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Author: Mr. Shashank Pathak
Geoforschungszentrum Potsdam, Germany

PREDICTION OF EARTH ORIENTATION PARAMETERS TIME-SERIES DATA USING MACHINE LEARNING MODELS

Abstract

Earth Orientation Parameters(EOP) are determined by Space Geodetic techniques which are then used for realization of the reference frames on Earth and space, precision orbit determination and satellite navigation as well as determination of Time systems among many other applications. The current data provided by international Earth Rotation and Reference Systems Service(IERS) is on a daily basis which is used to produce aforementioned applications. Technological advancements have now proven that a need for prediction of EOPs would be helpful as the need to improve our existing systems such as navigational, oceanic, atmospheric needs more accurate data to help humanity. However, the accuracy of the prediction even a few days in the future, is several times lower than the acceptable range of error margin. In order to achieve a predictive analysis of the EOPs a Machine Learning(ML) approach has been introduced with the help of modern day techniques which has proven to be of great success in the field of Machine learning and time series prediction analysis. Initial studies using the Long-Short Term Memory(LSTM) has shown promising results in the prediction, when an error analysis was performed using different error calculation methods including Root Mean Squared Error(RMSE), Mean Squared Error(MSE), the model accuracy with RMSE was at 0.00253 and MSE was 6.43003 which is an acceptable criterion to justify efficiency of the prediction modeling. It can be said that RMSE values between 0.2 and 0.4 shows that the model can relatively predict the data accurately. Transformers, a new hybrid ML technique is also introduced to find the relative adjustments which need to be done to accurately predict the six EOPs. Further analysis of the EOPs also introduces the geodetic techniques to bring the error rate in the acceptable margin of error.