Science - Hydrology and Earth System Sciences; University of Texas Austin Researchers Provide New Data on Hydrology and Earth System Sciences [A graph neural network (GNN) approach to basin-scale river network learning: the role of physics-based connectivity and data fusion]

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2022 NOV 4 (NewsRx) -- By a News Reporter-Staff News Editor at Science Letter -- A new study on hydrology and earth system sciences is now available. According to news originating from Austin, Texas, by NewsRx correspondents, research stated, "Rivers and river habitats around the world are under sustained pressure from human activities and the changing global environment. Our ability to quantify and manage the river states in a timely manner is critical for protecting the public safety and natural resources."

Financial supporters for this research include Biological And Environmental Research; Advanced Scientific Computing Research.

Our news editors obtained a quote from the research from University of Texas Austin: "In recent years, vector-based river network models have enabled modeling of large river basins at increasingly fine resolutions, but are computationally demanding. This work presents a multistage, physics-guided, graph neural network (GNN) approach for basin-scale river network learning and streamflow forecasting. During training, we train a GNN model to approximate outputs of a high-resolution vector-based river network model; we then fine-tune the pretrained GNN model with streamflow observations. We further apply a graph-based, data-fusion step to correct prediction biases. The GNN-based framework is first demonstrated over a snow-dominated watershed in the western United States. A series of experiments are performed to test different training and imputation strategies. Results show that the trained GNN model can effectively serve as a surrogate of the process-based model with high accuracy, with median Kling-Gupta efficiency (KGE) greater than 0.97. Application of the graph-based data fusion further reduces mismatch between the GNN model and observations, with as much as 50 % KGE improvement over some cross-validation gages."

According to the news editors, the research concluded: "To improve scalability, a graph-coarsening procedure is introduced and is demonstrated over a much larger basin. Results show that graph coarsening achieves comparable prediction skills at only a fraction of training cost, thus providing important insights into the degree of physical realism needed for developing large-scale GNN-based river network models."

For more information on this research see: A graph neural network (GNN) approach to basin-scale river network learning: the role of physics-based connectivity and data fusion. Hydrology and Earth System Sciences, 2022,26():5163-5184. (Hydrology and Earth System Sciences - http://www.hydrology-and-earth-system-sciences.net/). The publisher for Hydrology and Earth System Sciences is Copernicus Publications.

A free version of this journal article is available at https://doi.org/10.5194/hess-26-5163-2022.

Our news journalists report that additional information may be obtained by contacting A. Y. Sun, **Bureau of Economic Geology**, University of Texas Austin, Austin, TX, United States. Additional authors for this research include P. Jiang, Z.-L. Yang, Y. Xie, X. Chen.

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