Time & Location: July 2, 2013 at 9:00 AM in ENG-II 312-L
Title: Modeling of Socio-Economic/Cultural Factors and Adverse Events in an Active War Theater Using Cellular Automata

The Office of Naval Research's (ONR) Human Social Cultural and Behavior (HSCB) program targets capability building through developing a knowledge base, building models and creating training capacity in order to understand, predict and shape human behavior among different cultures. This capability will allow subordinating kinetic operations and promoting non-kinetic operations for better governance of economic programs to spur development and efforts to address the grievances among the discontented from adverse events. These non-kinetic operations include rebuilding indigenous institutions' bottom-up economic activity and constructing necessary infrastructure since the success in non-kinetic operations depends on understanding and using social and cultural landscape. This study intends to support decision makers by building a computational model to understand economic and cultural factors and their effect on adverse events.

In this dissertation, the analysis demonstrates that the use of cellular automata has several significant contributions to support decision makers allocating development funds to better stabilize regions of higher adverse events risk, and to better understand the nonlinearity and complex socio-economic and cultural interactions with adverse events. Thus, this analysis was performed on a set of spatial data representing factors from social and economic data. In studying behavior using cellular automata, cells in the same neighborhood synchronously interact with each other to determine their next states, and small changes in one iteration yield to complex formations of adverse event risk after several iterations of time. The modeling methodology of cellular automata for social and economic analysis in this research was designed in two major implementation levels as follows: macro and micro level. In the macro-level, the modeling framework integrates population, social, and economic sub-systems. The macro level will allow model to use regionalized representations, and understand why the events have occurred. Macro level subsystems will support cellular automata rules to generate accurate predictions. Prediction capability of cellular automata is used to model the micro level interactions between individual actors, which are represented by adverse events.

The results of this dissertation demonstrate that cellular automata model is capable of evaluating socio-economic and cultural influences that result in change in adverse events and identifies location, time and impact of these events likely to occur. Secondly, this research states that the socio-economic and cultural influences have different levels of impact on each adverse event, which are number of dead, wounded and hijacked people. Third, this research finds that the socio-economic, cultural influences and adverse events happened in a district have impacts on adverse events that will happen in neighboring districts. For the scenario examined, developed cellular automata model is used to enhance the capability to understand and use human, social cultural and behavioral factors by generating what-if scenarios to find out the impact of different aid sectors to predict and shape adverse events. Lastly, adverse events that will happen on upcoming years are predicted to allow decision makers forecast responses to their actions.

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The public is welcome to attend.