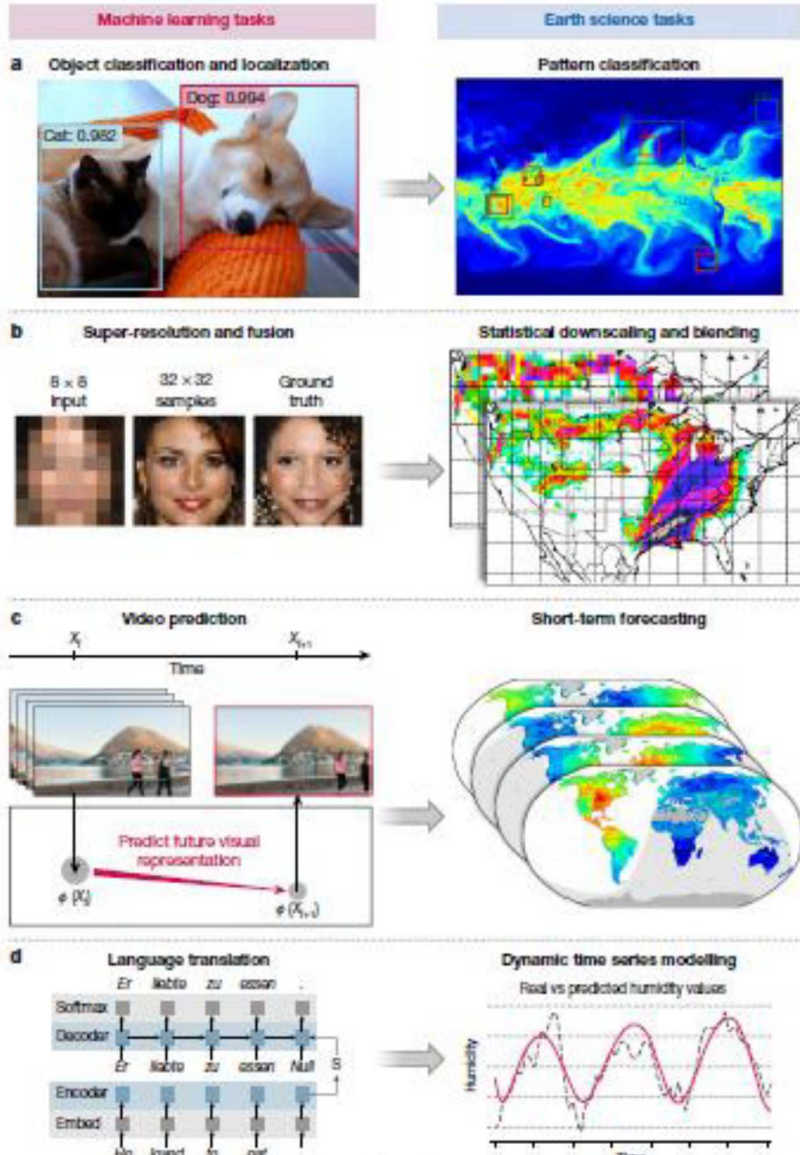


# Machine Learning R&D in Earth Science and Beyond

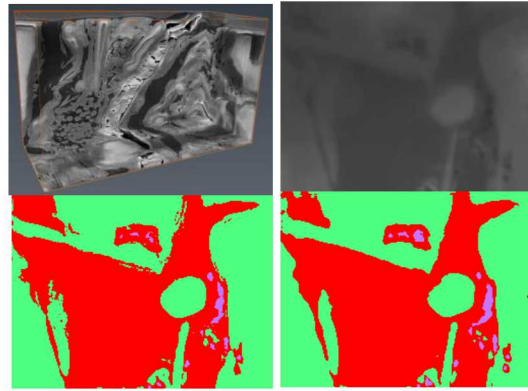
Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration. SAND2020-5057PE 13525.

Hongkyu Yoon (8864, Geomechanics)



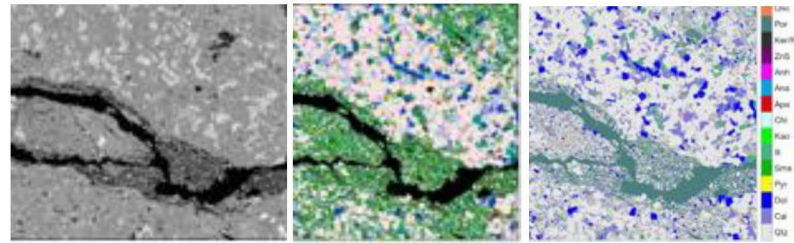
Reichstein et al. (2019, Nature)

Shale 3D FIB-SEM, One slice image, manual & ML segmentation

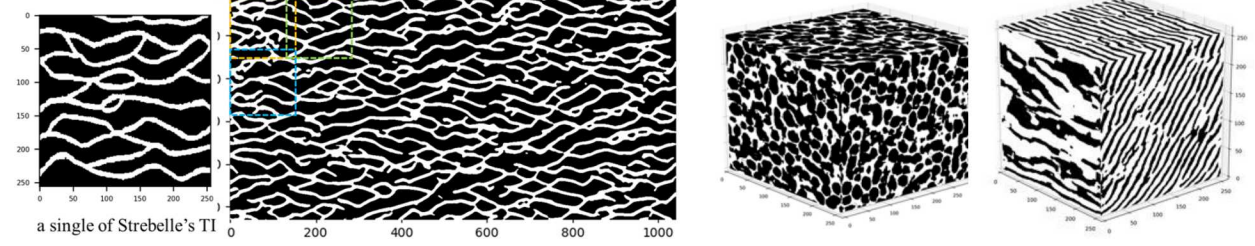


**Convolutional Neural Network**

Shale mineral multilabel classification

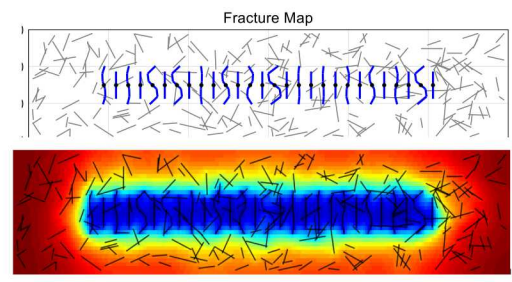


Training image Segments: 144 by 144 (overlapping 16 pixels) Generated image Generated 3D image

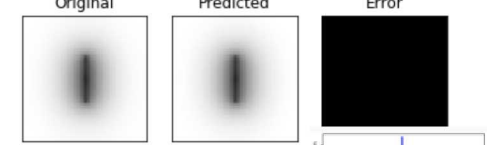


**Generative Adversarial Networks**

**ML for high fidelity numerical simulations**



**Shale gas production & pressure distribution**



**Supervised (CNN) & Unsupervised clustering**

