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.
- Te result was the creation of the Darkmachines initiative.



Topics

- Physics:
- 1. Strong Lensing.
- 2. Direct and Indirect searches.
- 3. LHC searches for Dark Matter particles.
- 4. Dark Matter Models.
- Data science:

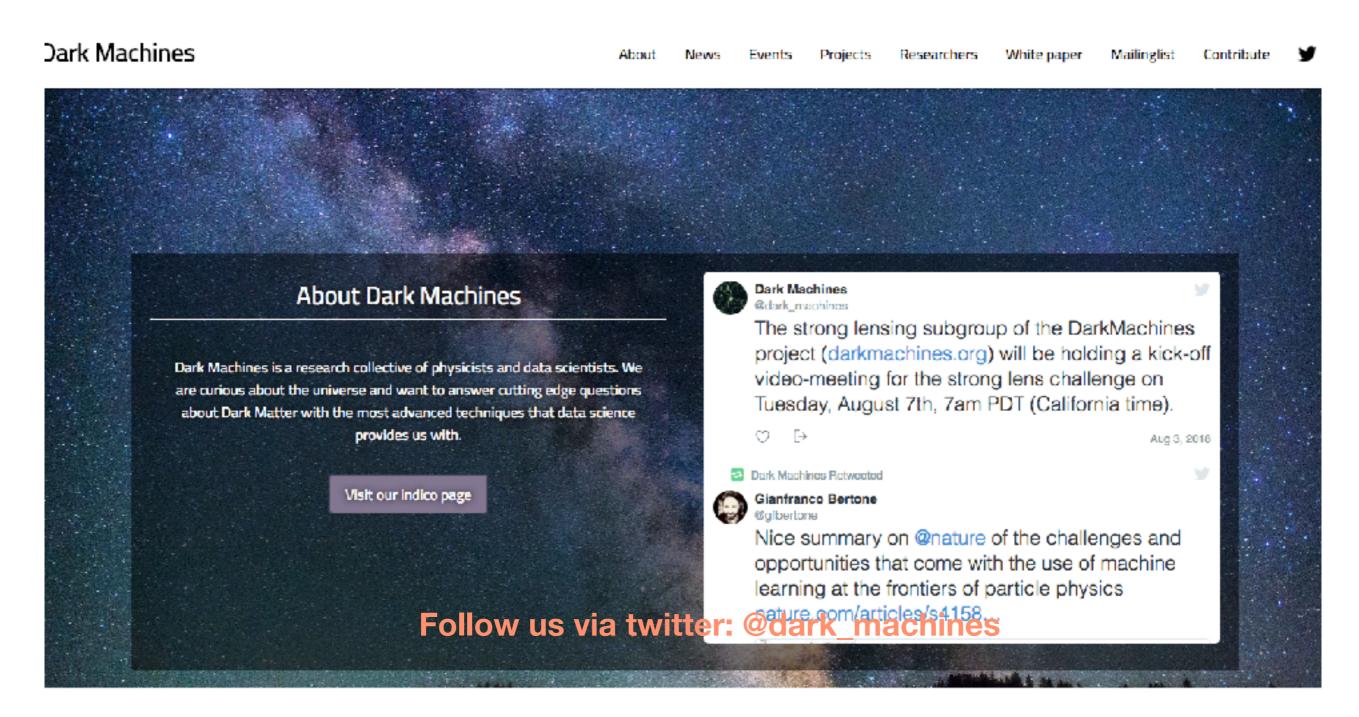
Supervised & Unsupervised Learning, Experimental Design, Active Learning, Adversarial Networks, ...

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



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).