Artificial intelligence reconstructs missing climate information

Historical temperature measurements are the basis of global climate datasets like HadCRUT4. This dataset contains many missing values, particularly for periods before the mid-twentieth century, although recent years are also incomplete. Here we demonstrate that artificial intelligence can skilfully fill these observational gaps when combined with numerical climate model data. We show that recently developed image inpainting techniques perform accurate monthly reconstructions via transfer learning using either 20CR (Twentieth-Century Reanalysis) or the CMIP5 (Coupled Model Intercomparison Project Phase 5) experiments.


Scientific Scheme

Example

Evaluation

Reconstruction of HadCRUT4

When applied to HadCRUT4, our method restores a missing spatial pattern of the documented El Niño from July 1877 [SEE RED BOX]. With respect to the global mean temperature time series, a HadCRUT4 reconstruction by our method points to a cooler nineteenth century, a less apparent hiatus in the twenty-first century, an even warmer 2016 being the warmest year on record and a stronger global trend between 1850 and 2018 relative to previous estimates.

These results are promising enough to warrant further research into the reconstruction of missing climate information via image inpainting using partial convolutions in a DNN.

REFERENCE / ACKNOWLEDGEMENT

Guilin Liu, Fitsum A. Reda, Kevin J. Shih, Ting-Chun Wang, Andrew Tao, Bryan Catanzaro; Proceedings of the European Conference on Computer Vision (ECCV), 2018, pp. 85-100