

Class 6: Geostatistics

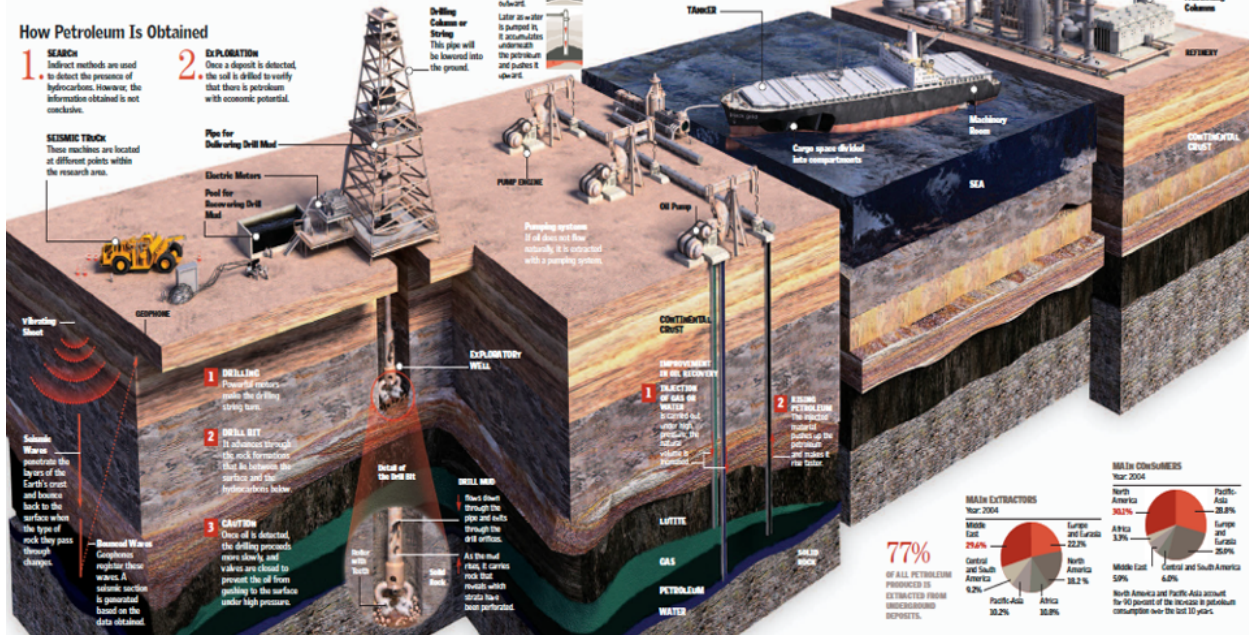
1. Introduction

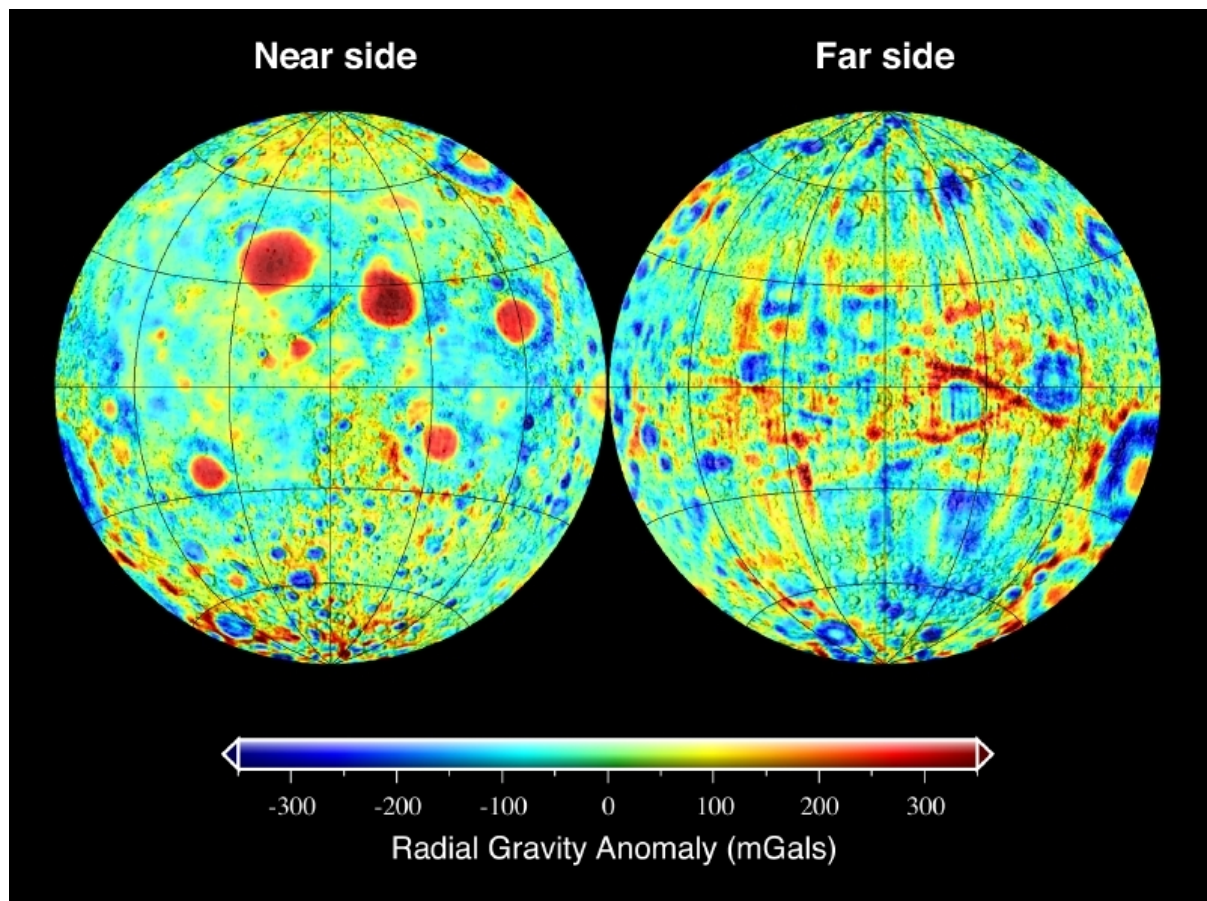
- What is geostatistics?
- Typical Questions
- Examples (Mining/Drilling; Seafloor topography – GeoMapAPP; lunar gravity)

Mining

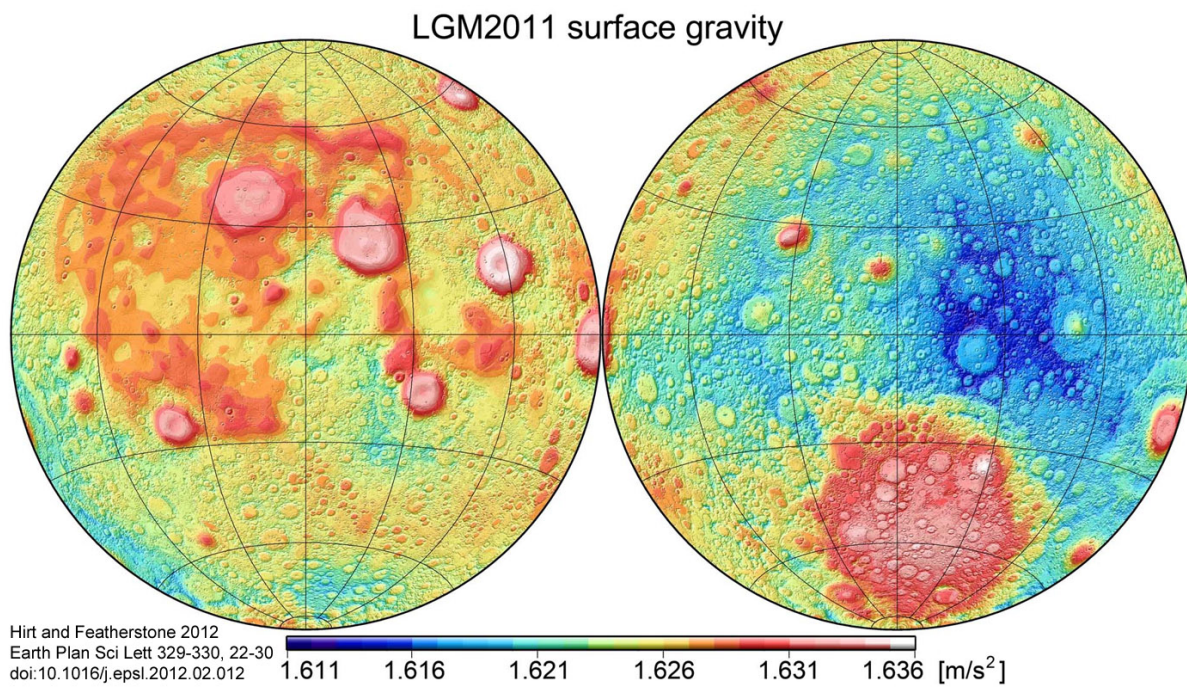
Black Gold

Because of its economic importance as a source of energy, petroleum, or oil, is called black gold. Searching for it requires large amounts of money and years of investigation and exploration, all with no guarantees. Once discovered, petroleum extraction entails the use of expensive machinery, which includes everything from oil pumps to refineries that convert oil into many derivative products. The oil trade is one of the most lucrative businesses worldwide, and a change in its price can affect national economies and put whole countries on guard. Petroleum is a nonrenewable source of energy.





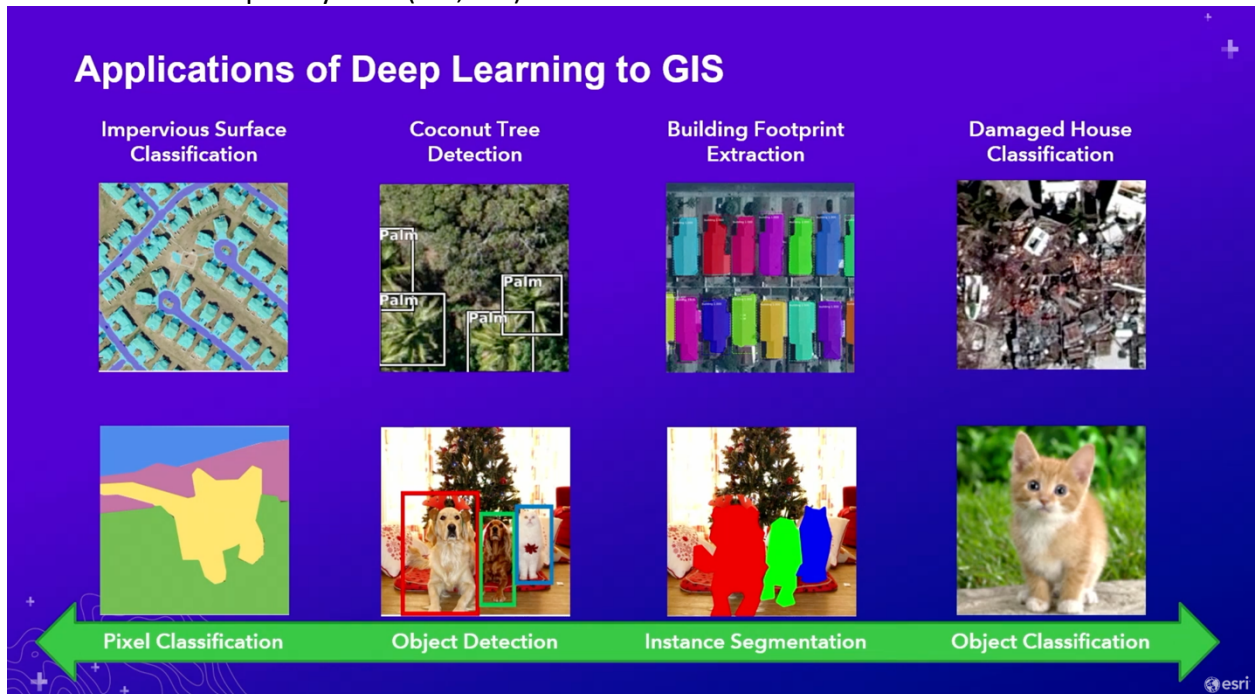
Lunar gravity field based on Lunar Prospector (no farside data).



Lunar gravity field based on GRAIL mission.

2. Spatial Variability Sources and Spatial Prediction Model

- Deterministic (Mechanical) model
- Statistical model (i.e., kriging)
- Data-driven expert system (ML, NN)



3. Deterministic Method

- Inverse Distance Weighted Interpolation
- Natural Neighbor Interpolation
- Spline Interpolation (e.g., Spherical Abel-Poisson)

4. Geostatistical Model (i.e., Kriging)

- Ordinary Kriging
 - Variogram Modeling
 - Variable prediction (minimum variance unbiased estimator)
 - Kriging variance
 - Isotropy
- Moving window
 - Example (RBA)
- Regression Kriging

5. Kriging in the Bayesian inference framework

References:

1. Cressie, Statistics for Spatial Data
2. Tomislav Hengl, A Practical Guide to Geostatistical Mapping
3. Geostat 2014 Bergen Workshop:
<https://www.youtube.com/playlist?list=PLxVwQCAyQyxdtkkjayMNV479UBPhls5z>

4. [https://wiki.52north.org/AI_GEOSTATS/SoftwareGeostatistical \(including Vesper](https://wiki.52north.org/AI_GEOSTATS/SoftwareGeostatistical_including_Vesper) that I have tried: <https://precision-agriculture.sydney.edu.au/resources/software/>)
6. GeoENV Conference: <https://2020.geoenvia.org/#important-dates>
7. GEOSTAS Conference: <http://www.geostats2020.com/home.html>