2010 STUDENT CAPSTONE CONFERENCE

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Virginia Modeling, Analysis and Simulation Center Suffolk, VA

proceedings

MODELING • SIMULATION • VISUALIZATION



2010 STUDENT CAPSTONE CONFERENCE



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The Virginia Modeling, Analysis and Simulation Center 1030 University Boulevard • Suffolk, Virginia 23435



Invited Keynote Speakers

Dr. Agostino Bruzzone, University of Genoa Dr. Tuncer Ören, University of Ottawa

Conference General Chairperson

Kaleen Lawsure

Primary Sponsor

The Virginia Modeling, Analysis and Simulation Center

http://www.vmasc.odu.edu/ conferences/capstone2010.html



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Modeling, Simulation, and Visualization Student Capstone Conference

The Virginia Modeling, Analysis, and Simulation Center is pleased to provide the conference proceeding for the 2010 Modeling, Simulation & Visualization (MS&V) Student Capstone Conference.

This annual conference featured students from the ODU Modeling and Simulation graduate degree program and other national and international colleges or universities. The student research and projects submitted to the conference are central to MS&V. It is here that students are given a venue to present their research to members of the modeling and simulation community in academe, industry, and government. For many of our students these presentations serve as a culmination of their research and academic careers.

The 2010 conference facilitated five tracks and each track was assigned judges who voted for the first, second, and third outstanding project of that particular track. These students were recognized at the Capstone Banquet the evening of April 8th.

Also participating in the conference were faculty who have volunteered their time to impart direct support to their students' research by facilitating the various conference tracks, serving as referees for papers, serving as judges for each of the tracks, and providing overall assistance to this conference.

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speakers

MODELING • SIMULATION • VISUALIZATION

Dr. Tuncer Ören | University of Ottawa, Canada



Dr. Tuncer Ören is a Professor Emeritus of Computer Science at the School of Information Technology and Engineering of the University of Ottawa, Canada. His Ph.D. is in Systems Engineering from the University of Arizona.

His research interests include advanced methodologies for modelling and simulation, agentdirected simulation, cognitive simulation, failure avoidance, and ethics in simulation as well as body of knowledge and terminology of simulation.

He has over 400 publications including 21 books and proceedings. He contributed to over 370 conferences and seminars held in 30 countries.

Some of the positions Dr. Ören currently has within SCS (The Society for Modeling and Simulation International) are: member of the Board of Directors, VP Publications, AVP ethics, AVP student chapters, distinguished lecturer, and founding director of M&SNet.

Dr. Tuncer Ören's awards include "Information Age Award" from the Turkish Ministry of Culture, and Distinguished Service Award from SCS. Honors and distinctions include recognition by IBM as a pioneer of computing in Canada, invitations from United Nations, over 20 Who's Who citations, and plaques and certificates of appreciation from organizations including ACM, AFCEA, Atomic Energy of Canada, NATO, SCS, Turkish General Staff, and some universities.





Dr. Agostino G. Bruzzone | University of Genoa, Italy



Agostino G. Bruzzone began his engineering studies at the Italian Naval Academy with the Faculty of Pisa in 1984. After successfully completing this phase, he transferred to the University of Genoa where he earned his doctorate in Mechanical Engineering.

Since 1991, he has taught "Theories and Techniques of Automatic Control" and in 1992 he has become a member of the industrial simulation work group at the ITIM University of Genoa. Dr. Bruzzone has extensively utilized simulation techniques in harbor terminals, maritime trading and sailboat racing sectors. He worked on research projects involving innovative modeling, AI techniques and DOE (Design of Experiments); particular

attention was focused on the application of Neural Networks, GAs and Fuzzy Logic to industrial plant problems using Simulation and Chaos Theory.

Dr. Bruzzone has been actively involved in the scientific community for several years and served as Director of the McLeod Institute of Simulation Science (MISS), Associate Vice-President and Member of the Board of the SCS (Society for Modelling & Simulation International), President of the Liophant Simulation, Vice President of MIMOS (Movimento Italiano di Simulazione), Vice Director of M&S Net, Industrial Relation Chair in SCS Europe, Italian Point of Contact for the ISAG (International Simulation Advisory Group) and Sim-Serv. In addition, Dr. Bruzzone has written more than 150 scientific papers as well as technical and professional reports in partnerships with major companies (i.e. IBM, Fiat Group, Contship, Solvay) and agencies (i.e. Italian Navy, NASA, National Center for Simulation, US Army).

Dr. Bruzzone is presently Director of the Technical Council of "SIMulation applications in Management, PLanning & forEcaSTing" for the Society of Computer Simulation International. He is MISS DIPTEM Genoa Director for the McLeod Institute of Simulation Science (an Institution with over 28 Centers distributed worldwide: Brazil, China, USA, UK, Italy, France, Germany, Canada, Spain etc.). He is founder member and president of the Liophant Simulation. He is also a member of Who's Who, IEEE, IASTED, ANIMP, SCS, MIMOS, etc.

Agostino G. Bruzzone currently works in the Department of Industrial Production, Thermoenergy, Engineering and Mathematical Modelling (DIPTEM) at the University of Genoa as a Full Professor. He is active in the field of simulator-based applications for industrial plants, developing new methodologies and intelligent system integration techniques. As director of the Master Program in Industrial Plants for Genoa University, his courses include Project Management and Industrial Logistics, Management Engineering, Logistics & Production Engineering, Modelling & Simulation, and M&S for Biomedical Systems.

Presentation Tracks, Track Leaders, and Judges

Conference Tracks

General Science • • • • • • • •

Track Leader: Dr. Joshua Behr, VMASC

1) Dr. Hua Liu, Old Dominion University

2) Mr. Thomas Verna, Lockheed Martin

This track encompasses the use of modeling and simulation in the nonmedical sciences and is open to all science disciplines. Examples include, but are not limited to, ecology, evolution, paleontology, climate modeling, oceanography, biochemistry and behavior. Any application of modeling and simulation in the life sciences is a candidate for this track.

Homeland Security/Military • • • • • • • •

Track Leader: Dr. Barry Ezell, VMASC

1) Dr. Steven Bennett, DHS Office of Risk Management and Analysis

2) Mr. Richard Flannery, Hampton Roads Planning District Commission

3) Dr. Jennie Jastrzembski, TRADOC Operations Analysis & Evaluations Division

This track encompasses modeling and simulation that has been applied in either the military or homeland security domain. It will also include any work done in these domains that interfaces M&S capabilities with command and control systems and M&S work to support operations research, analysis, and visualization of military or homeland security systems or problems.



Medical M&S • • • • • • •

Track Leader: Dr. Gianluca DeLeo, VMASC/ODU College of Health Sciences

1) Mr. Robert J. Alpino, Eastern Virginia Area Health Education Center

2) Dr. Jeff Wilkinson, MYMIC

This track looks into various aspects of medical modeling and simulation from imaging capability to the augmented standardized patient (using augmented virtual reality). Modeling of physical systems, such as joints and muscles, the virtual operating room, and virtual reality for rehabilitation are also key to this application area. The development of simulators and the validation of those simulators will also be covered in this track.

M&S in Engineering • • • • • • • •

Track Leader: Dr. Rafael Diaz, VMASC

1) Dr. Hüseyin Sarper, Colorado State University

2) Mr. Jeff Laskowski, Lockheed Martin

This track focuses on M&S methodologies and applications in the broader domain of engineering. One aspect is that simulation more and more replaces the traditional experimentation and prototyping. The track looks for such M&S ideas and examples and necessary changes in these traditional disciplines. Examples are, but are not limited to, enterprise decision support, optimization, product design, testing, life cycle support, and more.

Transportation • • • • • • • •

Track Leader: Mr. Mike Robinson, VMASC

1) Ms. Amy Truesdell, Dewberry, Emergency Management & Homeland Security Branch

2) Dr. Jeff Adler, Open Roads Consulting, Inc.

This track includes applications of modeling and simulation to solving multimodal transportation problems. The development, validation, and application of microscopic and macroscopic traffic simulation, travel demand models, and hardware in the loop simulation are appropriate research topics for surface (road) transportation. Simulations of port facilities, railroads, and the air transportation system are also included in this track.













The Gene Newman Award for Excellence in M&S Research

The Gene Newman Award for Excellence in M&S Research was established in recognition of Mr. Eugene G. Newman for his tireless effort in advancing modeling and simulation education, research, and development.

Mr. Newman played a significant role in the creation of VMASC (in 1997) by realizing the need for credentialed experts in the M&S workforce in the military and in industry. His foresight has affected both the economic development and the high level of expertise in the M&S community of Hampton Roads.

Students receiving this first place award have proven themselves to be outstanding researchers and practitioners of modeling and simulation.











	1 st	Ilyas Ustun, Old Dominion University
	2 nd	Faisal Mahmud, Old Dominion University
	3 rd	Prakash Viswanathan , Old Dominion University
Medical M&S		
	1 st	Jacqueline Jackson, Old Dominion University
	2 nd	Deepak R. Joshi, Old Dominion University
	3 rd	Lydia Wigglesworth-Ballard , Old Dominion University
Homeland Security/M	ilitary	Elaine Blount Old Dominion University
	-	
	2 nd	Jessica Jones, Old Dominion University
	3 rd	Zachary Fenn, United States Military Academ
M&S in Engineering		
	1 st	Francesca Madeo, Federico Tarone, Universit of Genoa, Italy
	2 nd	Marshall Gangel, Old Dominion University
	3 rd	Matthew McClary, Raymond Vetter, Joseph V Dusen, Kurt Bujewski, United States Military Academy
General Science ——		
	1 st	Nick Drucker, Kenyth Campbell, Old Dominio University
	2 nd	Narisong Huhe, Old Dominion University
	3 rd	Surivan Saramul. Old Dominion University

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abstracts••••••

Homeland Security/Military • • • • • • • •

Modeling Arms Races: The Necessity of an Interdisciplinary Approach Jessica A. Jones

Abstract: The attention given to modeling arms races has dropped off in the literature since the end of the Cold War, yet the research is critical. There are a number of modeling methods appropriate for use in investigating arms races that span across many disciplines including economics, international relations theory, game theory, and decision-making. I advocate a renewed interest in modeling arms races to update the research as well as generate policy recommendations to increase the preparedness of the US to effectively and efficiently manage future arms races. Models to date have had limited success in mapping arms races because of their limited focus. Many qualitative models lack the strategic interaction component of game theory and, therefore, conclude with inconsistencies in their findings. A process of characterizing the conditions and constraints on various arms race scenarios will greatly improve the accuracy and efficiency of an interdisciplinary model. Integrating the risks associated with multiple nuclear false alarms into the model will further aid in highlighting the risks associated with arms races especially in a world where a growing number of nations are expanding their military capabilities. The use of an interdisciplinary model for assessing potential future conflict will aid in developing preparation and policy options for US involvement. Action-oriented policy, as opposed to reaction-oriented policy, would expand the leverage of the US in diffusing dangerous scenarios before they occur rather than after the fact. In a changing global political, economic, technological, and social environment preparedness is key in securing national security and global stability.

Assessing Information Assurance Architectures for Protected Communications On The Move

CDT Zachary Fenn, United States Military Academy

Abstract: Troops in combat require up-to-date information to complete their mission successfully and with minimal loss. To facilitate this, the Department of Defense is sponsoring an acquisition program to develop a satellite terminal to provide commanders, as low as platoon level, access to the Warfighter Information Network – Tactical (WIN-T) and Global Information Grid (GIG). This project, known as Protected Communications On The Move (PCOTM), would improve our military's situational awareness and increase our combat power. The National Security Agency (NSA) has been tasked to provide security guidance for the PCOTM information security architecture and our group has been tasked with helping the NSA assess and improve it. We are using the Systems Decision Process (SDP) developed by the Department

of Systems Engineering at the United States Military Academy to build a value model to evaluate the information assurance architecture. This model is being constructed based on research we have done through interviews with military commanders who have been deployed (the intended users), information assurance documents and professional knowledge, and technical knowledge about the hardware and software being used to design the terminal from the Lincoln Labs at the Massachusetts Institute of Technology. This model will allow us to compare different architectures and inform the NSA on the areas that PCOTM is not meeting their goals and where they should focus their development efforts.

The Incorporation of Layout Design into an Agent-based Evacuation Model Tariq M. Elhassani, Jun Zhang, Mahmoud T. Khasawneh, and Ra'ed M. Jaradat

Abstract: The innovative designs and layouts of buildings and public places have created a major issue in evacuating a massive group of people under intense and panic situations. In this paper, we developed an agent-based model to investigate the effect of layout design, people, and nature of threat on emergency evacuation. The purpose of this research was to provide a preliminary attempt at using agent-based modeling and simulation analysis to explore potential options that people have when faced with bomb explosion in an open market Environment. The results show that evacuation time, number of fatalities, and number of injuries are influenced by the layout design components, namely locations of rescue area, check point, and the bomb itself.

Guns in Demand: Modeling the Arms Trade Cody Zimmerman

Abstract: This NetLogo model is designed to, at a very basic level, simulate the trade in arms between states in the international system, as a foundation for further expansions to include procedures that simulate the formation of alliances, strategic arms exporting, and war itself. At the basic level, the model succeeds, in that money and guns change hands between states, and it even captures at least one of the phenomena seen in the real world: spiraling, but stable, arms races. However, the model would benefit greatly from revision to certain procedures. Supply is determined solely by states as a function of their security, and client states buy what is offered whether they "need" the quantity being sold or not, or whether it would bankrupt them or not. Coding some form of fiscal responsibility would both temper the high bankruptcy rate seen in the first year or two of simulations, as well as endogenously create an element of demand to interact with the supply. Moreover, all

states can be producers under the right circumstances, and all states must buy arms from other states, instead of producing them indigenously. Endowing states with a production capability, so that only a handful of states are able to make and sell arms, and so producer-states meet their own demand, would further increase the accuracy of the model.

Physical Fitness for Tactical Success Elaine M Blount

Abstract: Tactical simulations assume that all participants have the same level of fitness and the same capabilities in all battlefield tests. This article discusses the importance of including data from physical tasks performed on the battlefield and the importance of physical fitness to perform these tasks successfully. It focuses on the 3-5 second rush and the rate of travel necessary for various chances of a successful rush given enemy shooter accuracy of 20% and cadence of one shot per .5 seconds. It continues to discuss potential shooter reaction time from visualization and human performance studies. The final simulation incorporates multiple rush scenarios based upon the width of streets in Lashkar Gah, Afghanistan.

M&S in Engineering • • • • • • • • •

West Point Capstone Project: Claims Processing Improvement of the Veterans Benefits Administration using Simulation Matthew McClary, Raymond Vetter, Joseph Van Dusen, Kurt Bujewski

Abstract: The Department of Veterans Affairs is currently experiencing a backlog of over 125,000 claims from military veterans seeking compensation for disabling medical conditions related to their military service. Claims are processed at 58 regional Veterans Benefits Administration (VBA) offices throughout the United States. On average, the time to complete an individual claim exceeds the processing standard by over 36 days resulting in a wait of over five months before claimants receive their disability compensation; therefore, the Undersecretary of VBA has called upon our Capstone group to perform a systems engineering analysis of the situation and provide potential solutions to their problem. In order to analyze the current VBA system, our team uses a systems decision making process, coupled with ProModel simulation software, to quantitatively evaluate the process in its current form and compare them with new models integrated with system improvements drawn from our research. Our research currently includes primary sources from the Philadelphia VBA processing center, the office of the Undersecretary of VBA, and the Military Operations Research Society. Our simulation encompasses the number of employees, quantities of claims processed, and distributed processing times in order to accurately represent the current VBA system. With the help of our simulation software, and the VBA's universal Claims Processing Initiative, our team's effort has a high probability of creating a national impact on the way the Department of Veterans Affairs gives back to our nation's military.

Environmental Impact Analysis in a Port Simulation Francesca Madeo, Federico Tarone, Agostino Bruzzone

Abstract: In recent years, all countries had to cope the increasing awareness to the environmental problems, referring to the concept of sustainable development of firms and society. This research deals with the environmental impact analysis in a port simulation in order to estimate the emission entities and evaluate improvements to increase the port sustainability; in fact the purpose is to reduce consumption, garbage/waste disposal, noise, Ship discharges and spills. In this paper the authors use a simulation model to estimate the environmental impacts and to outline different strategies to optimize the supply chain sustainability; In fact, analysis use GreenLog Simulator, a Modeling & Simulation tool developed by the authors to modelling and evaluate environmental impact in the every supply chain levels. The experimental application provides another opportunity for validating and verifying the simulator.

A Preliminary Framework for Analyzing Warehouse Picking Operation by Discrete Event Simulation Mandar Tulpule

Abstract: Increasing importance of efficient and cost effective supply chains has led to critical thinking in various aspects of supply chain management. Warehousing is an important aspect of any supply chain as it provides the service of receiving, storage, sorting and distribution of products, which is critical to any enterprise. It also plays the key role of receiving bulk shipments of products from supplier and satisfying customer orders, which are usually smaller quantities of a large number of items. This naturally leads to an order picking activity in the warehouse, which is done manually; in a number of warehouses and hence presents a significant cost. In this paper, we attempt to prepare groundwork for future research by surveying relevant literature pertaining to order picking and gain an understanding of the key issues and approaches used by previous researchers. We particularly focus on warehouse zoning and storage location assignment. We then build, a simulation model and perform a set of experiments to compare two popular storage location assignment

abstracts••••••

policies namely cube per index and random location. We use these experiments to test and validate the model by comparing results of similar study in the literature. We conclude by discussing our results and proposing future direction for extending this research.

Exploring the Contagion Effect of Foreclosures with Agent-Based Modeling Marshall Gangel

Abstract: Over the last several years, the US financial and real estate markets have experienced a significant recession. During this downturn, the number of real estate foreclosures rose drastically. Recent studies have shown reduction in real estate values due to neighboring foreclosures. This study uses an Agent-based modeling (ABM) approach to explore the contagion effect of foreclosures and the emergent behavior that is observed from the interconnected property agent behavior. Several emergent behaviors are exposed showing the relationships between average property value, foreclosure contagion discount, and foreclosure time.

Modeling & Simulation - A System of Systems Engineering View Polinpapilinho F. Katina

Abstract: The purpose of this paper is to explore the value of modeling and simulation as related to system of systems (SoS) engineering using Discrete Event Simulation Formalism. The paper traces the importance of Independent Verification and Validation (IV &V) and also explores the use of sociotechnical system principles and how they can be related to system of systems Engineering (SoSE). An example is provided to illustrate the use of Discrete Event System Specification (DEVS) and of the possibilities for advancement of SoS in terms of philosophies, methodologies, and theories related to modeling and simulation.

GPU Accelerated Stylistic Augmented Reality Rifat Aras

Abstract: With the introduction of programmable graphics pipeline, the highly parallel processing power of graphical processing units (GPU) is being used not only for special graphics effects but also for general purpose computation in areas such as molecular dynamics simulation, stock options pricing, and image processing. In this work, we utilize this power to increase the immersion level in an augmented reality (AR) application. To accomplish this task, the visual gap between real world and virtual objects are closed by applying non-photorealistic filtering/rendering

techniques to both the real world video image and the rendered virtual object. The inherent requirement of real-time operation of AR is satisfied by implementing the mentioned techniques on GPU by using NVIDIA's CUDA.

General Science • • • • • • • •

Development of Circulation Model for the Upper Gulf of Thailand (UGoT) Suriyan Saramul

Abstract: The pollution problems, such as eutrophication, in the Upper Gulf of Thailand is mainly influenced by human activities. The knowledge of the circulation pattern in the Upper Gulf will help us to understand the behavior of pollutant after being release into the system and finally the management could be applied in order to solve those problems. Therefore, the circulation modeling for the Upper Gulf has to be considered as a tool to understand the circulation pattern. The twodimensional depth-averaged model (2DH) of the Delft3D-Flow modeling system developed by Delft Hydraulics was applied to compute tides and tidal currents in the Upper Gulf. The finite-differencing was schematized on the curvilinear grid system. At the open sea boundary, a total of 8 tidal constituents (M2, S2, N2, K2, O1, Q1, P1, and K1) were defined according to the observation data at two tide gauge stations. Comparisons between computed and observed water levels were made among the tide guage stations that located along the coast. Furthermore comparisons between computed and observed current velocities at two Oceanographic Buoy stations were also taken into consideration. It was found that the model results show satisfactory agreement with the observation data for both water levels and current velocities and could be used to study for further study. However discrepancies occurred during high water levels were found at some locations. These errors were investigated and finally it was found that land subsidence is the major reason for the changing of water levels at those two stations.

A software tool for visualization of the cardiac action potential in a 2-dimensional tissue

Prakash C. Viswanathan

Abstract: Heart disease is the leading cause of death and disability in the United States. Several mathematical models have been developed to simulate the electrical behavior of the heart. Models are used in several configurations (single cell or multi-cellular) depending upon the study and desired level of complexity. A major challenge with multi-dimensional models is the visualization of the generated data especially in real time. The goal of this study is to develop a software tool using

OpenGL (a software interface to the graphics hardware) routines to allow for easy visualization of the generated data in a multi-cellular tissue "grid". To achieve this, the mathematical model of the heart's electrical activity is combined with OpenGL routines using C++ programming language. In addition to visualization of the data, the tool offers other features such as real time manipulation of key cellular proteins in order to investigate their role in modulating behavior. The tool was subsequently used to create and visualize "spiral waves" that have been thought to underlie several forms of cardiac arrhythmias. In conclusion, we have developed a software tool that can be used by researchers to study cardiac arrhythmias by easily visualizing the electrical behavior in a multi-dimensional tissue.

Differentiating between Serious Games and Computer Aided Instruction Michael Martin

Abstract: As the field of Serious Games matures, it will become necessary to develop more precise definitions and understandings of what the term 'serious game' means. This paper presents a discussion of one particular defining feature of a game, specifically, the ability of the user to choose from an array of viable alternatives. This distinction is useful for differentiating between games and other forms of computer based teaching. It is also important because it takes advantage of the educational principle referred to as the psychosocial moratorium to enhance the education potential of the software. This discussion is presented in the context of the development of a serious game for teaching memorization of the periodic table of elements.

Dynamic and Static Training for Driving Simulation Route Performance Kellie D. Kennedy

Abstract: The current research is a portion of a larger study dealing with reliability and GPS navigation. This section focuses on the participant performance resulting from static and dynamic route training in a simulated driving task. Performance measures include task success rating, average speed, overall duration of travel, and total distance traveled. Participants were divided into three navigational training groups: no training (control), static, and dynamic. Findings indicated that though both training groups acquired knowledge, the dynamic group achieved greater task success. All groups receiving training demonstrated task learning across sessions. These results suggest drivers may benefit from pre-exposure to navigational tasks and directives. Data cleaning resulted in a large floor effect in task performance with 29 of 65 participants not completing the task appropriately. No significance was found in any training condition.

An Analysis of the Value of Animated Pedagogical Agents in Instructional Simulations

Jo Ann Reber-Thomas

Abstract: This paper examines the many design aspects of animated pedagogical agents that may contribute to cognitive, affective, and behavioral learner effects through exploration of research that places emphasis on their added value to the electronic learning environment.

Designing physical instructional simulations to promote learning from multiple external representations Jennifer R. Morrison

Abstract: This article provides a review of the conceptualization of imagery and its role in the learning environment. Multiple representations are the presentation of multiple images to the learner, which facilitate deeper understanding of content and can potentially increase the learners' ability to transfer knowledge to additional situations. While the use of images in instruction is encouraged, few concrete design strategies exist for the use of multiple representations in instruction and even fewer exist for the design of instructional simulations where these representations are thought to facilitate cognition of complex concepts. The role of images in learning, the manipulation of mental representations by experts in problem solving, and the use of multiple representations are considered here in order to inform the design of physical instructional simulations.

An investigation of the dual-process theory of decision making in simulated airport luggage screening Patricia C. Brennan

Abstract: Enhancing the effectiveness of aviation security is vital to protect our national interests, passengers and aircraft. The purpose of this paper was to evaluate the dual-process model to determine whether emotion or cognition is more powerful in influencing decisions and behavior in threat detection. Using a 3 (frame: analytical, affective, comparative) x 2 (incentive: positive, negative) x 4 (trial block) design, we measured performance with hit rate, false alarm rate and response time. Our results indicate that the analytical frame outperformed both the affective and comparative frames. The analytical frame elicited rational thinking (gaining/losing points), the affective frame elicited emotion (saving/losing lives) and the comparative frame elicited both rationality and emotion (performing better/worse than peers). By eliciting strong emotions, our reason and logic are inhibited and participants do not perform as well in target detection.

Emotion in Animated Pedagogical Agents Performing as Virtual Social Actors Enilda Romero

Abstract: The use of pedagogical agents in instructional interactive environments allows learners to obtain one-on-one interaction with a virtual social actor creating the illusion of a human to human interaction. Today, the characteristics of these pedagogical agents have transcended into far more animated characters that portray life-like qualities. Yet, learners still perceive these animated pedagogical agents as characters with low level believability. A breakthrough in the application of character building qualities to increase the perceived believability of the agents could have positive effects towards increased levels of performance, engagement and sense of realism. The purpose of this paper is to present a strategy that could assist in the design and development of emotionally expressive animated pedagogical agents performing as virtual social actors in interactive instructional environments. In an effort to provide a solution to increase the level of perceived believability of the agents, an intellectual framework on the role of emotion in pedagogical agents is discussed. Facial expressions are presented as a solution to provide a more realistic emotional social interaction between the learner and a believable virtual social actor. Additionally, reference to the use of a Face Reader[®] software is addressed as a possible alternative to emotionally adaptive pedagogical agents. Suggestions are made for future empirical validation of both the role of emotion in pedagogical agents performing as virtual social actors and the use of the Face Reader[©] software in instructional interactive environments.

The Future of Japan's Population: An Agent Based Modeling Approach Erika Frydenlund

Abstract: With a growing percentage of retirees and fertility rates at unsustainable levels, Japan is currently facing a population crisis. This model explores the relationship between certain policy and cultural choices and the declining fertility rates in Japan. Government assistance allocated to each child and costs of living are explored as economic options to influence fertility rates. The effects of several cultural aspects are also explored including women's desire to marry, percentage of women working while raising children, and parents' level of cautiousness when determining whether to have additional children. Because the model consistently results in the extinction of the Japanese population, the factors are explored with respect to increasing the longevity of the population using survival analysis. Cost of living is, as expected, a very important factor in the model for both its individual contributions as well as its interaction with other factors. The results of this study interestingly indicate that government subsidies are not a significant factor in motivating couples to have more children.

An Agent Based Modeling Approach to Examining the Relationships Between Education, Social Networks and Democratic Support Nick Drucker, Kenyth Campbell

Abstract: This paper presents an agent-based model that explores the relationships between education, social networks, and democratic support. The debate about how and why democracies arise is a long running one, lacking a consensus answer. This study examines two factors that impact democratic support, education and social networks. Current theory concerning these two variables suggests that positive relationships exist between education and democratic support and social networks and the spread of ideas. The model described in this paper contains variables that cover multiple aspects of democratic support, but the experimentation with the model focuses only on the two variables previously mentioned. The model in this paper is an agent-based model, allowing individual entities within the system to make "decisions" on their support of democracy independent of one another. The agentbased approach also allows entities to utilize their social networks to spread ideas. Experimentation with this model demonstrated outcomes in line with current theory. In addition, the results support the claim that this model is capable of accurately representing real world scenarios and does not produce un-realistic results. This paper explains the model creation process as well as the experimentation procedures. Future research avenues and potential shortcomings of the model are also addressed.

Social Capital, Public Goods Provisions, and Economic Inequality: An Agent-Based Modeling Approach Narisong Huhe

Abstract: How does social capital promote the provisions of public goods? Although myriads of quantitative researches offered us with insightful observations, they failed to address the causal linkages connecting social capital and public goods provisions. To explore its micro causal mechanisms, this article uses an agent-based model to explore how social capitals promote or inhibit the provisions of public goods. Compared to traditional research methods, agent-based modeling allows researchers to explore the emergence phenomena under complex adaptive system (CAS). Specifically, by simulating social agents as generalized and particularized trusters, this research conducts 12, 960 runs of experimentation of emergences and functions of social capital under various scenarios. The results from experimentation generally confirm the beneficial impacts of generalized social capital. Systems with high level of generalized social capital are more abundant with public goods. Rather than solely focusing the consequences of social capital, this research also finds that economic inequality is a key determinant of creation social capital.

Medical M&S • • • • • • •

Using Modeling and Simulation to Improve Oral Health Services Delivery Mohammad J. Alzahrani

Abstract: The purpose of this study is to examine the system performance in delivering oral health services in a public health setting based on the Conceptual Framework to Measure Performance of the Public Health System (PHS). Using modeling and simulation, a predictive model based on the conceptual framework dimensions: macro context, mission, structural capacity, processes, and outcomes will be developed to predict the performance of public health department in delivering oral health services. Modeling and simulation (M&S) will enable the author to modify the changeable variables without impacting the quality of care. In addition, using modeling and simulation methodology will enable dental practices to serve their clients effectively and efficiently with the best use of the resources. This research is going to address issues that affect the delivery of oral health care in public dental health settings. The results of this study will determine what variables in the dental practice setting influence oral health care delivery and to what extent. Results of this study will narrow the knowledge gap among oral health providers regarding the importance of modeling and simulation technique leading to improve oral health care delivery. This study will be the first to use M&S to examine PHS performance to deliver oral health services in public health settings. Many dental practices productions are complicated combination of parameters such as: information resources, organizational resources, physical resources, human resources and fiscal resources. Therefore, using simulation would be the best approach when the system under investigation produces outcomes that are complicated, stochastic, and dynamic. Therefore, these non-linear interactions make simulation modeling an appropriate methodology to study and improve the delivery of oral healthcare services outcomes in the public health settings. In addition, using modeling and simulation is less expensive than conducting research with many different parameters. This study will answer the following questions: are public health system conceptual framework dimensions: macro context, mission, structural capacity, processes, and outcomes appropriate to evaluate the oral health services performance in public health settings? What dimensions in the conceptual framework influence oral health care delivery and to what extent? Can using modeling and simulation improve the performance of public health settings in the delivery of oral healthcare? Index Terms— oral healthcare delivery, public health performance, modeling and simulation, public health settings.

Use of polyethylene microspheres to simulate hospital acquired infections: a teaching strategy for healthcare students and workers Lydia Wigglesworth-Ballard

Abstract: Hospital acquired infections are still a major problem in the United States despite infection control measures that have been put in place. The bacteria that cause most hospital acquired infections are constantly mutating and are becoming increasingly difficult to treat due to antibiotic resistance. This has created challenges for many hospitals and other clinical settings and many insurance companies will no longer cover the cost for these types of infections. The guidelines that have been put in place by the Center for Disease Control and Prevention says that hand washing is the most important method in the fight against the spread of infections. However, hand washing compliance and techniques still fall short of these guidelines. Ultraviolet polyethylene microspheres were developed and tested to determine if its behavior was sufficient to simulate the spread of hospital acquired infections and to determine if the microspheres could be used as a teaching strategy to incorporate into the curriculum for healthcare education and for infection control training in hospitals and clinical settings. The microspheres were able to simulate the spread of bacteria through direct and indirect contact on different surfaces and had the ability to be washed off under specific hand washing guidelines. Due to the positive results the use of microspheres as a simulator during instruction should be explored further in order to improve hand washing techniques and compliance.

An Analysis of Biosurveillance and Potential threats to Public Health Koren S. Goodman

Abstract: The recent swine flu outbreak was a public health call to action to enhance established systems using electronically reported data to monitor real time utilization patterns. Public health organizations have invested in biosurveillance tools because of heightened threats of bioterrorism and emerging infectious diseases such as influenza. It has been made a priority in health care because of its ability to monitor information sources of potential value in detecting an emerging epidemic that occurs naturally or as the result of bioterrorism. One avenue of early detection of disease clusters to minimize morbidity and mortality is syndromic surveillance. Syndromic surveillance is defined as an avenue for early detection of disease clusters to minimize morbidity. With the shift of syndromic surveillance focusing now on bioterrorism, efforts are placed on proper collection, analysis, and reporting mechanisms. While these mechanisms enhances disease detection, physicians will continue to play integral roles in reporting unusual occurrences. Understanding the

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epidemiology of infectious diseases in the United States involves the understanding of demographic, environmental, and geographic patterns. Because multiple data sources are used in this integrated system, global public health will be enhanced. Simulated events allow public health officials to formulate intervention strategies. Ultimately, the goal is to minimize time to detection and to have the ability to identify anomalies. This paper will explore the extent to which biosurveillance techniques are effective in identifying influenza outbreaks.

A Comparative Survey of PSD Estimation Methods for EEG Signal Analysis John Musson

Abstract: Digital frequency domain analysis often involves spectral power determination. Although the Fourier Transform is often the primary tool, limitations exist with respect to power spectral density (PSD) measurements. Accurate PSD calculation requires interpolation and smoothing techniques, prior to most applications typically found in modern test equipment. Non-parametric methods provide a means to create representative periodograms, which provide a variety of flexibility with respect to pre-filtering, data windowing, and smoothing. Although more computationally demanding, parametric models employ predictive algorithms to represent the PSD, to arbitrary accuracy. A survey of both methods is presented, using real biometric data. Benefits and shortcomings are identified, and an attempt is made to qualitatively optimize each particular method. Results are presented in the form of numerical data, spectral estimates, and possible applications.

Brain Tumor Growth Analysis Using a Dimensionality Reduction Method Deepak R. Joshi

Abstract: In this paper, analysis of brain tumor growth using a dimensionality reduction method (DRM), i.e., multidimensional scaling (MDS) is presented. The data of one patient's complete MRI records scanned during his visits in the past two years are used for the analysis. There are ten MRI series, including DTI, for each visit. After registering all series to the corresponding DTI scan at the first visit, the registered images were used to construct a 10-dimensional vector at each pixel. However, it is difficult to visualize and analyze the ten dimensional data set by human eyes. We utilized the MDS algorithm to compress the ten dimensional data to one dimension and visualized the compressed data for analysis. The aim of this paper is to study the feasibility of analysing brain tumor progression using the high dimensional MRI series.

Games for Team Training Elena Radici

Abstract: Team building has become an important organization development interventions widely used to train individual who has to work together. In this paper we propose a team training through virtual reality for two related purpose: the first is to verify if it is possible a "team-building" by using the virtual world as a training; the second purpose is to test if a virtual training is useful for a team to perform better in a real environment. To verify this assumption we have trained college students to accomplish a serious game as a team using an on-line virtual environment as a training. Every team had to complete a task through his/her avatar to learn how to achieve the same task in a real environment after the training. The results so far are about the experiment in the real environment. Preliminary results show that there are other further areas about team building to investigate.

The use of Getis and Ord cluster analysis for analyzing rainfall data in relation to Rift Valley fever outbreaks Jacqueline Jackson

Abstract: Rift Valley fever (RVF) activity has been known to follow periods of high rainfall due to an increase in mosquito vectors following these periods. Studies in Kenya and northern Senegal have correlated RVF outbreaks with periods of widespread and heavy rainfall. Cluster analysis has been used to study geographic variation patterns such as rainfall but Getis and Ord spatial cluster analysis technique has not been used in the study of rainfall patterns. In order to determine the usefulness of Getis and Ord cluster analysis in analyzing rainfall pattern analysis was performed on rainfall datasets prior to and during the 2006-2007 RVF outbreaks in Kenya and results compared to basic Geographic Information Systems (GIS) analysis results. Although basic GIS analysis found above average rainfall for December of 2006 at the beginning of the RVF outbreak in Kenya, Getis and Ord spatial cluster analysis did not find such a relationship. Getis and Ord results were inconsistent and did not prove to be an effective way to analyze rainfall.

Transportation • • • • • • • •

Development and Validation of Peak Hour Model Using NCHRP Factors for the Hampton Roads Peter Foytik

Abstract: Macroscopic modeling and simulation does a good job at reflecting congestion of daily volume over daily capacity, but does not represent surges of vehicles and the directional congestion that could be useful. A peak hour model would act the same as the daily travel demand forecasting model (TDF) but only produce results for a peak hour by giving a clear representation of the directional level of service for each road segment within the network. This paper describes a method of creating a peak hour model using the National Cooperative Highway Research Program NCHRP 365 peak hour factors on production and attraction trips matrices. Next it will outline the method by modifying the Hampton Roads Traffic assignment to accommodate hourly assignment. Third it will provide values from a means of validation.

Using discrete event simulation to identify choke points in passenger flow through airport checkpoints Jeremy Brown

Abstract: The movement of passengers through an airport quickly, safely, and efficiently is the main function of the various checkpoints (check-in, security, etc) found in airports. Human error combined with other breakdowns in the complex system of the airport can disrupt passenger flow through the airport leading to lengthy waiting times, missing luggage and missed flights. In this paper we present a model of passenger flow through an airport using discrete event simulation that will provide a closer look into the possible reasons for breakdowns and their implications for passenger flow. The simulation is based on data collected at Norfolk International Airport (ORF). The primary goal of this simulation is to present ways to optimize the work force to keep passenger flow smooth even during peak travel times and for emergency preparedness at ORF in case of adverse events.

Origin Destination Estimation for Trucks Based on Re-identification Methods Ilyas Ustun

Abstract: Origin-destination (OD) flows are important for transportation planning and modeling. The main objective of this paper is to estimate OD flows for trucks based on re-identification algorithms. Trucks crossing two weigh-in-motion (WIM) sites

are anonymously re-identified based on axle spacing and axle weight data. The sites selected for this study are separated by more than 100 miles. The data for model training and testing is obtained from WIM sites in Oregon. Two different OD pairs or links are considered in this study. Several methods are evaluated for estimating OD flows. The parameters or threshold values of these methods are first optimized based on the known OD flows on one of the links. When the optimized thresholds are applied to the other link, the estimated flows are found to be very close to the actual flows, within 3-10%, which show that the proposed methods can be effective in estimating truck-flows between WIM sites.

Transit Signal Priority Assessment for LRT in Downtown Norfolk: Transit Preference Traffic Impacts Faisal Mahmud

Abstract: Transit Signal Priority (TSP) is an operational strategy that facilitates the movement of transit vehicles like buses, LRT (Light Rail Transit) or streetcars, through traffic-signal controlled intersections. The benefits of TSP include improved schedule adherence and improved transit travel time efficiency while minimizing impacts to normal traffic operations. New advances in Global Positioning Systems, detection and communication, and control strategies have overcome many problems with early systems and increased interest in implementing TSP for LRT and other transit operations. The increased capabilities of these advanced systems have led to a dramatic increase in operational and planned TSP deployments across the U.S. This study will show the at grade (or street level) Tide light rail (LRT in Norfolk, VA) operational impacts which will extend 7.4 miles on an east to west alignment from the East Virginia Medical Center through downtown Norfolk, continuing along the Norfolk Southern right-of-way, adjacent to I-264, to Newtown Road. For current study, different consecutive downtown intersections have chosen to sketch the overall measures of effectiveness adjacent to those intersections. VISSIM, a microsimulation tool is used with its Ring Barrier Controller (RBC) emulator to evaluate complex TSP strategies. A case study network from Northbound Monticello Avenue to Southbound St. Paul's Boulevard with 684.37 meter LRT line is considered where recently a LRT line is introduced. The goal of the study is to assess the operational implementation of TSP strategies and to compare the TSP abilities with No-TSP scenario. The objective is to consider trade-off analysis for transit preference versus traffic impacts.

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Traffic Adaptive Approach for Pedestrian and Vehicular Signal Timing Plan During Peak-Hour

Faisal Mahmud, Rifat Aras, Tanweer Rashid

Abstract: Pedestrian signal timing becomes an important issue where pedestrian volumes are relatively high and the intersection capacity utilization becomes critical for vehicular movement. It is obvious to give right-of-way for both pedestrians and vehicles. An intersection signal timing plan sometimes requires special analysis for allocation of green time to both pedestrians and vehicles for special scenarios. The situation also varies according to the time of the day as well as the day of the week. In this paper, an adaptive approach for pedestrian and vehicular signal timing is investigated. This approach allocates green time based on queue length of the individual phases. The data collection area is chosen near Hampton Boulevard and 49th Street, which makes this work unique in the sense that the pedestrian and vehicle traffic patterns in a university/college area is significantly different than the patterns considered in previous works. A modular approach for modeling intersections is also used for the analysis of traffic adaptive signal timings. Peak-hour demand scenario is considered for accuracy and perfection to negotiate pedestrians and vehicles at the same time. The proposed model and fixed time model are simulated in ARENA under realistic conditions. The fixed timing model is used as a base for comparing the results of the proposed system.

Simulating the Arrivals and Departures of United Airlines at Chicago O'Hare International Airport Prakash C. Viswanathan, Anil Ustun

Abstract: With over one hundred commercial airlines, airport delays have become increasingly common and unavoidable. Chicago O'Hare Airport (ORD) has the distinction of being one of the worst in the nation for delays. Our objective in this study was to use the Arena Software suite to develop a model of United Airlines (UA) arrivals and departures at ORD and use this model to determine if UA was using their resources (gates) effectively to maximize revenue. Airline data was obtained from U.S. Department of Transportation, Bureau of Transportation Statistics (BTS). The data included time of arrival and departure of each flight and taxi times. Probability distributions were fit to this data and used in the model. Runway configurations and length were obtained from the airport web pages, while the distance from the runway to the gates was estimated using Google maps. We validated our model with data from the BTS. For example, the model arrival taxi time was 7.0869 \pm 0.002 minutes while the real (BTS) taxi time was 6.799 \pm 1.3 minutes (p = 0.688). Similar results were obtained for departure taxi times. Using this validated model we found that the gate utilization by UA ranged between 10 and 35% leading to a significant

reduction in their net operating profit. Our results also indicate that addition of an extra runway (as envisioned in the master expansion plan for O'Hare) can have a major influence in runway utilization and minimizing runway incursions, a potentially dangerous situation.

A simple carbon friendly code-sharing agreement between Northwest Airlines and US Airways to maximize revenue Prakash C. Viswanathan

Abstract: Competition between airlines has led to the creation of the policy of "Code sharing", which is an inter-airline partnership where one carrier markets a service and places its code on another carrier's flights. Code share alliances not only benefit the airlines by reducing operating costs, but also benefit passengers by providing better connectivity and lower fares. Currently, almost all airlines have some agreements in place, ranging from agreements only for specific routes to full mergers. However, with ever-changing market requirements, establishing new code-share routes can play a vital role in maximizing airline industry revenues, while satisfying changing customer needs. Additionally, current code sharing agreements have failed to take the human impact on the environment into account. The goal of this paper is to develop a model to maximize the revenues of Northwest and US Airways, operating between Detroit, Charlotte, and Norfolk. The revenues are subject to the typical constraints such as aircraft capacity, fare classes and available seats, along with new constraints that incorporate costs incurred to mitigate human impact on the environment. The overall goal of the model is to design new code-share policies that could be adopted in order to increase efficiency and profit, while satisfying consumer demand. Our study shows that airlines can consider the environmental impacts of their operations and still achieve profits through successful code-sharing policies.



Track Leads

Josh Behr	ODU VMASC
Gianluca DeLeo	ODU VMASC
Rafael Diaz	ODU VMASC
Barry Ezell	ODU VMASC
Mike Robinson	ODU VMASC

Speakers

Agostino Bruzzone University of Genoa Tuncer Ören University of Ottawa

Judges

Jeff Adler	Open Roads Consulting
Robert Alpino	Eastern Virginia Area Health Education Center
Steven Bennett	DHS Office of Risk Management & Analysis
Richard Flannery	Hampton Roads Planning District Commission
Jennie Jastrzemski,	TRADOC
Jeff Laskowski	Lockheed Martin
Hua Liu	Old Dominion University
Hüseyin Sarper	Colorado State University
Amy Truesdell	Dewberry
Thomas Verna	Lockheed Martin
Jeff Wilkinson	MYMIC

ODU's MSVE Department

Rick McKenzie	Old Dominion University
Roland Mielke	Old Dominion University
Yuzhong Shen	Old Dominion University
Guoqing Zhou	Old Dominion University
Trey Mayo	Old Dominion University

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Old Dominion University		
Old Dominion University		
Mohammed Ferdjallah Old Dominion University		
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Old Dominion University		
Old Dominion University		
Old Dominion University		
Old Dominion University		
Old Dominion University		
Old Dominion University		
Old Dominion University		

Students & Attendees

Mohammad Alzahrani Old Dominion University **Rifat Aras** Old Dominion University Elaine Blount Old Dominion University Patricia Brennan Old Dominion University Jeremy Brown Old Dominion University Kenyth Campbell Old Dominion University Mecit Cetin Old Dominion University Saikou Diallo Old Dominion University Joyce Downs Old Dominion University Nick Drucker Old Dominion University David Earnest Old Dominion University Tariq Elhassani Old Dominion University Zachary Fenn US Military Academy Peter Foytik Old Dominion University Erika Frydenlund Old Dominion University Marshall Gangel Old Dominion University Koren Goodman Old Dominion University

Christopher Hartline Old Dominion University Patrick Hester Old Dominion University Narisong Huhe Old Dominion University Jacqueline Jackson Old Dominion University Ra'ed Jaradat Old Dominion University Jessica Jones Old Dominion University Deepak Joshi Old Dominion University Rani Kady Old Dominion University Polinpapilinho Katina Old Dominion University Rebecca Kennedy Old Dominion University Mahmoud Khasawneh Old Dominion University Francesca Madeo Old Dominion University Faisal Mahmud Old Dominion University Michael Martin Old Dominion University Jennifer Morrison Old Dominion University John Musson Old Dominion University Julie Oh **US Military Academy Rachel Phillips** Old Dominion University Alex Proapa Old Dominion University Kellie King Old Dominion University Elena Radici Old Dominion University Tanweer Rashid Old Dominion University JoAnn Reber-Thomas Old Dominion University Enilda Romero Old Dominion University Suriyan Saramul Old Dominion University Mark Scerbo Old Dominion University Nevan Shearer Old Dominion University Michael Seiler Old Dominion University University of Genoa Federico Tarone

Mandar Tulpule Old Dominion University Ilyas Ustun Old Dominion University Joseph VanDusen Old Dominion University Raymond Vetter US Military Academy Prakash Viswanathan Old Dominion University Old Dominion University Xiaotian Wang Lydia Wigglesworth-Ballard Old Dominion Old Dominion University Jun Zhang Cody Zimmerman Old Dominion University

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