NESSF Proposal Review

Evaluation of New Proposal

Proposal Number: 17-HELIO17F-0034

Proposal Title: Neural Networks for Computer Tomography Imaging Spectroscopy of the Solar Atmosphere

Institution: Montana State University

Student: Roy Smart

Faculty Advisor: Charles Kankelborg

Brief Description of Research:

To exploit innovative datasets from Montana State University rocket experiments, the student would develop computer tomography imaging spectroscopy tools using neural networks. These new methods will allow unprecedented data to be obtained of solar explosive events, one of the main direct signatures of magnetic reconnection in the quiescent solar atmosphere.

Scoring Guidelines
(Check Only One Box For Each Criteria)

Criterion Description: **Scientific and Technical Merit of the Proposed Research**
Criterion Score: ☒ Excellent = 5 ☐ Very Good = 4 ☐ Good=3 ☐ Fair =2 ☐ Poor =1

Criterion Description: **Relevance of Proposed Research to NASA Earth or Space Science Objectives**
Criterion Score: ☒ Excellent = 5 ☐ Very Good = 4 ☐ Good=3 ☐ Fair =2 ☐ Poor = 1

Criterion Description: **Academic Qualifications and Performance of the Student**
Criterion Score: ☒ Excellent = 5 ☐ Very Good = 4 ☐ Good=3 ☐ Fair =2 ☐ Poor =1

Scoring Guidelines

Excellent: A comprehensive and thorough proposal of exceptional merit. One or more major strengths. No major weaknesses or only minor correctable weaknesses.
Very Good: Demonstrates overall competence. One or more major strength and strengths out balance any weaknesses. Any major weaknesses are correctable.
Good: Reasonable sound response. There may be strengths or weaknesses, or both. As a whole, weaknesses, not offset by strengths, do not significantly detract from the offeror's response. Major weaknesses are probably correctable.
Fair: One or more weaknesses. Weaknesses have been found that out balance strength. Major weaknesses can probably be improved, minimized, or corrected.
Poor: One or more major weaknesses which are expected to be difficult to correct, or are not correctable.

Narrative Evaluation Strengths:

The proposers have obtained exciting and innovative datasets that hold the promise to shed light on the detailed workings of explosive events in the solar atmosphere. Since these events are thought to be caused by magnetic reconnection, detailed studies of their spatio-temporal evolution as a function of wavelength would shed light on the physical mechanisms involved in reconnection (e.g., plasmoid instability,…), something that is not straightforward to do with currently available data from other instruments.
The sounding rocket data the proposers have access to is very interesting but has proven difficult to interpret because of the convolution between the spatial and spectral domains. The proposed work deals with novel methods to "invert" the sounding rocket data using computer tomography. In particular, the proposers would use existing IRIS data to train neural networks and exploit these novel techniques to "invert" data from MOSES and ESIS (when it becomes available). Preliminary tests look promising. The proposed research has great relevance to the science goals of the Heliophysics division by helping develop novel analysis techniques to use innovative remote sensing to diagnose physical processes in the solar atmosphere.

Weaknesses:

One minor weakness is that the proposers state that current instruments (e.g., IRIS) lack the spatial/temporal resolution to properly resolve these dynamic events. However, they do not mention what kind of resolution is required to make progress in understanding these events, and why/how the data from MOSES/ESIS will be better than existing data from single-slit instruments.

Overall Evaluation: ☒ Excellent = 5 ☐ Very Good = 4 ☐ Good=3 ☐ Fair =2 ☐ Poor =1

Rationale for Overall Evaluation:

The proposer has access to innovative data and can build on more than a decade of experience with interpreting these types of data. The proposer has provided a solid rationale for the need for this work, and the method they will use is well described. The proposed method holds a lot of promise to make sense of this complex data, and may also impact other areas of solar physics.

	Reviewed by the Heliophysics Division	