Time Series Forecasting With LSTM Networks for ENSO Case

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Abstract

We applied LSTM networks to study ENSO case in this paper, which can been viewed as a time series forecasting problem on climate change field. We designed different experiments to testify the effectiveness of prediction models with different time series steps. the result showed that the LSTM networks have the ability to capture the long dependencies between the SST data, then forecast the ENSO phenomenon of 15~16 successfully, which show great potential as the supplement with the conventional prediction models, especially with longer multiple steps forecast ahead.

Introduction

1.reason of study ENSO and present situation;  
2.why deep learning（LSTM network） is suitable for this problem and present situation;

As one of the most influenced climate phenomenon, El Niño-Southern Oscillation (ENSO) has raised great research interests among academic field. Concretely, the predictable of ENSO is a very hot topic among meteorology

Problem Formulation

1.Prediction ENSO 🡪 using Nino 3.4 as the predictand;  
2.Predict Nino 3.4 🡪 a time series forecasting problem with multiple steps ahead.

Nino3.4 as the predictand

Predict ENSO 🡪 time series problem of predict Nino 3.4 index with multiply steps(the predictand).

Data and Model

Dataset Description

1.Data source 🡪   
<https://www.esrl.noaa.gov/psd/gcos_wgsp/Timeseries/Nino34/> （From 1870~2018 May, we use from 1870.01~2017.12 ）

2.Some data Analysis (why no need normalization and pre-processing)

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“The training sequences are sliding windows”

MIMO Time Series Forecasting

Introduction of multiple input and multiple output and why we need multiple steps for ENSO case.

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LSTM Networks

Brief introduction of LSTM networks

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Experiment

Tools introduction(Kears), parameter setting,metric(MSE)…

Compare with Convention Neural Networks

Detailed

Compare with Climate Models

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Prediction of ENSO during 2015~2016

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Conclusion

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Applied LSTM for ENSO case and compare the result with classical models, the result show great potential for this problem.

Works todo :

1.more complex data setting (considering the inner Dynamics mechanism) ;  
2. Single is not enough to cover all ENSO information, grid dataset is a optional;

References

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