Abstract No: 309 ***ICT, Mathematics and Statistics***

WEATHER FORECASTING USING DYNAMIC MODE DECOMPOSITION

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Weather forecasting is one of the most scientifically and technologically challenging problems around the world. Historical weather data is rich with important information, which can be used for weather prediction. In this paper, a method based on dynamic mode decomposition (DMD) was used for weather forecasting. DMD is a data-driven, matrix decomposition technique, which is developed using a linear Koopman operator concept. It is basically a modal decomposition algorithm that gives insight into the underlying dynamics of the system. The DMD algorithm can extract both spatial and temporal patterns of the weather data where existing methods are restricted to either of the patterns. This paper utilizes the capability of DMD to forecast the future response by learning the available historical weather data. The technique is illustrated considering daily temperature at seven sensor stations in Sri Lanka. The temperature values at sensor locations are reproduced using dynamic modes at dominant eigenvalues of the observation matrix. Root mean square error is calculated to measure the accuracy of the results. It was shown in this study that the error of the reproduced data at Kurunegala sensor station for 10 consecutive days is only 6%. Further, the DMD approach is a good candidate for weather forecasting and to find out natural disasters in advance.

Keywords: Dynamic mode decomposition, Koopman operator theory, Non-linear dynamical system, Numerical analysis, Weather forecasting