Announcing the Final Examination of Erman Cakit for the degree of Doctor of Philosophy

Time & Location: July 1, 2013 at 9:00 AM in ENG-II 312-L
Title: Investigating The Relationship Between Adverse Events and Infrastructure Development In An Active War Theater Using Soft Computing Techniques

The military recently recognized the importance of taking sociocultural factors into consideration. Therefore, Human Social Culture Behavior (HSCB) modeling is getting much attention in current and future operational requirements to successfully understand the effects of social and cultural factors on human behavior. There are different kinds of modeling approaches to the data that are being used in this field and so far none of them has been widely accepted. HSCB modeling needs the capability to represent complex, ill-defined, and imprecise concepts, and soft computing modeling can deal with these concepts.

To our knowledge, there are currently no studies on the use of any computational methodology for representing the relationship between adverse events and infrastructure development investments in an active war theater. This study investigates the relationship between adverse events and infrastructure development projects in an active war theater using soft computing techniques including fuzzy inference systems (FIS), artificial neural networks (ANNs), and adaptive neuro-fuzzy inference systems (ANFIS) that directly benefits from their accuracy in prediction applications. Fourteen developmental and economic improvement project types were selected based on allocated budget values and a number of aids at different time periods, urban and rural population density, and total adverse event numbers at previous month selected as independent variables. A total of four outputs reflecting the adverse events in terms of the number of people killed, wounded, hijacked, and total number of adverse events has been estimated. For each model, the data was grouped for training and testing as follows: years between 2004 and 2009 (for training purpose) and year 2010 (for testing). Ninety-six different models were developed and investigated for Afghanistan and the country was divided into seven regions for analysis purposes. Performances of each model was investigated and compared to all other models with the calculated mean absolute error (MAE) values and the prediction accuracy within Â±1 error range (difference between actual and predicted value). Furthermore, sensitivity analysis was performed to determine the effects of input values on dependent variables and to rank the top ten input parameters in order of importance.

According to the results obtained, it is concluded that the ANNs, FIS, and ANFIS are encouraging modeling techniques to predict the number of adverse events based on historical development or economic projects' data. When the model accuracy was calculated based on the MAE for each of the models, the ANN had better predictive accuracy than FIS and ANFIS models in general as demonstrated by experimental results. The percentages of prediction accuracy with values found within Â±1 error range around 90%. The sensitivity analysis results show that the importance of economic development projects varies based on the regions and population density in Afghanistan. For the purpose of allocating resources and development of regions, the results can be summarized by examining the relationship between adverse events and infrastructure development in an active war theater; emphasis was on predicting the occurrence of incidents and assessing the potential impact of regional infrastructure development efforts on reducing number of adverse events.

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The public is welcome to attend.