Abstract Submitted
for the 4CS20 Meeting of
The American Physical Society

A Deep Neural Network Approach to the Inversion of Gravity and Cosmic Ray Muon Data for Shallow Subsurface Density Prediction[1]

KATHERINE COSBURN, BRADY SPEARS, MOUSUMI ROY, University of New Mexico — Estimating subsurface density is important for imaging and monitoring many geologic structures, such as volcanic edifices, reservoirs and aquifers. Muon tomography has been used in recent years to complement traditional gravity measurements in Bayesian joint inversion techniques as an effective method for probing shallow subsurface density variations. Also in recent years, the use of deep learning to address complex inverse problems in the geosciences has gained increasing attention, particularly in the field of seismology. Using deep neural networks on the inversion of gravity and muon data, however, has yet to be explored and we present a first study here. In this study, we examine the results of a deep learning model on sets of noisy synthetic gravity and muon data, which are generated based on theoretical knowledge of the forward kernels that relate these datasets to density. The deep learning model is trained with a suite of possible density values and variation patterns and its accuracy is determined by comparing against the known forward calculation. After testing our neural network on a toy model structure, we use an optimized placement of muon detectors and gravimeters on real topography to test the feasibility of our model for use by geologists in the field.

[1]Funding provided by NSF Advance

Katherine Cosburn
University of New Mexico

Date submitted: 23 Sep 2020 Electronic form version 1.4