**Towards CFD Fault Detection and Resolution Scaling with Machine Learning**

By: Adam Good, Lissa Moore, Howard Pritchard, Garrett Kenyon

**Abstract**:

Computational Fluid Dynamics (CFD) is a powerful technique that has resulted in many benefits to society, including the creation of accurate climate models and preventing aneurism ruptures with improved endovascular coil designs. CFD calculations take significant time to run and usually rely on high performance computing clusters. Unfortunately, this leaves these simulations vulnerable to computational faults which may cause errors in output. We aim to improve and harden CFD calculations by applying various machine learning techniques for image/video anomaly detection, scaling, and reconstruction. We will begin by applying machine learning to CFD visualizations at varying resolutions with computational faults injected using the PINFI tool as a proof of concept, and plan to fine-tune the most promising techniques to work on raw numeric CFD data. Our first step is to build datasets appropriate for our work via modifications to CLAMR, a testbed tool for simulating the shallow water problem using adaptive mesh refinement. At this point we have modified CLAMR to standardize simulation time in simulations at different resolutions, and are currently separating the domain of the simulation from the mesh resolution. Additionally, we have automated PINFI's injection process, and we are refining the injection process for efficiency and reliability.

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