. Ivan Grubisic, Johann Grubisic	0.85
2. Abbas Hanif, Shahzaib Abbas	0.84
3. Ferenc Wolter, Mohammad Amran Hossain	0.82
4. Pavicic Agostini, Sandro Agostini	0.79
5. Pedro Pimenta, Rui Carreira, Rui Humberto Pereira	0.77

2) Particle Images

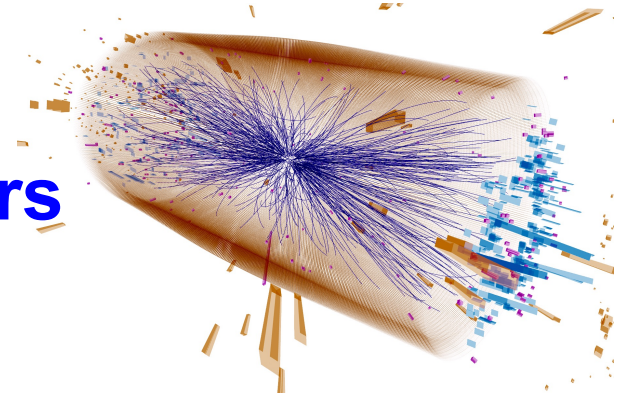
Dataset:

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



Identify electrons from photons:

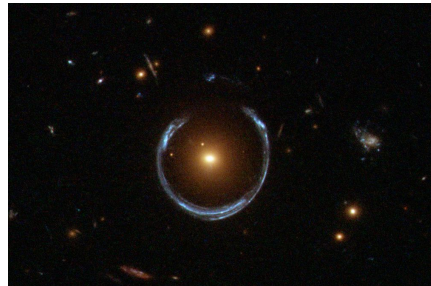
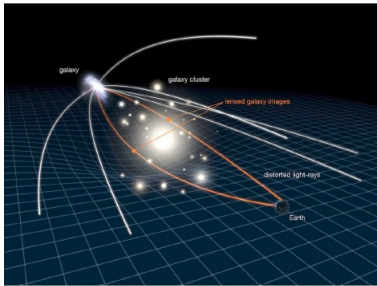
- Using any CV algorithm
 - CNNs, Vision Transformers



2) Particle Images Results

Team	Metric (auc)
1. Ivan Grubisic, Johann Grubisic	0.802

3) Gravitational Lensing



Dataset:

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

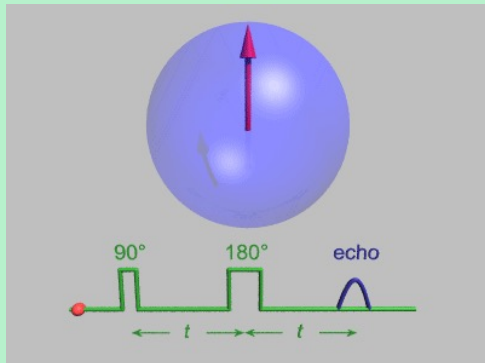
3) Gravitational Lensing Results

Team	Metric
Classification	auc/acc
1. Matthias Schwab, Markus Tiefenthaler	0.999/0.995
2. Ivan Grubisic, Johann Grubisic	0.998/0.971
SuperResolution	SSIM/PSNR
1. Matthias Schwab, Markus Tiefenthaler	0.995/46.6
2. Ivan Grubisic, Johann Grubisic	0.823/20.3

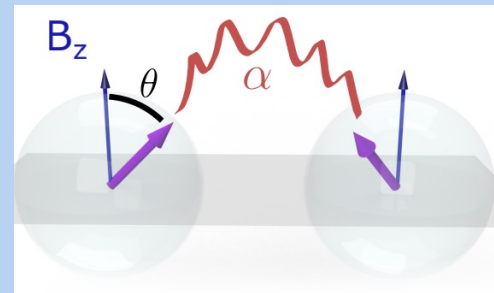
4) NMR Challenge

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



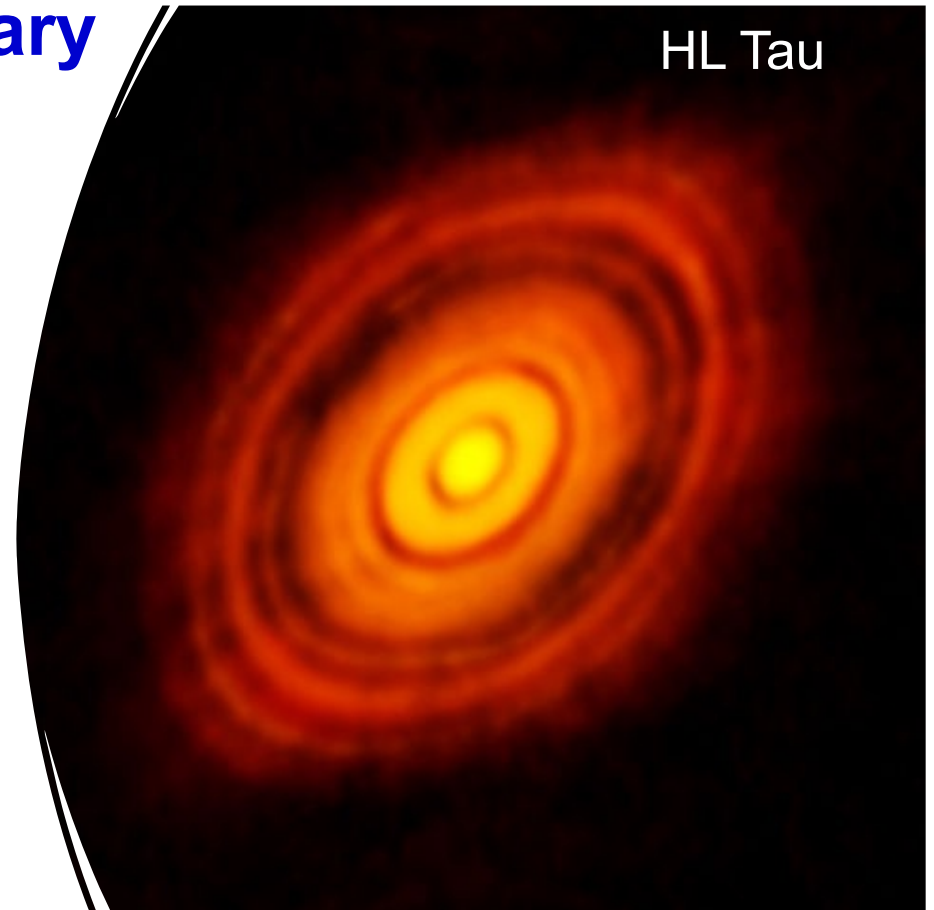
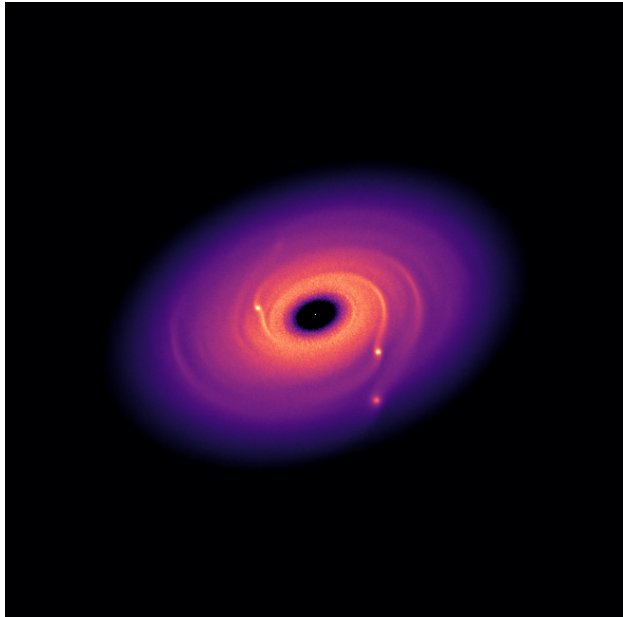
Multi-target Regression

4) NMR Results

Team	Metric
Ivan Grubisic, Johann Grubisic	Not readable

5) Exoplanet Search

Classify protoplanetary disks as containing planets (or not)



5) Exoplanet Results

Team	Metric (withheld/observations)
1. Grubisic, Grubisic	0.977/0.5
2. Schwab, Tiefenthaler	0.960/0.417
3. Osvaldo Gramaxo Freitas	0.999/0.333
4. Gabriel Texeira	0.950/0.417
5. Comotti Ivankovic Camarero	0.931/0.25

6) RenAIssance Challenge

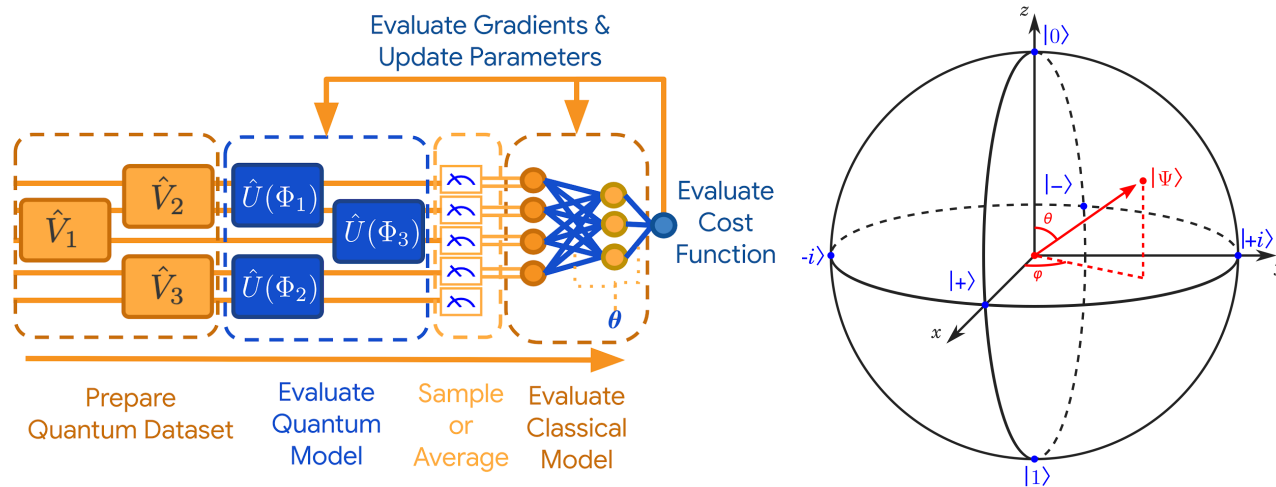
- Transcribe 17th century printed sources with Machine Learning
- Dataset: 31 scanned pages from centuries-old texts
- 25 with transcriptions, the rest are a challenge



6) RenAIssance Results

Team	Metric (expert)
1. Marie Ronald, Tita Enstad	9
2. Karolina Svitojute, Nick Theisen, Matt Kerin	5.5
3. Lucien Zippel	2

7) Quantum ML Challenge



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

7) QML Results

Team	Metric
No submissions	

Certificates

- Teams placing **1st - 3rd** in the individual challenges will receive **hackathon certificates** signifying their result

Prizes

- Our committee has determined the **top 3 overall teams** based on individual and cumulative performance
- These teams will additionally receive **monetary prizes**

Overall Results

Team	Overall Rank

Overall Results

Team	Overall Rank
3. Marie Ronald, Tita Enstad	3 (RenAIssance)

Overall Results

Team	Overall Rank
2. Matthias Schwab, Markus Tiefenthaler	2 (multiple)
3. Marie Ronald, Tita Enstad	3 (RenAIssance)

Overall Results

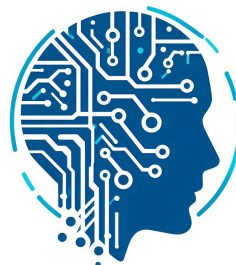
Team	Overall Rank
1. Ivan Grubisic, Johann Grubisic	1 (multiple)
2. Matthias Schwab, Markus Tiefenthaler	2 (multiple)
3. Marie Ronald, Tita Enstad	3 (RenAIssance)

Congratulations to all the winning teams!

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

Thank you to DeepLearn!



Program Chair: Prof. Carlos Martín Vide

Thank you for taking part

- We'll organize more hackathons
- In the meantime, feel free to get in touch if interested in research topics related to the challenges.

