Interpretable machine learning for high-speed, high-fidelity GEOS-Chem model simulations with uncertainty quantification

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The scientific concept that I will be utilizing is universal differential equations. Essentially, this approach involves using a standard set of differential equations to represent our understanding of a system. However, since our understanding of the system is often incomplete, the resulting model may not perfectly align with real-world observations. This is where the process of model validation and refinement comes in, which involves comparing the predictions of the model to real-world data and adjusting the model as necessary. In context of my proposed project, I will be applying this concept to the Geos-Chem model and satellite data observations.

Geos-Chem model is used to simulate atmospheric chemistry and transport on a global scale. Despite the impressive capabilities of this model, it is not without its limitations. As I mentioned before, the model is built based on our available knowledge and not capable of perfectly aligning with the satellite observations, which might lead to inaccurate prediction of the atmospheric chemistry and transport. To address this discrepancy, I will be incorporating a neural network into the Geos-Chem-Adjoint model. By training this neural network, we aim to improve the accuracy of the model's predictions and better align them with the observed data.

The informatics program includes the area of Data Analytics & Information Visualization, and the research project I will be working is driven by numerous satellite data combined with advanced machine learning methods, which is aligned with the research themes of this area. Drawing from my previous knowledge acquired through machine learning courses, I am eager to enroll in more advanced courses in the fields of machine learning and information science. This will enable me to strengthen my skills and delve deeper into my research topic. Thus, the Informatics is the correct program to pursue my PhD.