VirginiaTech
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Computer Science Seminar Series

National Capital Region

Scientific Data Mining and Its Applications in Tropical Cyclone Research

Speaker: Prof. Ruixin Yang
George Mason University

Friday, November 22, 2013
1:00PM- 2:00PM, NVC 325

Abstract

A few high level examples of scientific data mining application in Geoscience will be introduced first. And then the presentation will focus on association rule mining technique and its application to the analysis of intensity changes of North Atlantic tropical cyclones (TCs).

Since Rapidly Intensifying (RI) tropical cyclones are the major error sources in TC intensity forecasting, association rules are used here to facilitate the RI process of mining for candidate sets of conditions which have strong interactions with rapidly intensifying TCs. Compared to the relation analysis method, the technique of association rules can simply explore associations among multiple conditions. Our mining results identified a reduced predictor set with fewer factors but improved RI probabilities. That is, the RI probability with three conditions satisfied: low vertical shear, high humidity, and the TC being in an intensification phase is higher than that with five satisfied conditions including high sea surface temperature and an intensity far away from the maximum potential intensity in addition to the above three. Furthermore, in searching the "optimal" RI condition combinations, a special condition combination is found, which (high latitude, low longitude, the TC being in an intensification phase, an initial intensity far away from the maximum potential intensity, high steering layer value, and low relative eddy flux convergence) gives such a high RI probability that the combination can be considered as a sufficient condition for RI, which almost guarantees an RI will take place.

This study found that the data mining technique not only sheds light on the roles of multiple-associated physical processes in tropical cyclone development—especially in rapid intensification processes—but also will help improve TC intensity forecasting. This presentation will also discuss issues with data mining techniques for TC intensity investigations.

Biography: Ruixin Yang is Associate Professor of Department of Geography and GeoInformation Sciences (GGS) in College of Science at George Mason University. He received his PhD in Aerospace Engineering from University of Southern California. His research areas ranged from fluid dynamics, to astrophysics and general relativity, to data sciences, and then to data information systems, data analysis, and earth systems science. He led a team developing several data information systems for online data analysis and metadata services. Recently, his research focuses on exploratory data analysis and/or data mining with advanced data analysis methods to hurricane related earth science data. He can be reached at ryang@gmu.edu.