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Ensemble Predictions of Wildfire Spread Through TPU-Compatible TensorFlow Acceleration[1] MATTHEW BONANNI, MATTHIAS IHME, Stanford University — Wildfire spread is a complex process that is sensitive to numerous environmental factors, making it difficult to simulate from first principles. Percolation models offer a simple framework in which to implement physical relationships derived from observations. This research presents a percolation-based wildfire spread model, weighted by environmental parameters such as fuel characteristics, wind, and slope. It is implemented using the TensorFlow machine learning platform, which provides useful data structures as well as an interface with Tensor Processing Units (TPUs). Originally designed for machine learning, these processors feature linear algebra optimizations, making them highly efficient for ensemble simulations. By formulating the model as a discrete convolution, this implementation can efficiency simulate heat accumulation and fire-spread dynamics. This additionally allows for a simple extension to compute multiple wildfire cases simultaneously. When there is uncertainty in input parameters, aggregate spread paths may be generated using multiple cases which span this uncertainty, thereby increasing confidence in the result.

[1]Computational resources were provided by Google through the TensorFlow Research Cloud (TFRC) program.

Matthew Bonanni
Stanford University

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