Detecting climate signals with machine learning

We present a new approach to quantify the indicators of climate change using artificial neural networks (ANNs). The basic idea is to formulate the problem of finding indicators first as a prediction problem. Namely, given a global (or regional) temperature map averaged over a particular year, we train the network to predict the year to which the temperature map belongs. We use NCAR's CESM1 Large Ensemble and the CMIP5 ensemble for this purpose. By training the ANN to predict the year of each map, it learns to focus on the more reliable patterns of climate change across members while ignoring internal climate variability. The resulting indicator patterns are thus a non-linear combination of both the strength of the climate change signal as well as the local noise.