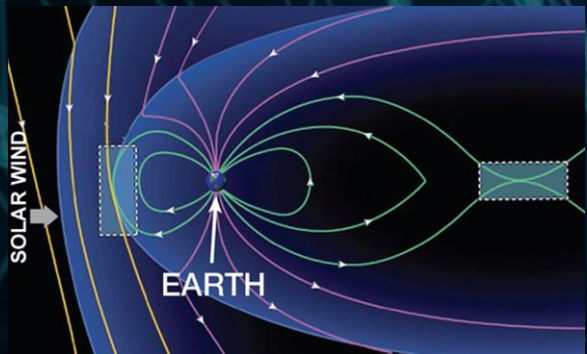


Case Study of Applying Neural Networks to Remove Non-Linear Instrument Noise

ML-Helio 2019
Amsterdam, Netherlands

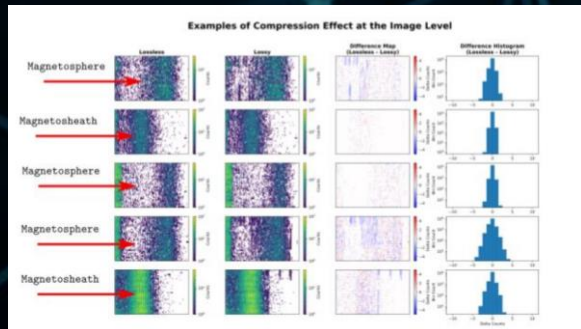


D. da Silva [1,2,3], A. Barrie [2,4], D. Gershman [2], J. Dorelli [2], B. Giles [2], B. Paterson [2]
[1] Johns Hopkins University [2] NASA/GSFC [3] Trident Vantage Systems [4] Aurora Engineering



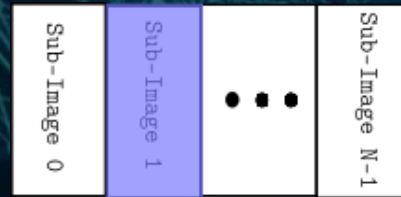
MMS Mission Studies magnetic reconnection in the Earth Geospace environment

Image Compression on-board creates significant artifacts in measurements of plasma distribution functions for small fraction of data



Task: Remove Lossy Compression Artifacts

Correction Model: Image-2-Image NNet Transformation



Model is applied on sub-images (patches) individually to minimize hidden layer size

Input Image

Single-Layer Neural Network

Output Image



Input:

Flattened Sub-Image Pixels

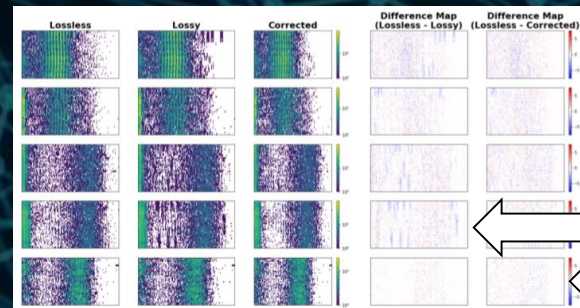
Output:

Flattened Sub-Image Pixels

Model Specs:

- Number of Hidden Layers: 1
- Hidden Layer Size: 1024
- Activation: RELU
- Optimization: ADAM
- Library: Sci-Kit Learn

Correction Example



Before
After

Interpretation:

$$y(x) = B\sigma(Ax + a) + b$$

Output image (y) is combination of basis functions (columns of B) with weights equal to hidden layer values

