Modelling using Deep Learning

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Abstract

Machine learning, and in particular, deep learning has emerged as an important tool for advancing science, in addition to its broad based impact on the world. This talk describes three research efforts that illustrate how deep learning can complement modeling and simulation to pursue scientific discoveries and to tackle societal problems. We begin by describing a flood forecasting initiative that has already led to hundreds of thousands of alerts being sent to people in India. It utilizes a new hydrologic model that has been built using an LSTM (long short-term memory) architecture and a physics based inundation model whose effectiveness has been enhanced using machine learning methods. We also describe how self-supervised learning is being applied to study several interesting aspects of the organization of the human brain. The generated embeddings can be used to rapidly annotate new structures and develop new ways of clustering and categorizing brain structures based on purely data-driven criteria. Finally, we present a deep learning based modeling of human behavior in a specific game-based setting, which has very interesting implications if we are able to generalize that approach to broader settings.

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