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Comparison of missing value imputation methods in time series: The case of Turkish meteorological data

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Abstract

This study aims to compare several imputation methods to complete missing values of spatio-temporal meteorological time series. For this purpose, six imputation methods are assessed with respect to various criteria including accuracy, robustness, precision and efficiency for artificially created missing data in monthly total precipitation and mean temperature series obtained from the Turkish State meteorological service. Among them simple arithmetic average, normal ratio (NR) and NR weighted with correlations are the simple methods; multi layer perceptron type neural network and multiple imputation strategy adopted by Monte Carlo Markov Chain based on expectation-maximization (EM-MCMC) are computationally intensive ones. In addition, we propose a modification in the EM-MCMC method. Besides using an accuracy measure based on squared errors, we proposed the correlation dimension technique of nonlinear dynamic time series analysis which takes spatio-temporal dependencies into account for evaluating imputation performances. Depending on the results obtained, EM-MCMC method can be suggested for estimating missing values in meteorological time series.

***Keywords** Correlation dimension, expectation-maximization algorithm, Monte Carlo Markov Chain, multiple imputation, nonlinear dynamic time series.*

Full report available upon request (sipan@metu.edu.tr)

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