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Echo-State Networks for Predicting ENSO Beyond One Year

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Most forecasting schemes in the geosciences, and in particular for predicting weather and climate indices such as the El Niño Southern Oscillation (ENSO), rely on process-based numerical models [1]. Although statistical modelling[2] and prediction approaches also have a long history, more recently, different machine learning techniques have been used to predict climatic time series. One of the supervised machine learning algorithm which is suited for temporal and sequential data processing and prediction is given by recurrent neural networks (RNNs)[3]. In this study we develop a RNN-based method that (1) can learn the dynamics of a stochastic time series without requiring access to a huge amount of data for training, and (2) has comparatively simple structure and efficient training procedure. Since this algorithm is suitable for investigating complex nonlinear time series such as climate time series, we apply it to different ENSO indices. We demonstrate that our model can capture key features of the complex system dynamics underlying ENSO variability, and that it can accurately forecast ENSO for longer lead times in comparison to other recent studies[4].

Reference:

[1] P. Bauer, A. Thorpe, and G. Brunet, “The quiet revolution of numerical weather prediction,” Nature, vol. 525, no. 7567, pp. 47–55, 2015.

[2] D. Kondrashov, S. Kravtsov, A. W. Robertson, and M. Ghil, “A hierarchy of data-based enso models,” Journal of climate, vol. 18, no. 21, pp. 4425–4444, 2005.

[3] L. R. Medsker and L. Jain, “Recurrent neural networks,” Design and Applications, vol. 5, 2001.

[4] Y.-G. Ham, J.-H. Kim, and J.-J. Luo, “Deep learning for multi-year enso forecasts,” Nature, vol. 573, no. 7775, pp. 568–572, 2019.