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Title:	Selecting experiments to better inform predictive models for the Mars rover
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Selecting experiments to better inform predictive models for the Mars rover

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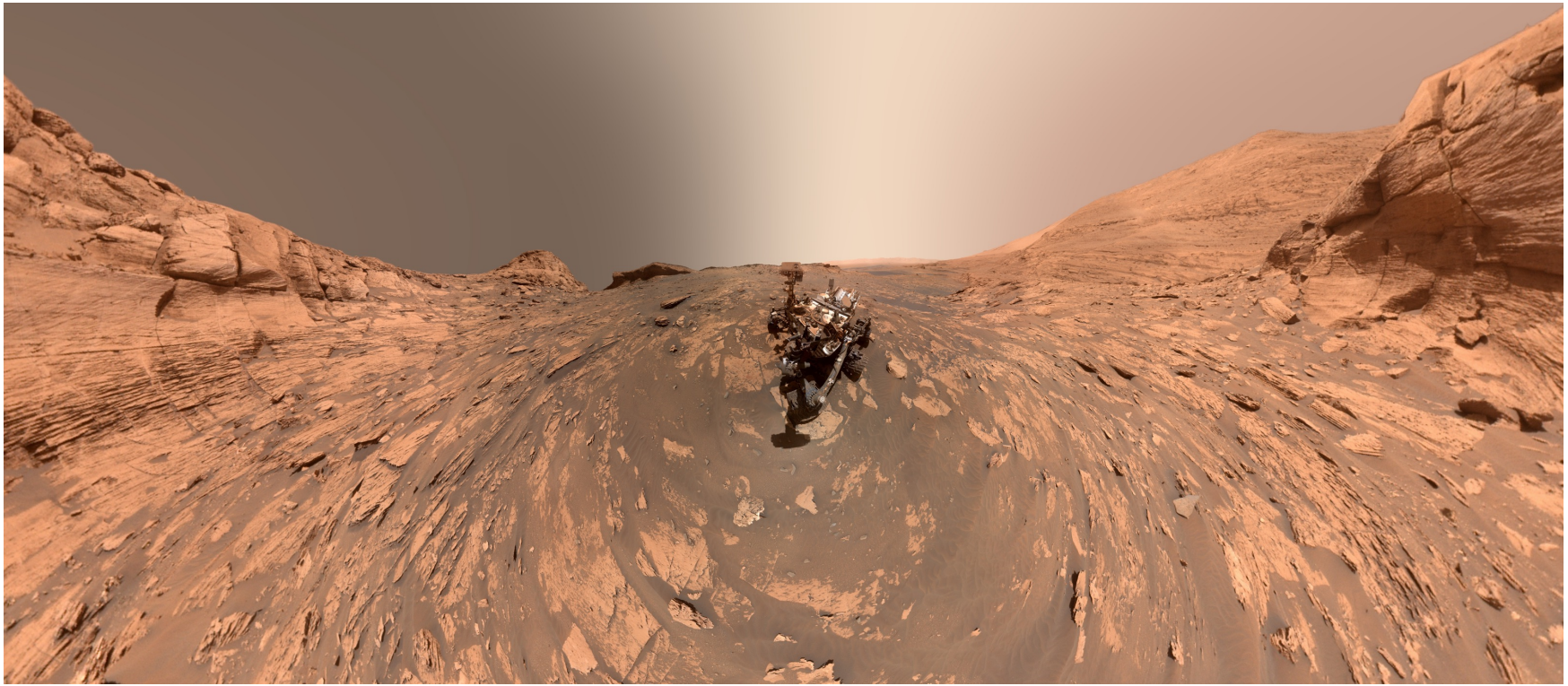
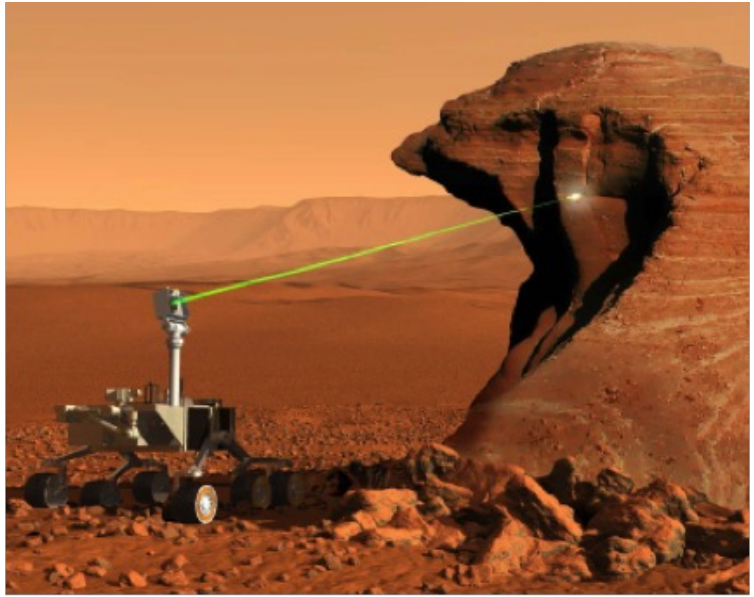
We want to explore and characterize Mars geologically, but we can’t go there or send back samples. (Yet.)

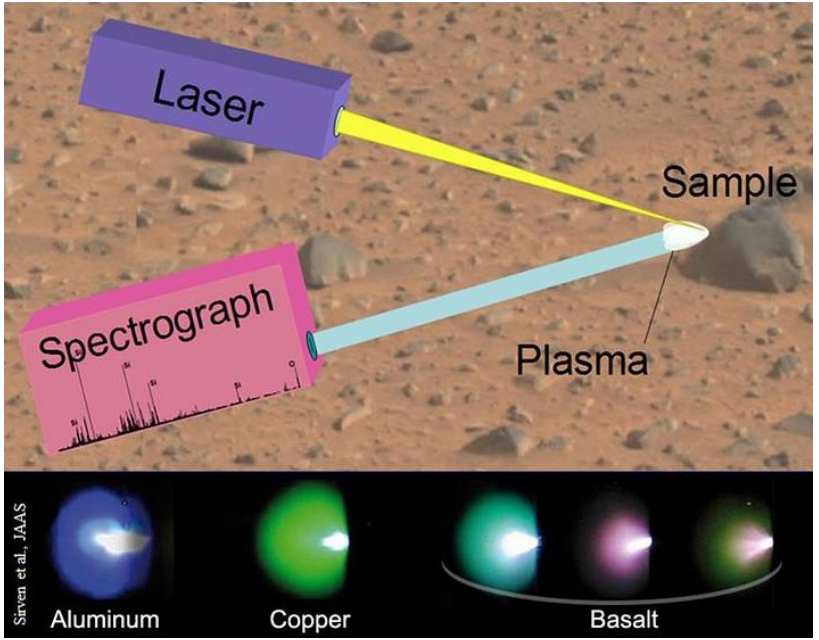


NASA/JPL-Caltech/MSSS

ChemCam is a laser-induced breakdown spectroscopy instrument deployed on Mars for over 3,600 sols.

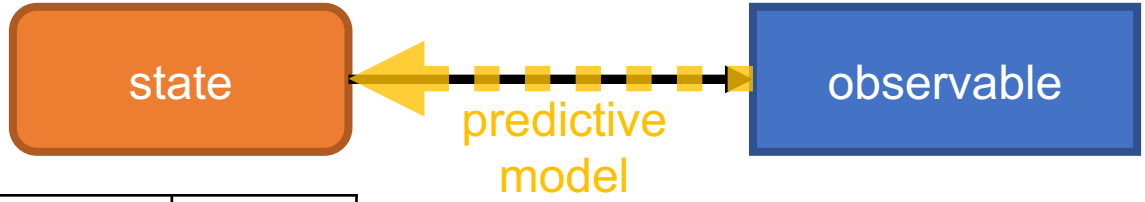


Images: NASA/JPL-Caltech/LANL; Sirven et al 2007

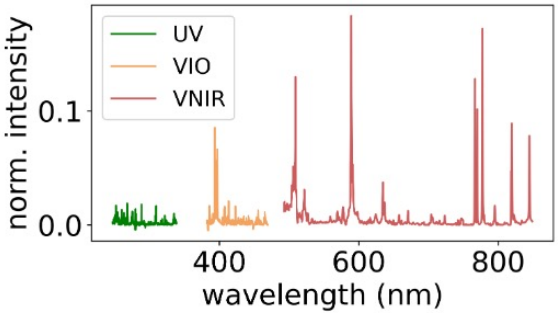


Statistical learning models are trained to predict composition from spectral observations.

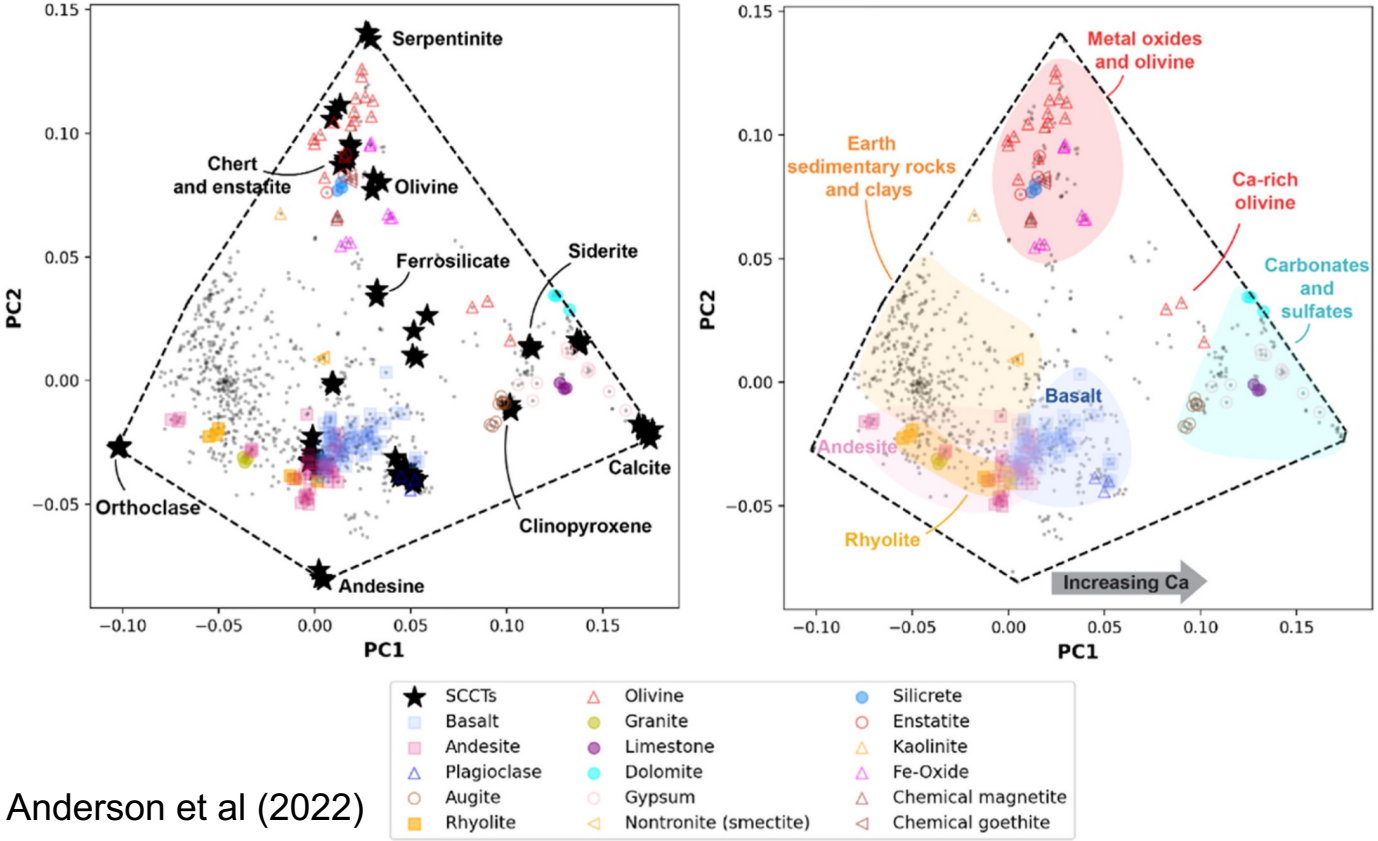
But what is the training data???



Oxide	Weight %
SiO_2	58.2
MgO	9.8
CaO	5.1
…	…



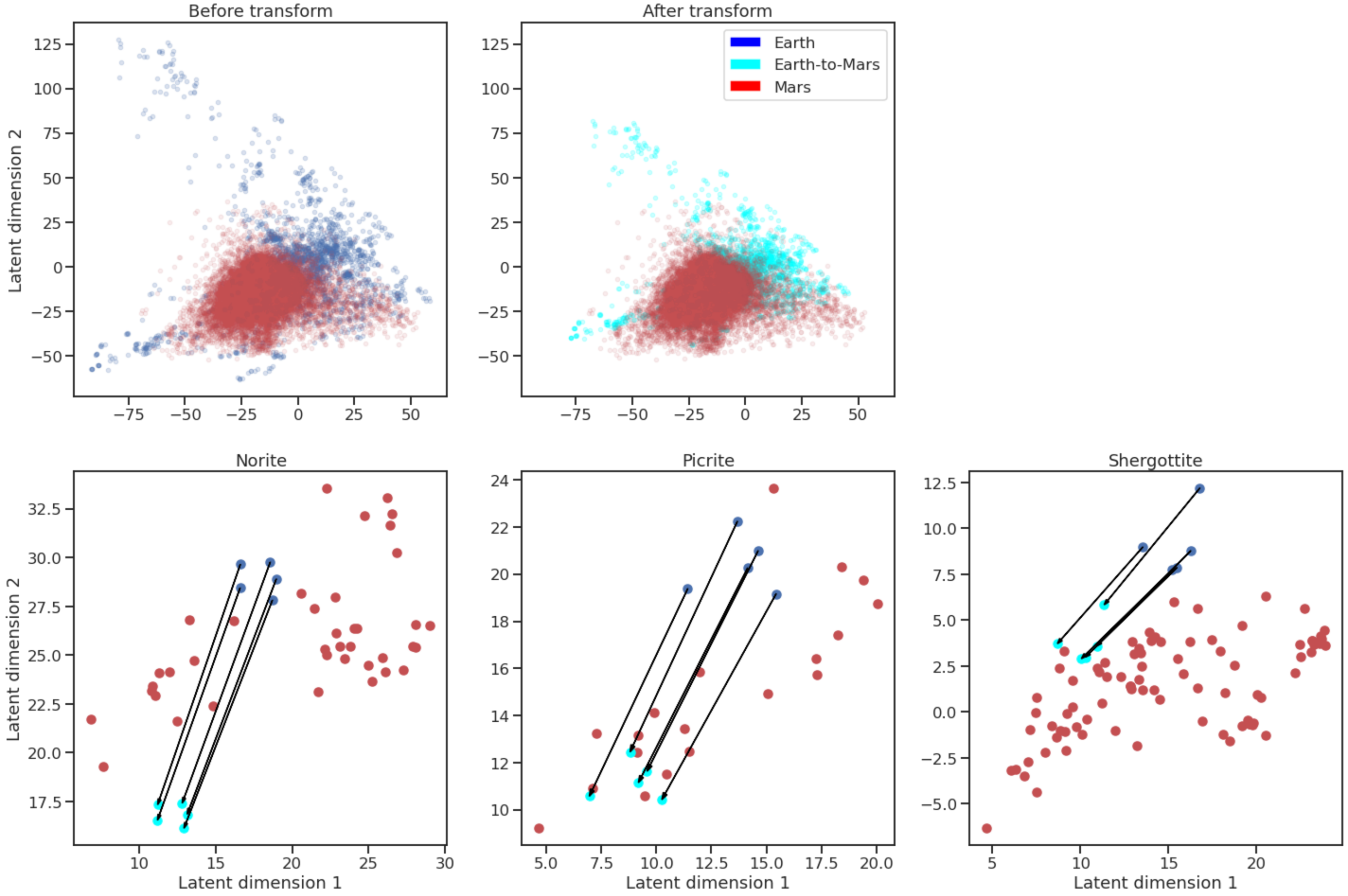
Spectral training sets are created by measuring known targets in the laboratory on Earth.



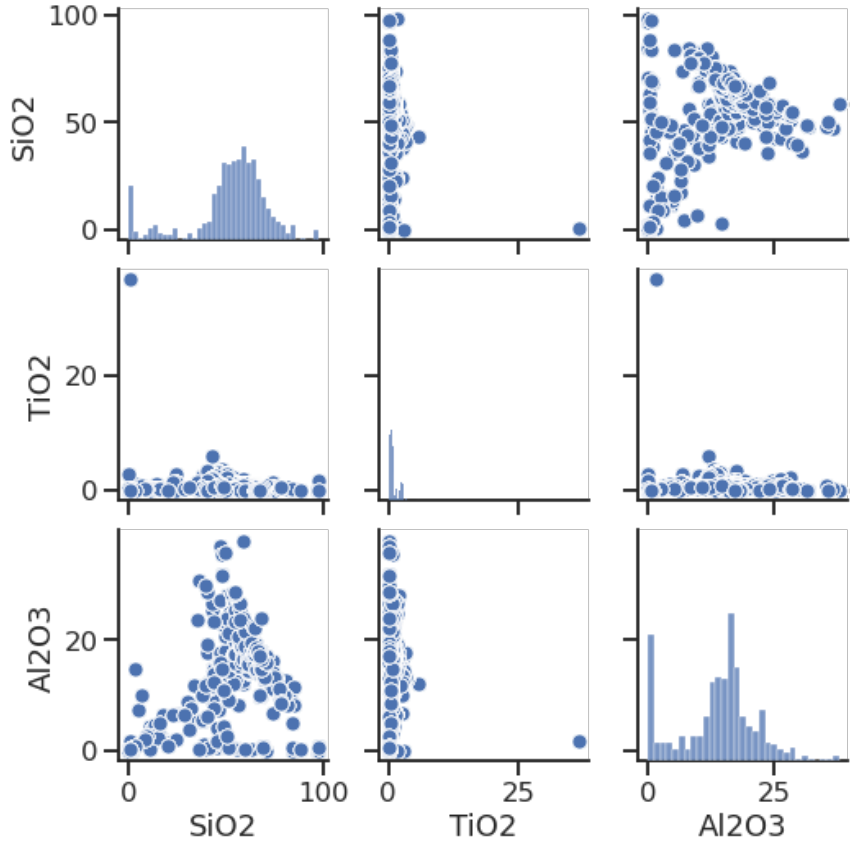
Anderson et al (2022)

We have very little labeled data from Mars, limited to a set of calibration targets mounted on the rover.

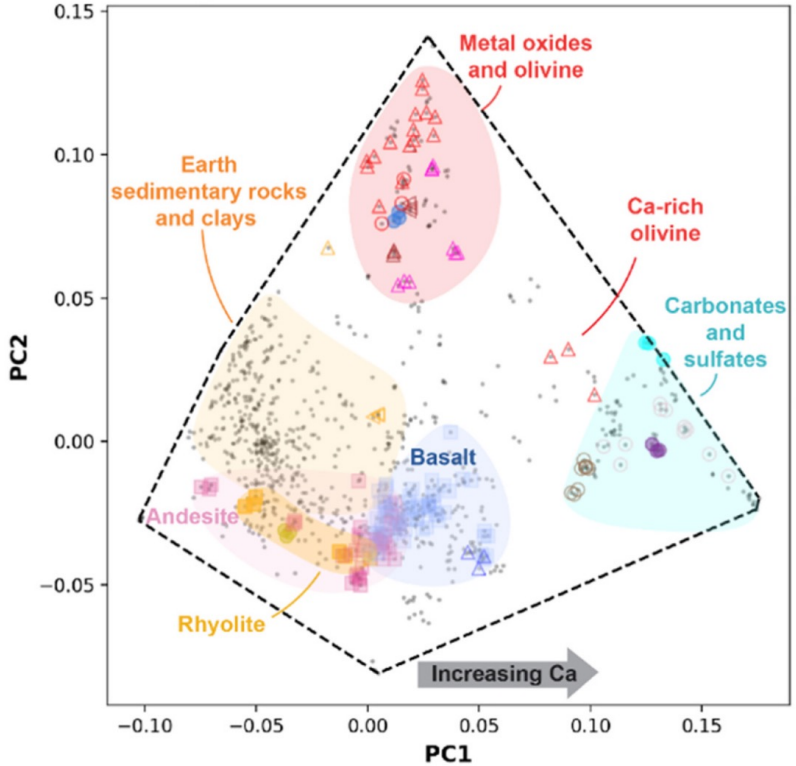
Question 1: how well do the current Earth and Mars samples align?



Question 2: how do empirical distributions of the training library in composition space affect the models?



Question 3: if we could collect more training data on Earth, which samples would most impact the models?



Anderson et al (2022)

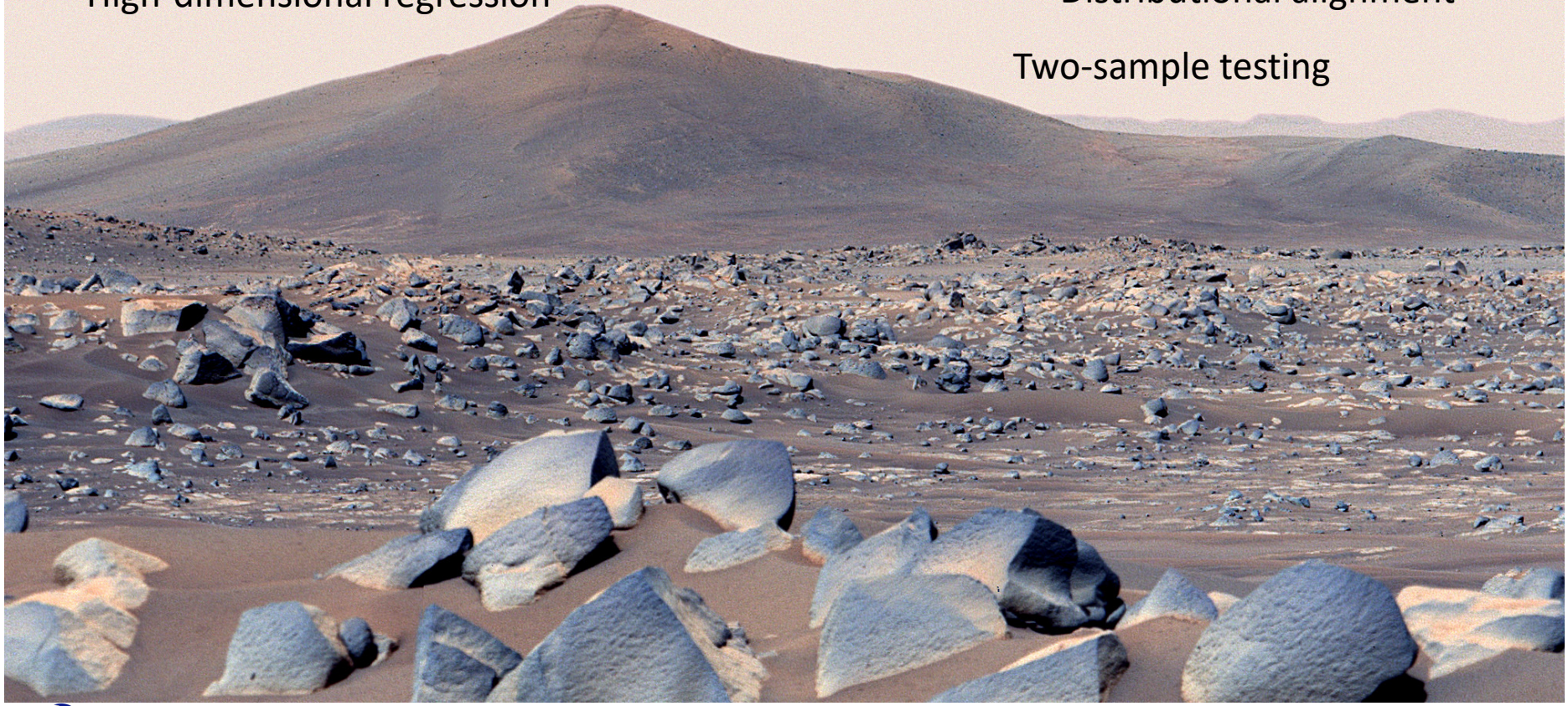
Statistical learning

High-dimensional regression

Active learning and experimental design

Distributional alignment

Two-sample testing



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