CHALLENGES AND OPPORTUNITIES FOR AI IN GEODOMAINS: CASE STUDIES OF GEOAI IN HYDROLOGICAL APPLICATIONS

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Over the last decade, artificial intelligence (AI), such as methods in machine learning and deep learning, has achieved tremendous success in computer vision and natural language processing. There is an growing anticipation of the same level of accomplishment of AI in geospatial domains (a.k.a. GeoAI). However, unique challenges exist such as the spatio-temporal autocorrelation, heterogeneity, teleconnection, missing domain physics and constraints, and paucity of ground truth. This poster presents our recent work that addresses some of these challenges. First, we develop a novel terrain-aware spatial machine learning model called hidden Markov contour tree (HMCT) for observation-based flood extent mapping. HMCT is a probabilistic graphical model with a contour tree structure to reflect the flow directions between locations on a 3D surface. Compared with existing AI models, our model achieved higher accuracy on high-resolution Earth imagery when the imagery has significant noise and obstacles (e.g., tree canopies). Second, to address the paucity of high-quality ground truth, we develop a novel weakly-supervised spatial learning framework that can train neural network parameters based on the noisy vector labels with registration uncertainty. The framework can also refine the vector labels at the same time. Preliminary results show that our framework outperforms baselines such as self-training in the application of National Hydrography Dataset refinement. The poster will also list future research directions, such as physics-informed GeoAI models and model robustness and interpretability.

PRESENTER BIO: Wenchong He is a Ph.D. student in Department of Computer and Information Science and Engineer at University of Florida. His research interests include spatiotemporal data mining and deep learning. He was a Ph.D. intern at the Los Alamos National Laboratory in Summer 2021 working on geophysical problem.