NSF HDR ML Challenges

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HDR Community

What is the NSF HDR program ?

- NSF's Harnessing the Data Revolution (HDR) Big Idea is a national-scale activity to enable new modes of data-driven discovery that will address fundamental questions at the frontiers of science and engineering
- There are 5 NSF HDR institutes

A3D3: NSF HDR aimed at deploying real-time machine learning into scientific domains

iHARP: NSF HDR Institute for Harnessing Data and Model Revolution in the Polar Regions

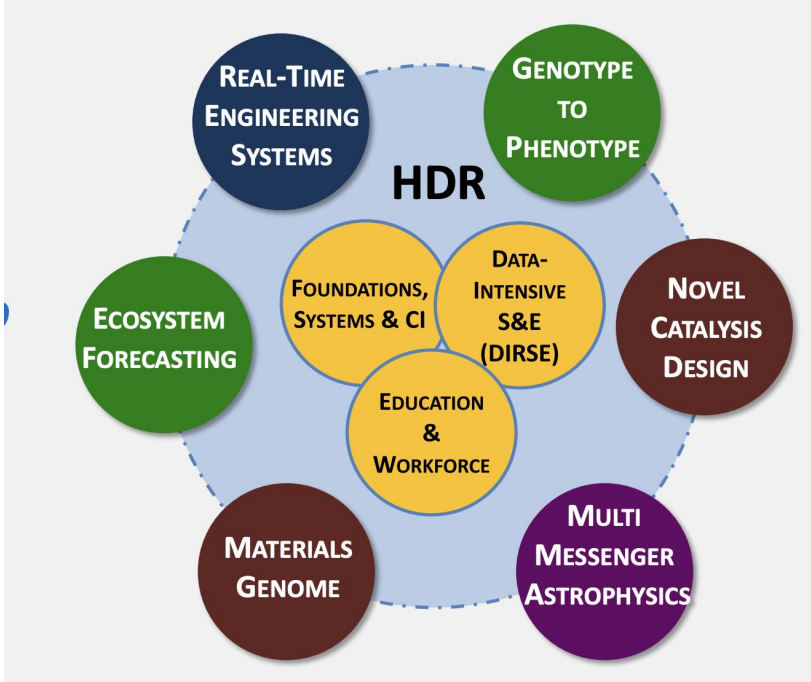
ID4: Institute for Data Driven Dynamical Design

iGuide: Institute for Geospatial Understanding through an Integrative Discovery Environment

A New Frontier of Biological Information Powered by Knowledge-Guided Machine Learning

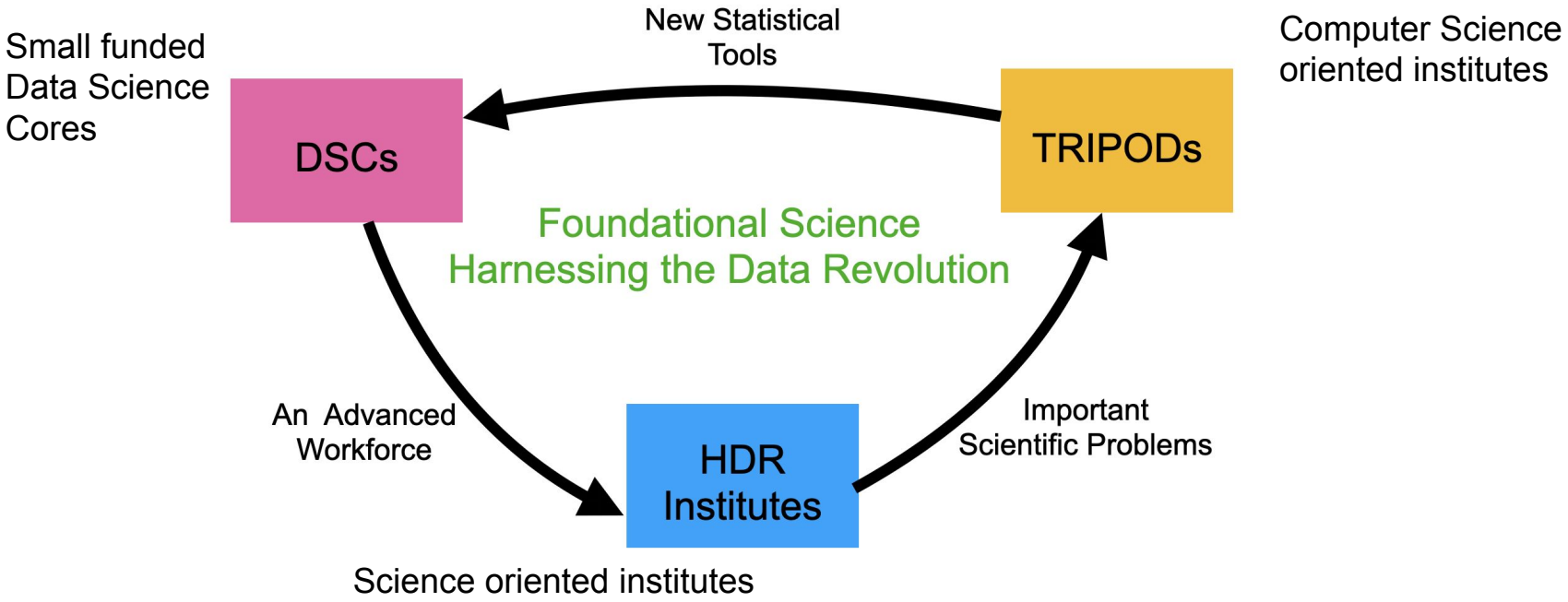
How HDR operation is envisioned

- HDR Aims to build a strategy around data science research



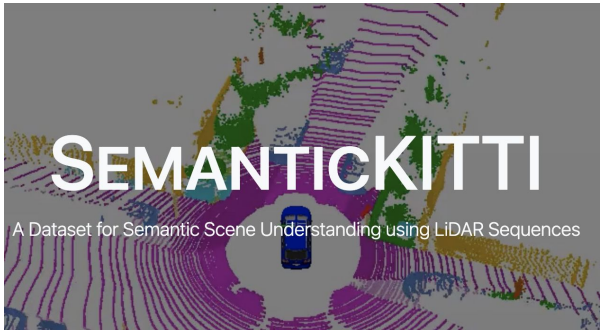
Scope of HDR

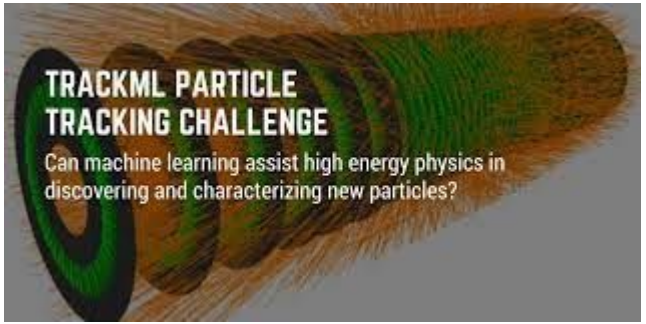
- The goal is to establish convection between institutes



What are ML Challenges?

- Aim is to make a series of datasets released to public
  - Use this dataset to make an ML Challenge
- Many datasets exist within the common use
  - This is our opportunity to align datasets with Science
  - Need to make it clear datasets have a different & special input
- Push community to think beyond the standards (below)





IMAGENET

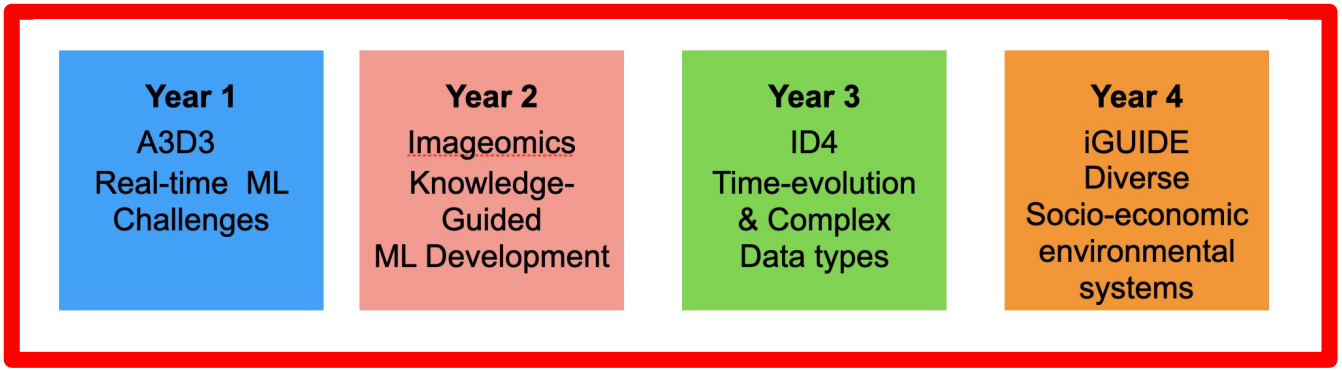
Advantages of ML Challenges

- A good way to advertise important scientific problem
  - Bring awareness to challenges within a field
  - Extends scope of problems beyond conventional ones
- A good way to expand FAIRness in community
  - ML Challenge datasets should aim to be FAIR
- A way to engage members outside of field/academia
  - Members of industry
  - Other scientific domains
- New and creative solutions to important scientific problems

HDR ML Challenges

- Goals is to perform a yearly ML challenge
  - For each ML challenge, we prepare FAIR datasets
  - Also prepare a directed goal for each of the datasets
  - Plan: release challenge, then award ceremony/conference
  - Aim is to focus each challenge on the institute topic
- Annual Bootcamp at UW to award results & have a tutorial

Suggested Plan

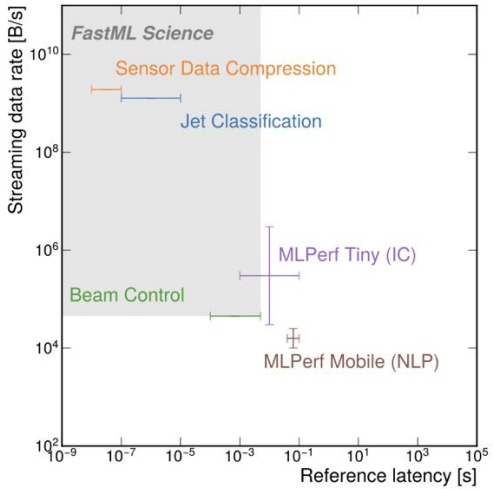


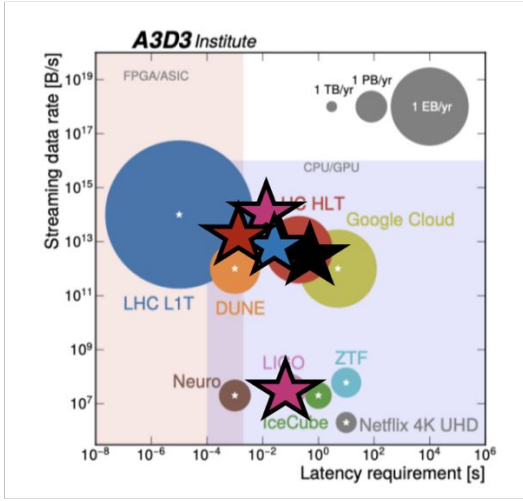
Cross HDR discussion

- We would like to connect with the work done within MLCommons Science
- These models can be potentially be integrated to metrics (such as MLPerf)
  - We will have a talk from MLPerf Tiny community later on
- More importantly : **This is a way to strengthen the HDR Community!**

ML Commons

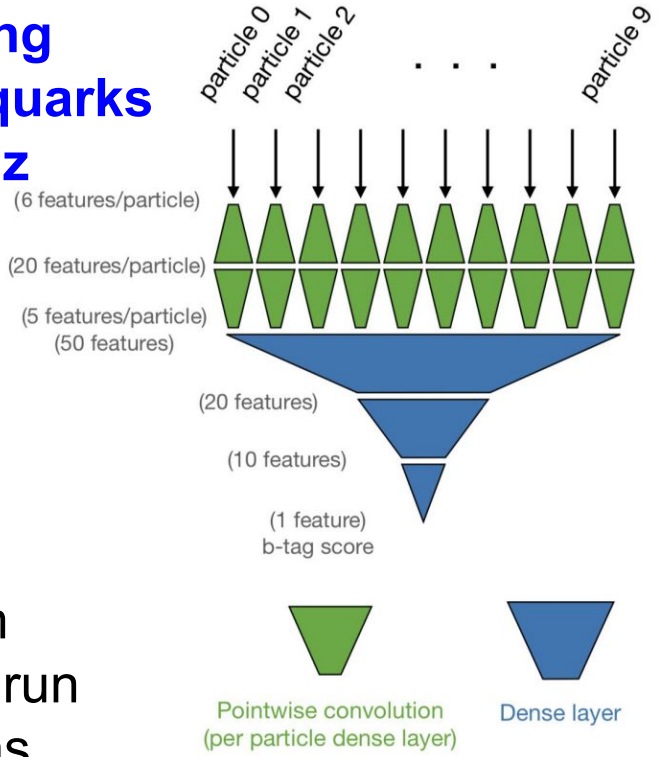
Machine learning innovation to benefit everyone.



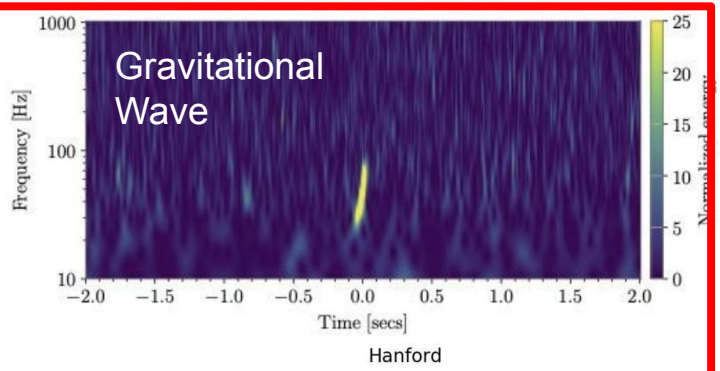


List of Possible Models

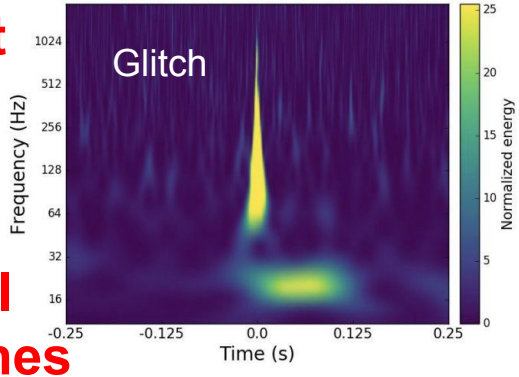
Identifying bottom quarks at 40 MHz



Algorithm needs to run in < 500ns



Building out dataset to generate+ identify gravitational waves glitches



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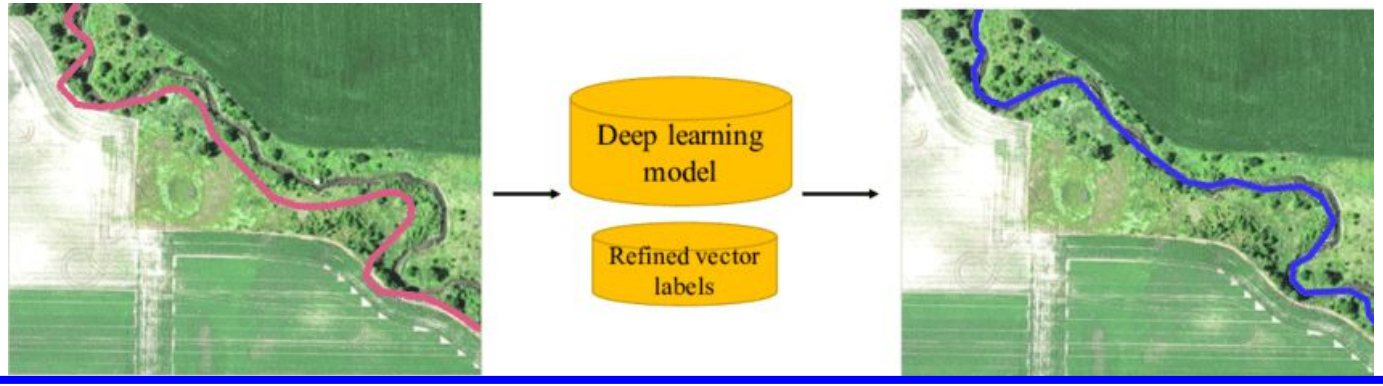


Mapping out water resources from USGS surveys

Discovering power outages from atmospheric sensors.

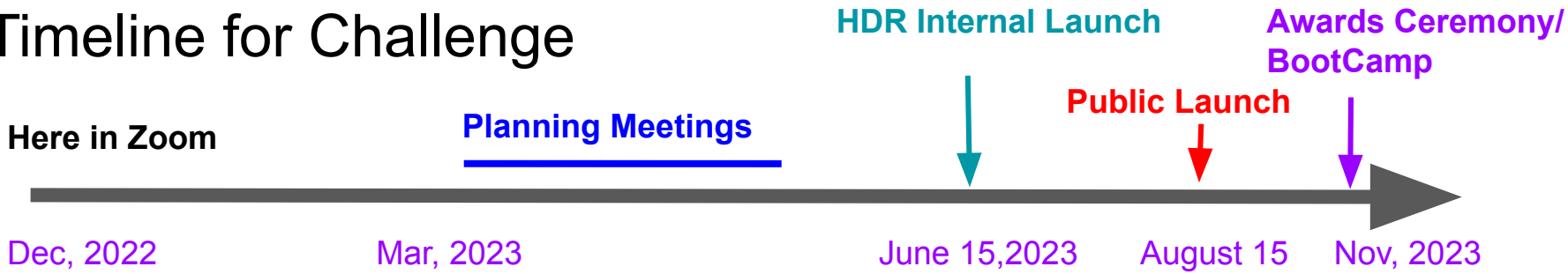
Where many of the sensors are propetary
So we can’t release challenge data

Except a small validation set

What needs to be done?

- We are lacking a clear framework for testing and validation
  - There are potentially a few options:
    - Hugging Face
    - https://www.modelshare.org/
    - Perhaps will hear more from the next talk
- Go for a future framework should have capability for many metrics
  - Basic research performance for minimizing loss
  - Low latency performance for checking optimized timing
  - Potentially these can evolve over time
- Aiming to have regular working group meetings
  - Would like as a goal for first ML Challenge meeting of before December
- Plan to have an internal ML challenge in summer (June 1st)
- Ultimate goal is to release ML Challenge by Fall (September 1st)

Timeline for Challenge



We aim for a one year timeline to setup the challenge to ceremony

We would like to engage i**ndustry partners to help sponsor our challenge**

- We can potentially release this on Kaggle or something else
- The other speakers here can really help push our plans forward

We support Awards ceremony/Bootcamp for the Challenge winners & for training

Summary

- Through the HDR community we are looking to make ML challenges
  - We see ML challenges as a way to promote science
  - This is also a way to curate a bunch of good data sets
    - New and interesting problems
- We have support to host an awards ceremony and develop challenge
  - Would need sponsor for monetary award of challenge
- Would like to engage several related communities
  - MLCommons science seems like a good way
  - Will hear from FAIRUniverse about hosting these