

DarkMachines: Accelerating the Search for Dark Matter with Machine Learning

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The Genesis

- The Darkmachines initiative is a result of the workshop:

Accelerating the Search for Dark Matter with Machine Learning

from 15 Jan 2018 through 19 Jan 2018 in Leiden

- A set of astronomers, astrophysicists, HEP experimentalists, phenomenologists and computer scientists met to discuss applications of Machine Learning to the Dark Matter field.
- The result was the creation of the Darkmachines initiative.

Lorentz center Accelerating the Search for Dark Matter with Machine Learning
Workshop @Dart 15 - 19 January 2018, Leiden, the Netherlands

Scientific Organizers

- Gianfranco Bertone, UvA Amsterdam
- Francesca Calore, CNRS Annecy-le-Vieux / U Savoie Mont Blanc
- Satcha Leeson, Radboud U / NWO-Nikhef Amsterdam
- Tom Heskes, Radboud U
- Roberto Ruiz de Avares, IFIC Paterna

Topics

- Astronomical Data
- Deep Learning and Image Analysis
- Direct and Indirect Searches
- Unsupervised Learning
- Large Hadron Collider
- (Semi-) Supervised Learning
- Dark Matter Models
- Active Learning & Experimental Design

The Lorentz Center organizes workshops to explore new scientific questions, to give a platform for researchers to discuss their work, to share ideas and to create a vibrant scientific community.

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Topics

- Physics:

1. Strong Lensing.
2. Direct and Indirect searches.
3. LHC searches for Dark Matter particles.
4. Dark Matter Models.

- Data science:

Supervised & Unsupervised Learning, Experimental Design, Active Learning, Adversarial Networks, ...

Our objectives

- We aim to explore, and to encourage, the utilization of state-of-the-art Machine Learning algorithms for research in Dark Matter physics and astronomy.
- We will create data sets for it.
- Our objective is to accelerate the identification of Dark Matter with a multidisciplinary approach: bringing together expertise in experimental and theoretical particle physics, astrophysics, astronomy, statistics and Machine Learning.
- We like to generate a new open research community.
- We plan a whitepaper and follow-up workshops.
- We plan to work on/organize problems/challenges.

Infrastructure

<http://www.darkmachines.org>

Dark Machines

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About Dark Machines

Dark Machines is a research collective of physicists and data scientists. We are curious about the universe and want to answer cutting edge questions about Dark Matter with the most advanced techniques that data science provides us with.

[Visit our Indico page](#)



Dark Machines
@dark_machines

The strong lensing subgroup of the DarkMachines project (darkmachines.org) will be holding a kick-off video-meeting for the strong lens challenge on Tuesday, August 7th, 7am PDT (California time).



Aug 3, 2016



Dark Machines Retweeted



Gianfranco Bertone
@gbertone

Nice summary on @nature of the challenges and opportunities that come with the use of machine learning at the frontiers of particle physics

[nature.com/articles/s41586-016-0415-8](https://www.nature.com/articles/s41586-016-0415-8)

Follow us via twitter: [@dark_machines](https://twitter.com/dark_machines)

Challenges

- A challenge is a scientific project related to Dark Matter and Machine Learning.
- Think about a research question which you think could be solved/approached with state-of-the-art Machine Learning methods.
- Our January workshop resulted in about 10 challenges:
 1. Each will produce data that will be stored somewhere and eventually made it public.
 2. Each should produce at least one publication in the time scale of several months.
 3. You can find them listed in the webpage:
 1. Each has coordinators and regular vidyo meetings and slack pages have been setting up for material exchange, etc ...
 2. Everybody is welcome to join them and propose new ones !!!

Conclusions

- A pool of leading experts in the Dark Matter field have organised an effort to exploit the large available datasets using Machine Learning.
- Register and join us contributing to the effort participating in the challenges (there are more than 100 scientists already registered).