World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:12, No:05, 2018

Application of Regularized Spatio-Temporal Models to the Analysis of Remote Sensing Data

Authors : Salihah Alghamdi, Surajit Ray

Abstract : Space-time data can be observed over irregularly shaped manifolds, which might have complex boundaries or interior gaps. Most of the existing methods do not consider the shape of the data, and as a result, it is difficult to model irregularly shaped data accommodating the complex domain. We used a method that can deal with space-time data that are distributed over non-planner shaped regions. The method is based on partial differential equations and finite element analysis. The model can be estimated using a penalized least squares approach with a regularization term that controls the over-fitting. The model is regularized using two roughness penalties, which consider the spatial and temporal regularities separately. The integrated square of the second derivative of the basis function is used as temporal penalty. While the spatial penalty consists of the integrated square of Laplace operator, which is integrated exclusively over the domain of interest that is determined using finite element technique. In this paper, we applied a spatio-temporal regression model with partial differential equations regularization (ST-PDE) approach to analyze a remote sensing data measuring the greenness of vegetation, measure by an index called enhanced vegetation index (EVI). The EVI data consist of measurements that take values between -1 and 1 reflecting the level of greenness of some region over a period of time. We applied (ST-PDE) approach to irregular shaped region of the EVI data. The approach efficiently accommodates the irregular shaped regions taking into account the complex boundaries rather than smoothing across the boundaries. Furthermore, the approach succeeds in capturing the temporal variation in the data.

Keywords : irregularly shaped domain, partial differential equations, finite element analysis, complex boundray
Conference Title : ICSSDA 2018 : International Conference on Computational Sciences, Statistics and Data Analysis
Conference Location : London, United Kingdom
Conference Dates : May 14-15, 2018