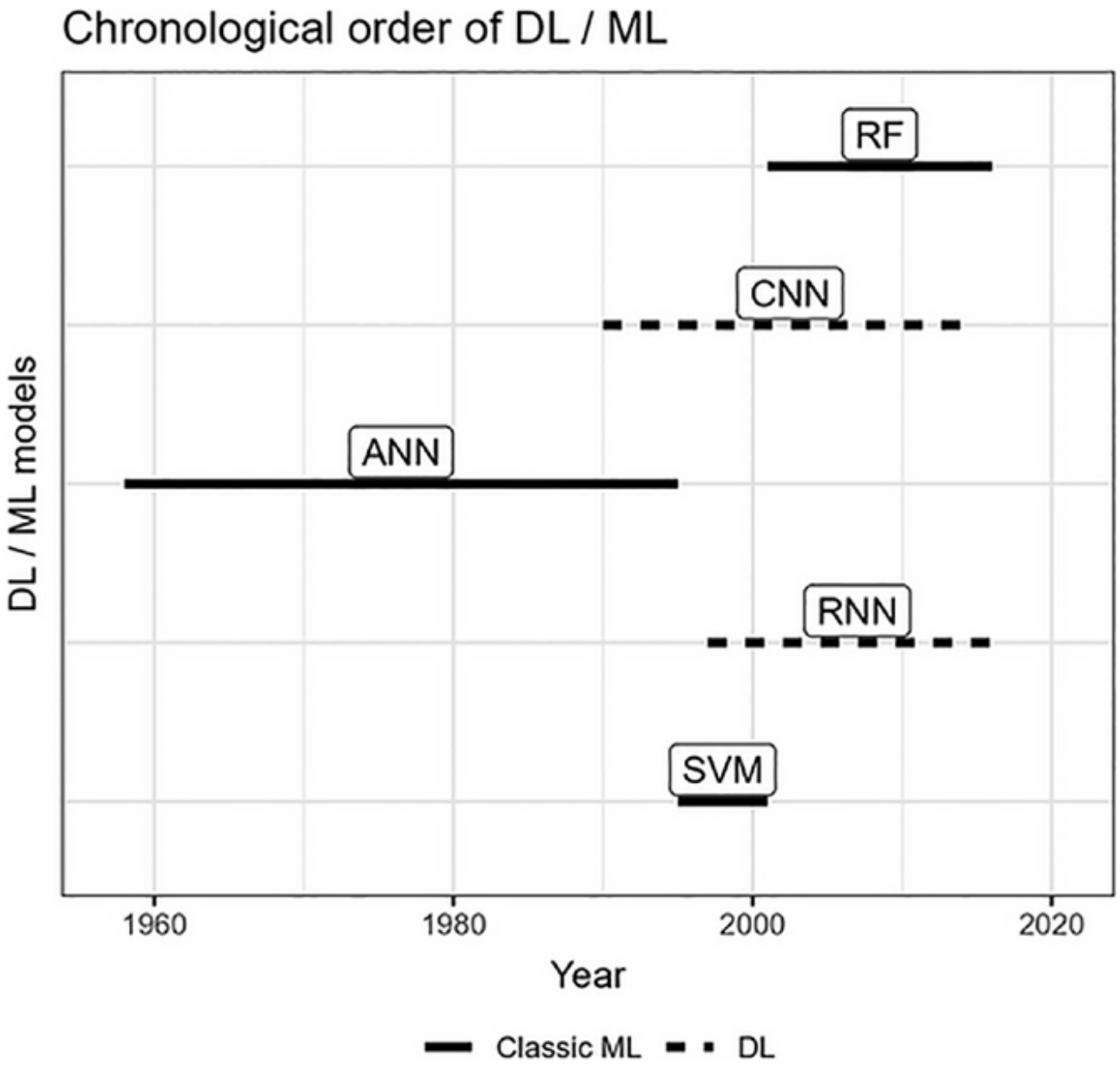
Science Societies

Machine-Learning Applications in Vadose Zone Hydrology

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Chronologic order of machine learning (ML)/deep learning (DL) development and their first application appearance in vadose zone/hydrology applications. CNN, convolutional neural network; RNN, recurrent neural network; ANN, artificial neural network; RF, random forest; SVM, support vector machine; LSTM, long short- term memory. Image from Li et al. (2024).

Machine-learning (ML) methods are often applied to assist scientists and engineers solve problems involving vast amounts of digital data. In the earth sciences, specifically for the research community studying vadose zone hydrology, the existence of large volumes of data collected from soils and deep vadose zones has provided the incentive for vadose zone scientists to begin utilizing the power of ML methods.

Researchers from the University of Minnesota reviewed the current state of ML methods as applied to vadose zone science. After reviewing more than 130 recent academic publications and demystifying the ML technical jargon, they summarized the ML progress in vadose zone research and identified a major trend in using traditional ML. The researchers recommend the vadose zone research community build readily accessible vadose zone relevant benchmark datasets in a fashion similar to the CAMELS dataset built by the watershed hydrology community for their ML research advancement. They also recommend promoting the development of knowledge-guided ML models that would incorporate vadose zone knowledge into the ML framework.

While it will be challenging to infuse vadose zone hydrology knowledge into ML designs, the outcome of such efforts will provide great benefits to the advancement of vadose zone science.

Adapted from

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