Applications of Machine Learning in The Hobby-Eberly Telescope Dark Energy Experiment

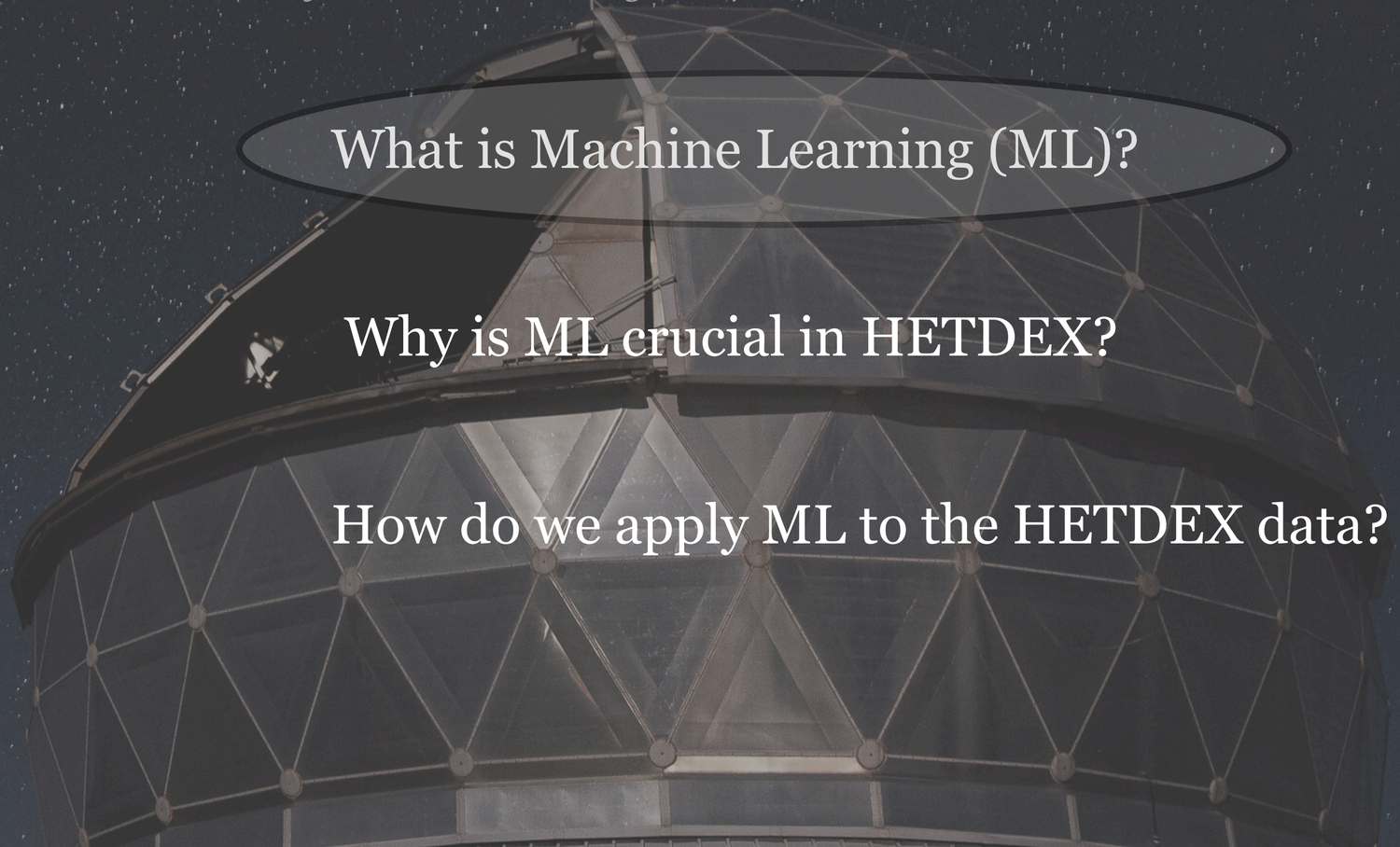
Mahan Mirza Khanlari - Board of Visitors Meeting - 02/24/2024

HETDEX

Integral field spectroscopic Survey

1 Million galaxies

Tackle the nature of Dark Energy



What is Machine Learning (ML)?

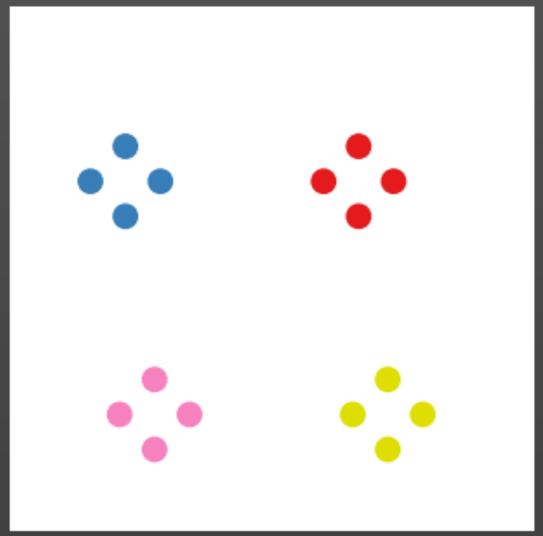
Why is ML crucial in HETDEX?

How do we apply ML to the HETDEX data?

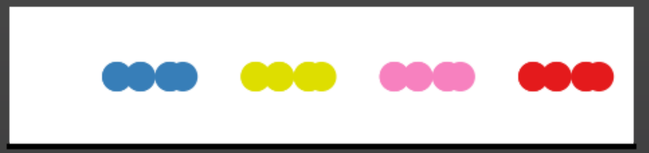
Photo Credit: Eli Hartman

Data Visualization

16 Identical balls in different colors

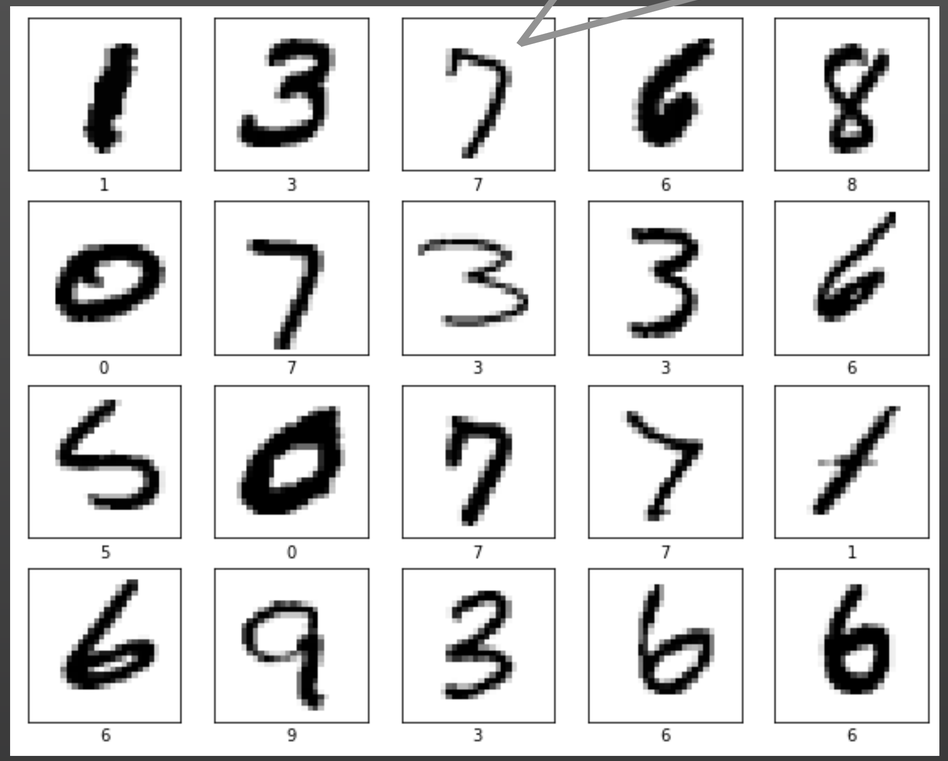


Reducing the dimension



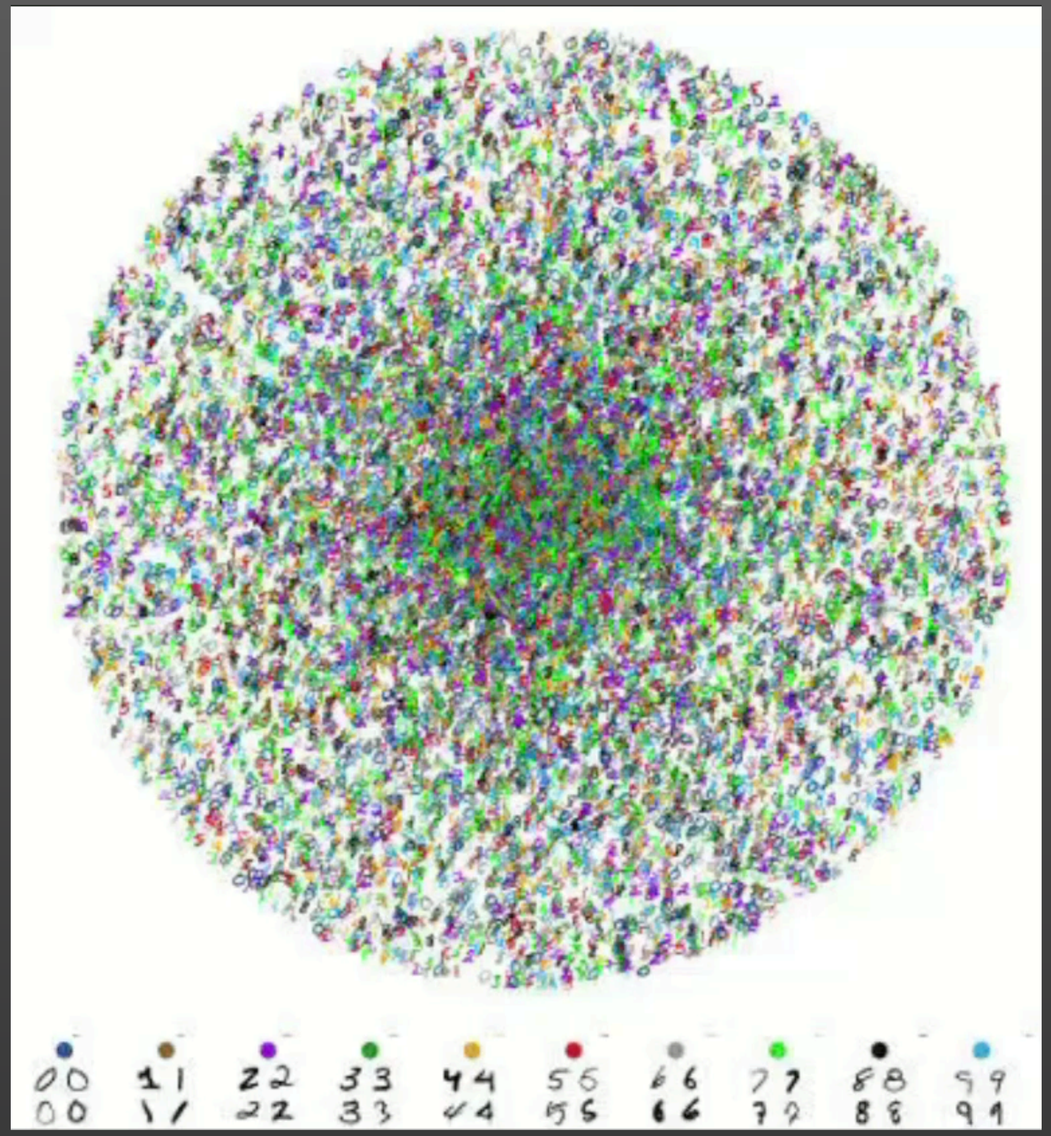
Preserves the **similarities**

28 x 28 pixel
Number of dimensions = 784



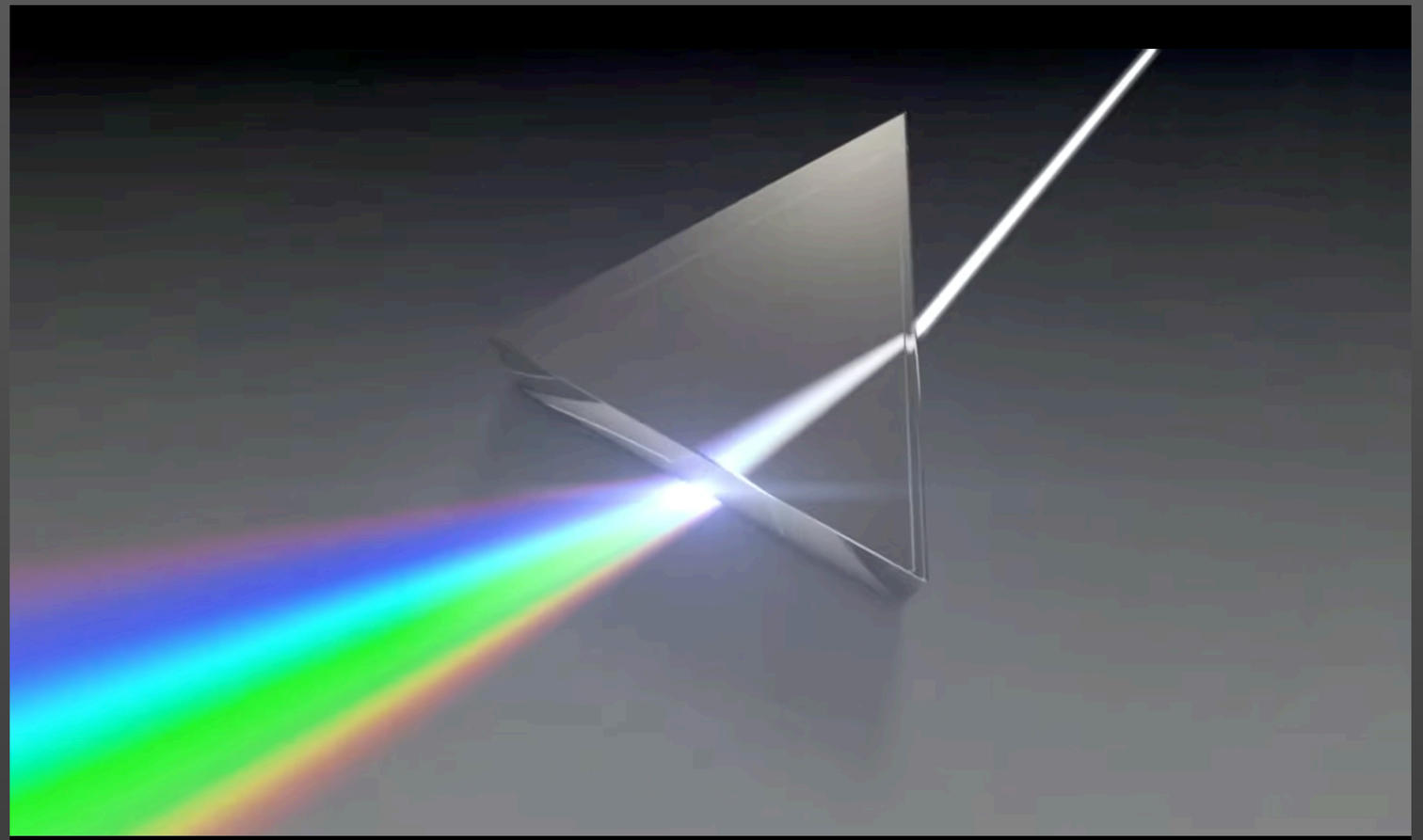
MNIST dataset

784D to 2D



Credit: Nicola Pezzotti

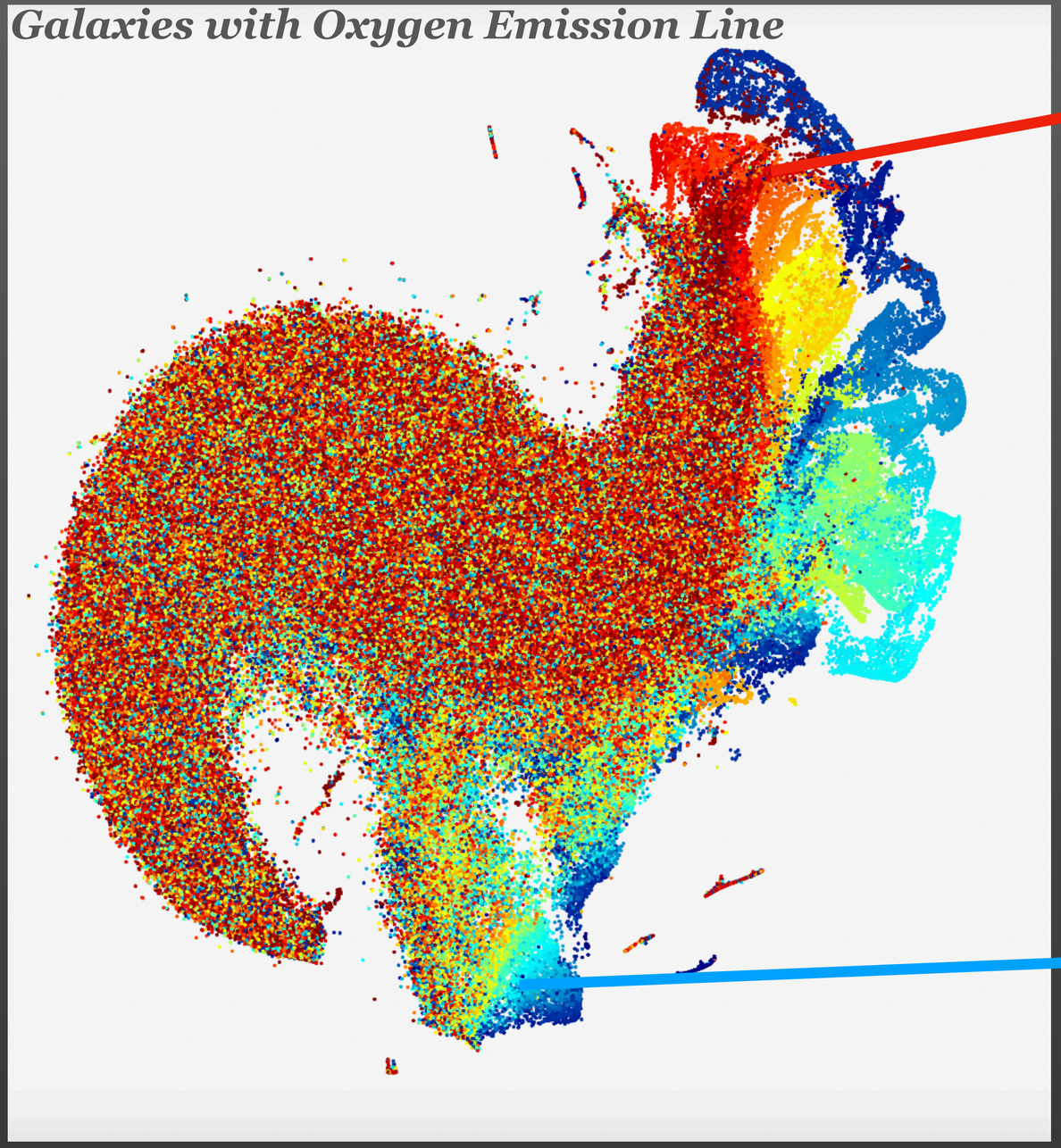
We have **spectra** from our sources in HETDEX

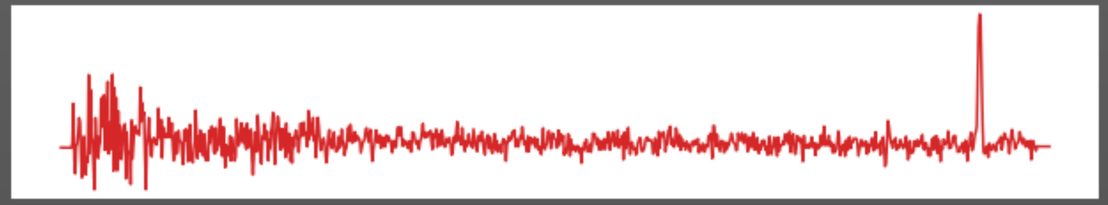


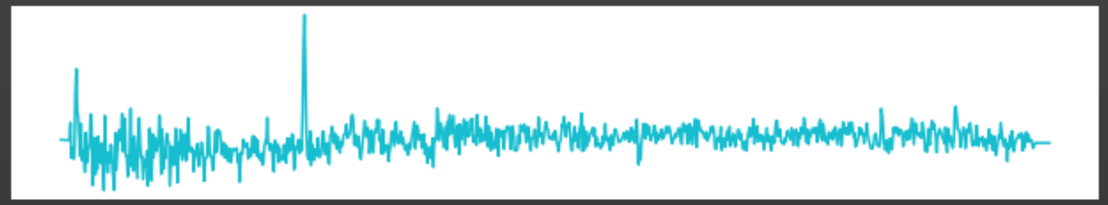
Credit: NASA Hubblecast

We'll have a Billion of these!
~8 Years of data collection

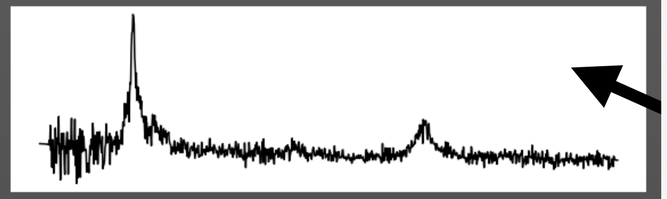
Galaxies with Oxygen Emission Line



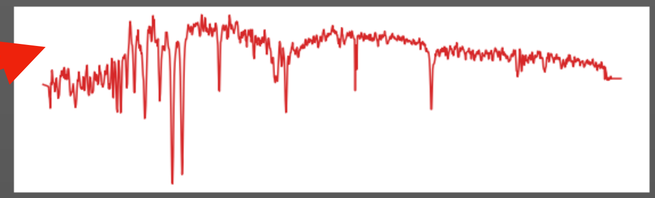




Continuum Sources

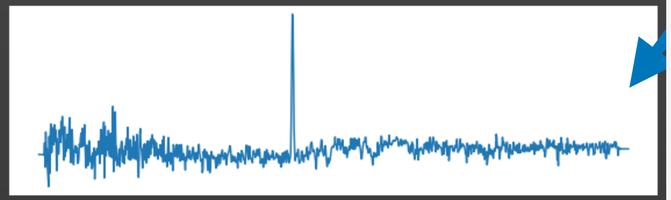


Accreting Black Holes

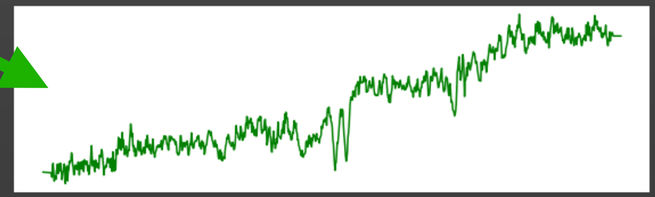


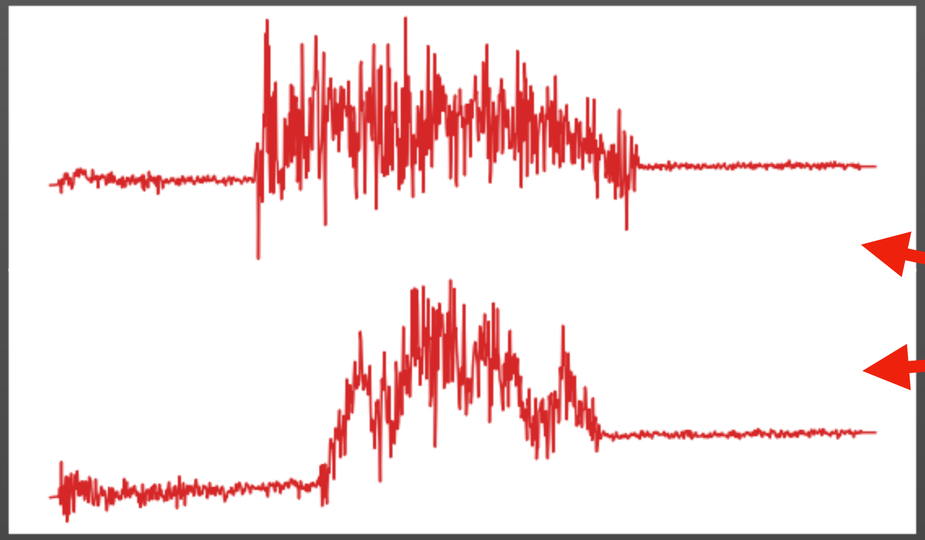
Stars

OII emitting galaxies

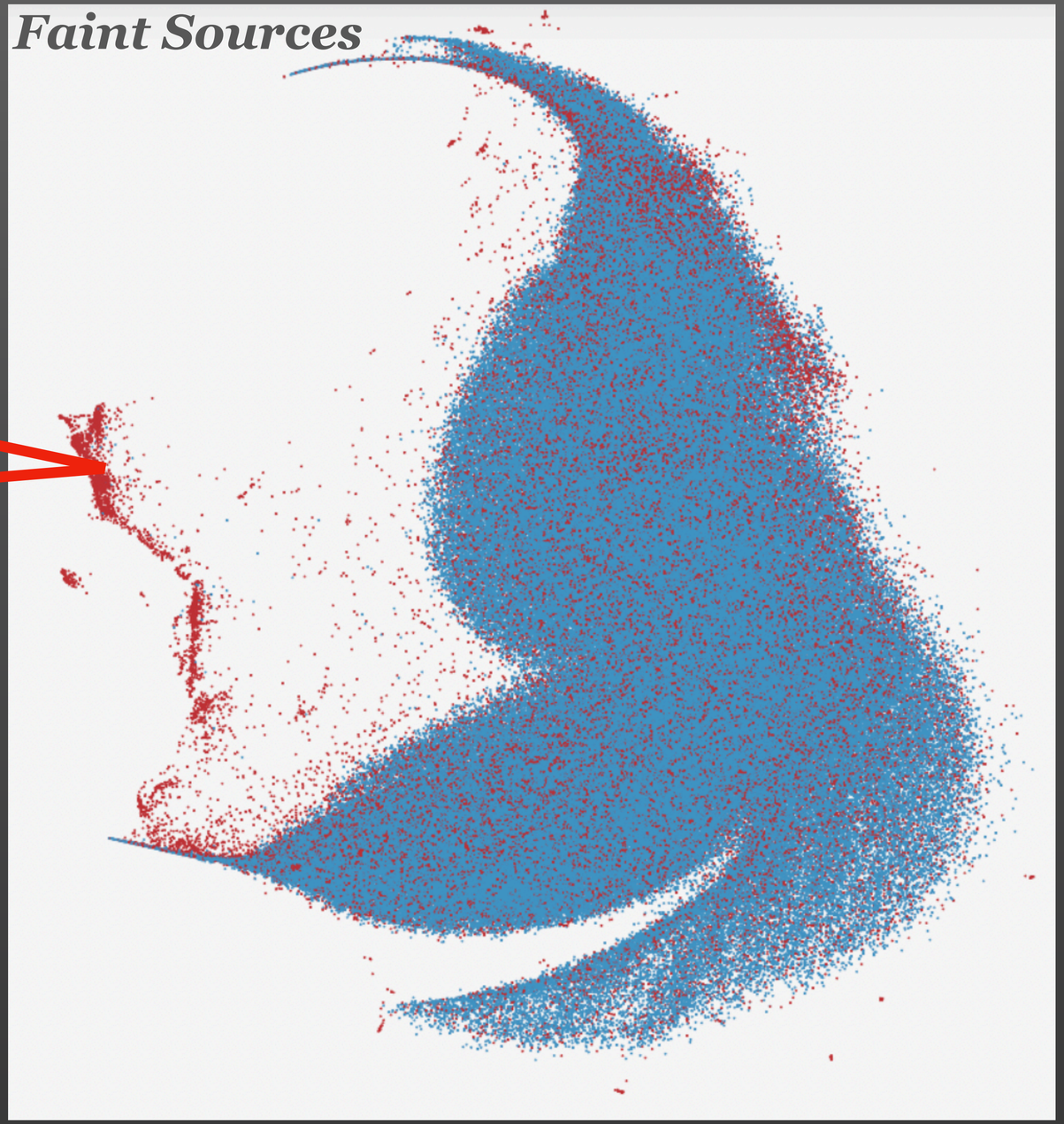


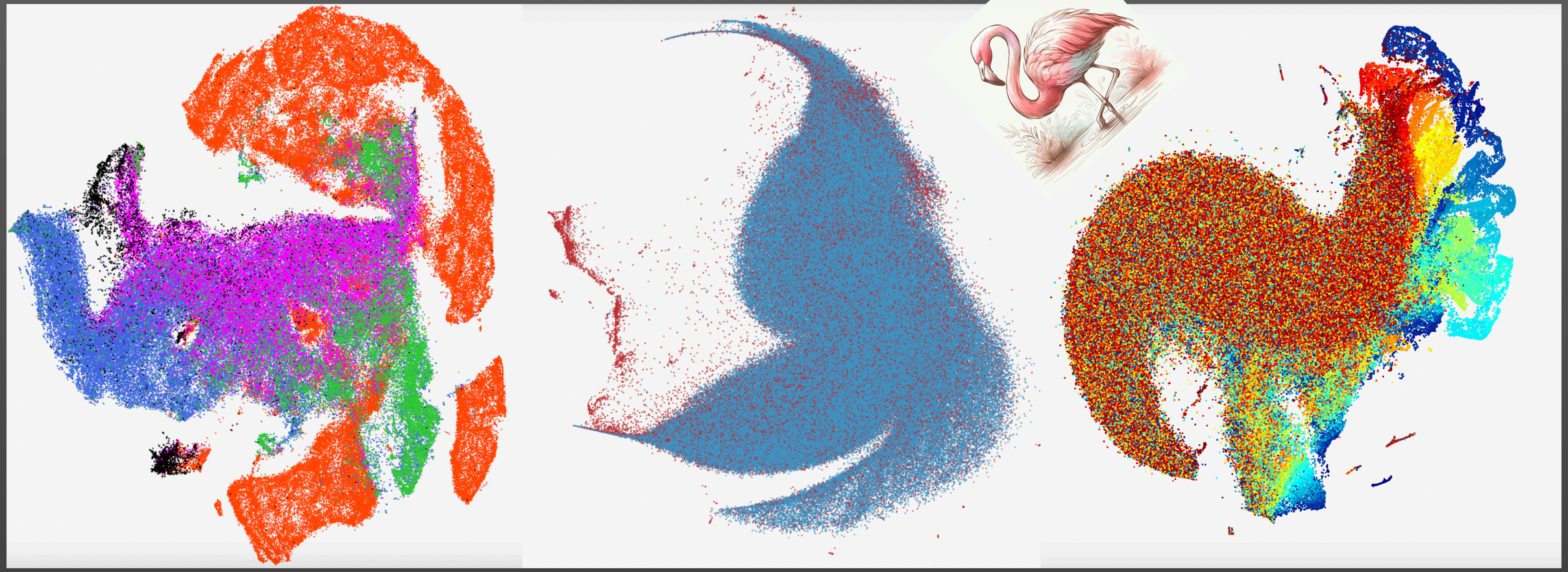
Nearby Galaxies





Artifacts





Data Visualization Helps us with

Categorization - Prediction - Removing artifacts - Going to fainter sources

Goal: Improve the accuracy of our Cosmological parameters by **~20%**

Thank You!