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SYSTEMS MODELING A GRAPHIC USER INTERFACE USING VIRTUAL WORLDS

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ABSTRACT

At Morgan State University the graduate level course Introduction to Advanced Systems Engineering is to teach graduate engineering students about systems engineering by research and an applied project. The applied research project is to be completed following the systems engineering lifecycle. This project is to include techniques and practices commonly practiced by organizations such as the United States Army (USAR), National Aeronautics and Space Administration (NASA), and others. This paper is a presentation of the completed research and design of the development of a Graphical User Interface (GUI) for an Automated Teller Machine (ATM).

Key Words: systems engineering, simulation and modeling, virtual words, information systems user interface

OVERVIEW

This paper is the findings of the applied system engineering research project to complete the IEGR 501: Introduction to Advanced Systems Engineering course. This project focused on the Automated Teller Machine (ATM). The reason for this selection is because over the decades ATM systems have been analyzed to better aid its users' requirements. Some requirements include those that are directly tied into the utilization of these systems, privacy of financial information, integrity of data, and availability of information. Financial institutions are currently reviewing occurring issues and are trying to improve their systems to continue to satisfy their users'. ATM systems require a hardware as well as cash cartridges to be able to activate and fulfill users' request.

A research study has been conducted to further understand ATM systems functionalities and improve customer service. The design to the new ATM system is a 24 hour self-cash service; which does not charge users' if they are not using their bank branch and provides identification theft security.

HIGH LEVEL SYSTEMS ANALYSIS

To begin any analysis of the system, a High Level Systems Analysis (HLSA) must be performed while in conjunction of communication with the users. This is the structure of the system, defining the essential core design features and elements providing the framework for

required components and for ones that may follow resulting in future adjustments. A High Level Systems Diagram (HLSD) is constructed from the analysis that provides an engineering view of the users' vision for what the system needs to be and do; including the paths that's are required for the system to function properly (Hoffer, George & Valacich, 2011). The HLSD is an approach in the methodology of SDLC following behind with a more in depth model of the system a Low Level Systems Diagram (LLSD).

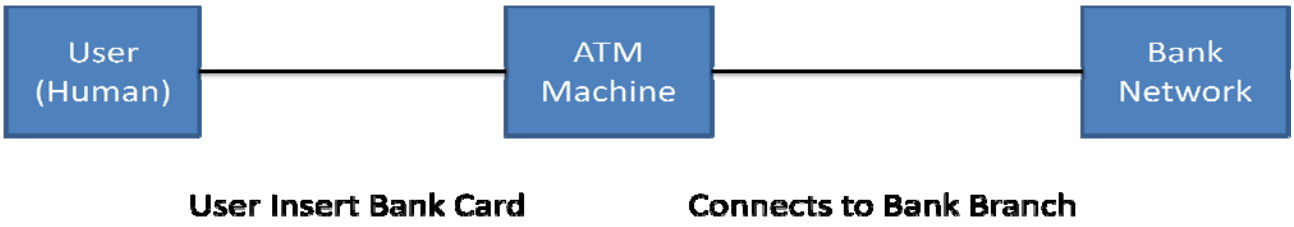
From the graphical representation models a problem definition can be created to depict the problem of the system and what steps can be performed to begin the design and implementation of the system to be evaluated to fit requirements of the user. In the next sections the HLSD and LLSD are reviewed to further understand the systems approach.

HIGH LEVEL SYSTEMS DIAGRAM

Before performing any task the stakeholder and users of the proposed system, needs to communicate with researchers and developers to understand exactly what the Users wants; a High Level Systems Analysis (HLSA) takes place. From the HLSA a High Level System Diagram (HLSD) highlights graphically the main entities of the systems goals and objectives; also known as the scope. A problem definition will be determined from the analysis and JAD sessions, which then results in the analysis and design phase to implementing the project. Developers can perceive what the desire system ought to look like or function as, also being well aware if the system is complex or not. This gives developers a better way in deciding how to approach a problem.

The entities that make up the HLSD show in figure 1 in this research paper are human users, an ATM Machine, and a Bank Network. These are what drive this system; there are dependent on each other to properly operate.

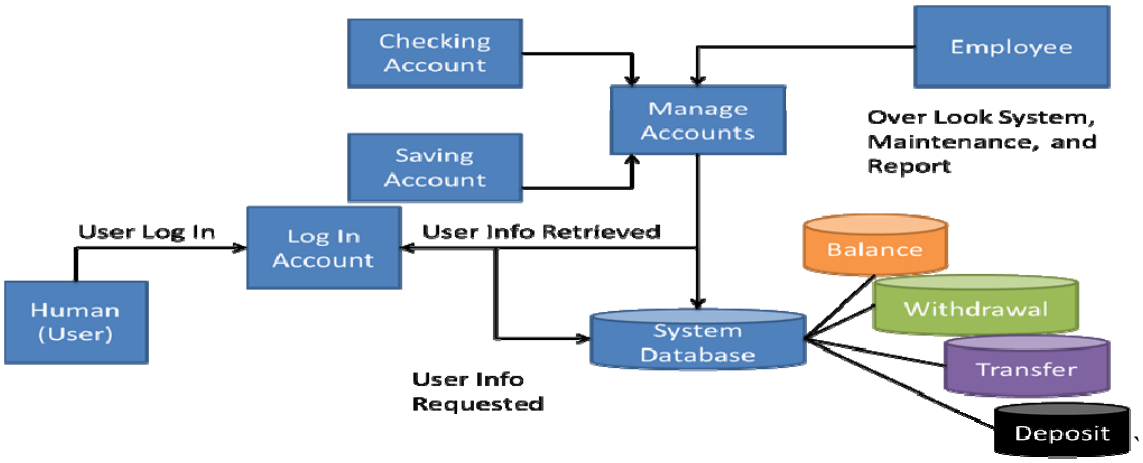
Figure 1: Virtual modeling process.



LOW LEVEL SYSTEMS DIAGRAM

Low Level System Diagram (LLSD) show in figure 2 gives a more detailed graphical representation of the system. It allows intended users to visually recognize what exactly it takes to run the system including systems entities. The requirements within the LLSD will allow user to select requested account and expect task to be achieved.

Figure 2: Virtual modeling process.



PROBLEM STATEMENT

The problem being addressed can be defined as: ATM machines are not reliable as developers want users to think that they are. Majority of ATM machines charge users to access their own personal accounts. As well as not having access to a 24 hour self-cash services; that allows users to access their bank accounts to withdraw, deposit, transfer or check funds within their accounts. Existing ATM machines are not benefiting users at a hundred percent reliability.

SCOPE

The scope of this research can be expressed by the following statement: To analyze, model, implement, and evaluate an ATM machine inside a virtually society. The primary focus is a user accessing their bank branch that they are associated to perform task such as; check balance, deposit, and transfer or withdraw funds at any desired time. Outside of Scope: Interaction between bank network employees and the potential users of the system will not be discussed in depth.

OBJECTIVES AND GOALS

The main objective is to research and clearly understand the requirements of an ATM system, as well as understand the application model requirements for integration with an ATM system simulation. The goal of this research paper is to discuss the planning, analyzing, designing, implementing, testing and evaluating phases of the development of a graphical user interface of an ATM machine model using the software Second Life (SL); virtual world.

Plan the path in which a developer will take to follow for production. Analyze requirements and literature review to understand the entities within the system. Use OOAD to graphically model users, use cases and scenarios, data and flow diagrams.

Implement the OO model into SL by constructing an environment in which the system will possibly be able to operate in. Program objects to function when virtual users wants to perform a task.

INTERFACE DESIGN PROCESS CHART

The process path that was used to develop and design the GUI was the Systems Development Life Cycle (SDLC) and Interface Design Process chart. The development of the ATM and environment was designed within SL which is a part of the design and implementation phases.

The structured path of the development of a successful GUI aids developers. Beginning from the Needs Analysis and continuing to insure users' requirements down to the summative evaluation shows how each step is repeated for proper development (Dennis, Wixom & Roth, 2006). The path is beneficial because it provided guidance throughout the different planning stages.

TEST RESULTS

Subject Models 1: The first subject is a female ranging between the ages of 25 – 30. The subject decided out of the two ATM Machines she wanted to explore. The subject decided to interact with the ATM Machine closer to the entrance and exit of the environment.

Subject 1 Result:

1. Time to complete test module: 8 seconds
2. Time to select and touch ATM object and run script: 1 second
3. Time to Complete Script: Approximately 1 second per line

Subject Module 2: The second subject is a female ranging between the ages of 25 – 30. The subject decided out of the two ATM Machines she wanted to explore. The subject decided to interact with the ATM Machine further from the entrance and exit of the environment.

Subject 2 Results:

1. Time to complete test module: 12 seconds
2. Time to select and touch ATM object and run script: 3 second
3. Time to Complete Script: Approximately 1 second per line

Subject Model 3: The third subject is a male ranging between the ages of 25 – 30. The subject decided out of the two ATM Machines he wanted to explore. The subject decided to interact with the ATM Machine closer to the entrance and exit of the environment.

Subject 3 Results:

1. Time to complete test module: 10 seconds
2. Time to select and touch ATM object and run script: 2 second
3. Time to Complete Script: Approximately 1 second per line

CONCLUSION

In conclusion a GUI of an ATM Machine has been produced and integrated with the scratch software to program scripts within the objects of the system. Three types of methodologies were used to plan, analyze, design, implement, test and evaluate the developed system within this paper.

Figure 3: Virtual modeling process.

Beginning from the initial problem definition and users' requirements a HLSA was proposed resulting into graphically modeling the system with high level and low level systems diagrams. This allowed the developers to capture the main important entities within this project. Once analyzing the problem and system a plan for design was implemented into Enterprise Architect (EA) using the SDLC OOAD methodology. The idea then leads to purchasing objects from the SL Market to use as prototypes within the environment of SL. Difficulties aroused while using the software SL. Difficulties such as programming objects as well as receiving objects from the market; some objects were unable to be modified and required to purchase other objects that would cooperate with the proposed system and environment.

The overall experience was interesting in learning to plan a development of a GUI. Future work will be to present the development process of the research project as well as further enhance knowledge within SL to use an effective tool in simulation work.

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NAVIGATING THE THIN LINE BETWEEN MANAGEMENT INFORMATION SYSTEMS AND COMPUTER SCIENCE

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ABSTRACT

In a world where information is power so are those who wield it. As the United States (U.S.) aggressively works hard to create more professionals in the Science, Technology, Engineering, & Mathematics (STEM) disciplines there are two disciplines that appear to be blended more than ever. Management Information Systems (MIS) and computer science programs around the country appear to be teaching nearly identical courses in relation to technical content. Even industry is unclear about the abilities of graduates from these programs as institutions around the country differ in the separation of these two disciplines. This paper will propose a needed research study to further understand this problem and methods needed to fix it.

Key Words: management information systems, computer science, technology, education

LESSONS LEARNED FROM THE INCORPORATION OF OPEN SOURCE SOFTWARE TO AID A HBCU IN BEING COMPETITIVE

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Jeffrey Stevens, Colorado Technical University
Larry McDaniel, Alabama A&M University

ABSTRACT

At Alabama A&M University the Management Information Systems (MIS) undergraduate program has been primary theory based with a lack of application. This is due to a lack of funding for expensive tools for network management, systems administration, cyber security, development tools, and simulations. This challenge has driven new initiatives to look at alternatives to reducing license costs but still providing students with the knowledge needed to obtain employment after graduation. This new method for teaching and learning technical concepts with the use of Open Source Software (OSS) could be applied to multiple state funded institutions to reduce significant costs without impeding the learning process of the students. This paper introduces new concepts for OSS to be implemented in state funded organizations.

Key Words: simulation, open source software, linux, education

EFFECTS OF TIME VALUE OF MONEY ON THE EPQ MODEL WITH THE IMPERFECT QUALITY ITEMS OF RAW MATERIAL

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ABSTRACT

In this paper an economic production model that takes into account the effects of imperfect quality items of raw material is extended to incorporate the time value of money. The mathematical model is developed and the optimal production quantity is obtained by maximizing the profit function. Numerical examples are given to illustrate the determination of the optimal solution.

INTRODUCTION

The classical economic production quantity model (EPQ) has been extensively researched in the past few decades. Many of the extensions accounted for different factors encountered in real life situations. Recently, the classical EPQ model has been extended in many ways to incorporate the effects of imperfect quality items. Salameh and Jaber (2000) developed a model to determine the optimal lot size in the case where each lot delivered by the supplier contains imperfect items. This study generated many extension and modification of the model. Khan et al. (2011) presented an extensive survey of such articles. In a different direction, El-Kassar et al. (2012) presented EPQ models that examine the effects of imperfect quality items of raw material used in the production process. The purpose of this paper is to incorporate the time value of money in these models. The effects of time value of money have been considered for many of the extensions and modifications of the EPQ model. For instance, Salameh and El-Kassar (2003) studied the effect of time discounting on the classical EPQ model. Kassar and Dah (2009) presented a model that accounts for the time value of money and studied the effect of the production costs as well as the costs of the acquiring and holding the raw material and the finished product. El-Kassar and Yassin (2011) developed an EPQ model that accounts for time value of money of various costs occurring at the stages of production.

Within this paper the following are considered: The mathematical model for the time discounting of the EPQ model with imperfect quality items of raw material is developed. The associated cash flows are derived and the optimal solution is obtained by maximizing the total profit function. Numerical examples are provided to illustrate and analyze the theoretical results.

EPQ MODEL WITH IMPERFECT QUALITY ITEMS OF RAW MATERIAL

Consider a production process that uses a certain type of raw material acquired from a supplier and is assumed to contain a known percentage of imperfect quality items. At the beginning of the inventory cycle the raw material is screened for detecting imperfect quality items which are sold at a discounted price at the end of the screening period. The remaining perfect quality items of raw material are used to produce the finished product. To develop the model that determines the optimal production quantity, we make use of the following terminology.

P = annual production rate
D = annual demand rate
x = annual screening rate
y = raw material order size in units per inventory cycle
q = percentage of imperfect quality items of raw material
K_r = ordering cost of raw material
K_p = setup cost for one production cycle
C_r = unit cost of raw material
C_p = unit production cost
s = unit selling price
S_r = discounted unit selling price of imperfect quality items ($S_r < C_r$)
h_r = raw material holding cost per unit per year, $hr = I\,Cr$
h_p = annual holding cost due to production per unit, $hp = I\,Cp$
y_{max} = maximum inventory of the finished product per cycle
T = cycle length
t_1 = production period
t_2 = zero production period
t_s = *screening period*
I = real continuous interest rate
HR = inventory holding cost due to raw material over the inventory cycle
HP = inventory holding cost due to production over the inventory period
SR = sales returns of one cycle
PC = production cost per cycle
SC = screening cost per cycle
RC = raw cost per cycle
G = annual profit function

Suppose that an order of size y of raw material is received at the beginning of the production cycle and contains a percentage q of imperfect quality items. The imperfect quality are screened at a rate x so that the screening period is $t_s = y/x$. The qy imperfect quality items are sold at a discounted price S_r at time t_s. The remaining perfect quality items, $y(1-q)$, are used to produce the finished product so that the production period is $t_1 = y(1-q)/P$ and the length of inventory cycle is $T = y(1-q)/D$. Throughout the screening period, the inventory level of raw material is depleted at a rate P, and when the screening process stops, the number of perfect and imperfect quality items of raw material reaches a level of $y-Pt_s=y(1-P/x)$. At this time the imperfect quality items are sold at a discounted price S_r resulting in a drop of the inventory level

of raw material to become $y–Pt_s–qy = y(1–P/x–q)$. This level is then decreases at a rate P until the end of production period where it reaches zero. The inventory level of raw material is shown in figure 1. During the production period, inventory of finished items is accumulating at a rate $P–D$ until a maximum level of $y_{max} = y(1–q)(1–D/P)$ is reached, see figure 2.

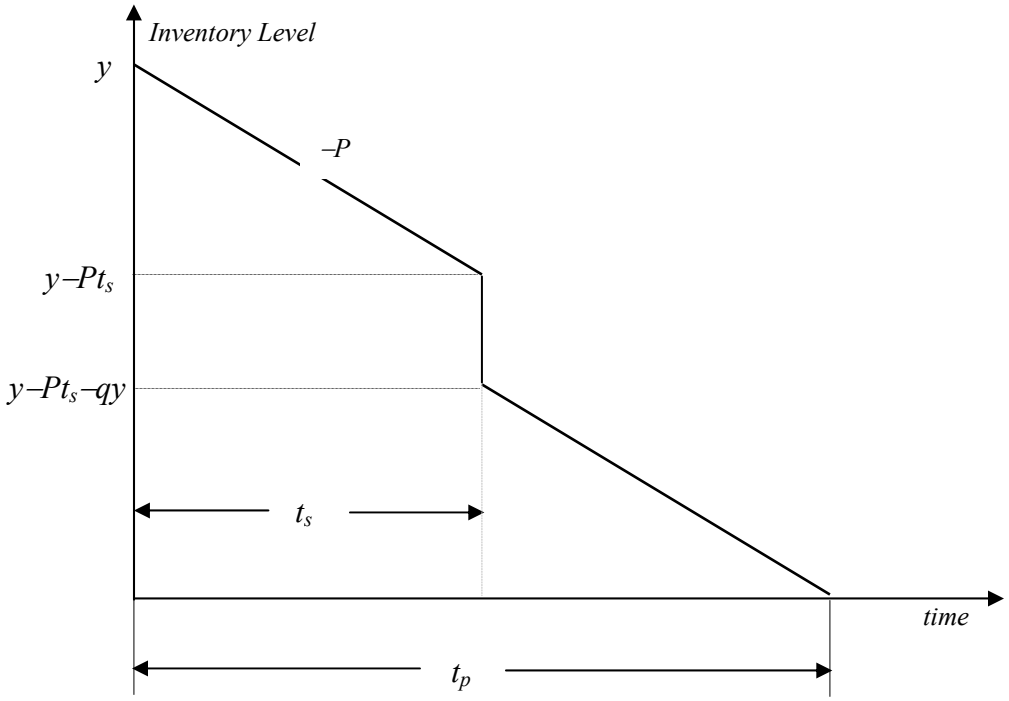

Figure 1: Raw Material Inventory Level, Imperfect Items Sold at a Discount

Ignoring the time value of money, El-Kassar et al. (2012) showed that the optimal order quantity can be obtained by minimizing the total cost function

$$TCU(y) = C_r \frac{D}{1-q} + C_p P + (K_s + K_p)\frac{D}{y(1-q)} + yD\left(\frac{(1-q)}{2P} + \frac{q}{(1-q)x}\right)h_r + \frac{y}{2}(1-q)(1-\frac{D}{p})(h_p + h_r)$$

The optimal order quantity is given by

$$y^* = \sqrt{\frac{2(K_s + K_p)D}{(h_p + h_r)(1 - \frac{D}{P})(1-q)^2 + Dh_r\left(\frac{(1-q)^2}{P} + \frac{2q}{x}\right)}}.$$

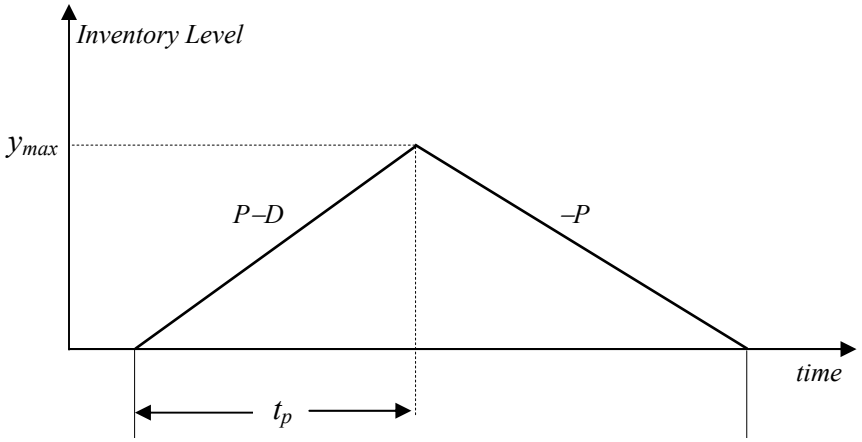

Figure 2: Finished Product Inventory Level

In the next section, this economic production model that takes into account the effects of imperfect quality items of raw material is extended to incorporate the time value of money. The mathematical model is developed and the optimal production quantity is obtained by maximizing the profit function.

THE DISCOUNTED CASH FLOW FOR THE EPQ MODEL WITH IMPERFECT QUALITY ITEM OF RAW MATERIAL

Now we introduce the effects of time value of money to the model presented in the previous section. For a continuous interest rate i, the present worth PW of a single future cash flow F occurring at time period N is given by $PW = Fe^{-iN}$. For a continuous cash flow per unit time (e.g., per year) represented by a continuous function $f(t)$ and extended over a period $[0, N]$, the present worth is

$$PW = \int_0^N f(t)e^{-it}dt. \quad (1)$$

Since the interest rate is expressed in terms of a year, the time unit is year and all time units in equivalence calculations must be converted into years. For a uniform cash flow amounting to a sum of A per year, the present worth is

$$PW = A\left(\frac{e^{iN} - 1}{ie^{iN}}\right) = \frac{A}{i}\left(1 - e^{-iN}\right) \quad (2)$$

For a linear gradient cash flow with $f(t) = Gt$, the present worth is

$$PW = \frac{G}{i^2}\left(1 - e^{-iN}\right) - \frac{G}{i}\left(Ne^{-iN}\right) = \frac{G}{i^2}\left(1 - e^{-iN} - iNe^{-iN}\right) \tag{3}$$

The selling returns of the finished product is a uniform cash flow extended over the entire inventory cycle, from $t = 0$ to $t = T = t_1 + t_2$, see figure 3a. From (2), we have that

$$PW(SR) = sD\left(\frac{e^{iT} - 1}{ie^{iT}}\right) = \frac{sD}{i}\left(1 - e^{-iT}\right) \tag{4}$$

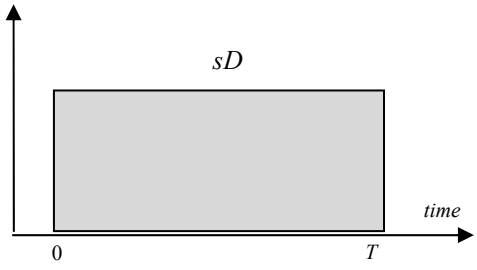

Figure 3a: Selling Returns Flow

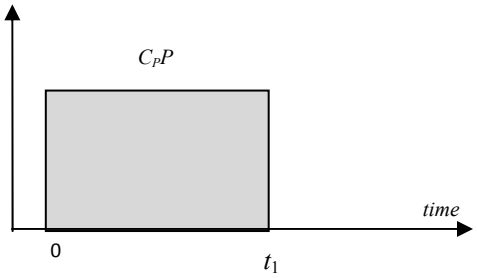

Figure 3b: Production Cost Flow

Similarly, the production cost is a uniform continuous flow extending over the production period, from time $t = 0$ to $t = t_1$, see figure 3b. From (2), we have that the present worth of PC is

$$PW(PC) = \frac{C_p P}{i}\left(1 - e^{-it_1}\right) \tag{5}$$

Similarly the screening cost is a uniform continuous flow extending over the screening period from time $t = 0$ to $t = t_s$. From (2), we have the present worth of C_S is

$$PW(SC) = \frac{C_s x}{i}\left(1 - e^{-it_s}\right) \tag{6}$$

The holding cost component due to raw material occurs as a continuous cash flow extending over the entire inventory cycle. From figure 1, this continuous cash flow can be represented by a continuous function

$$f(t) = \begin{cases} (y - pt)h_r & 0 \le t \le t_s \\ (y(1-q) - pt)h_r & t_s \le t \le t_1 \end{cases}.$$

Therefore,

$$PW(HR) = \int_0^{t_1} f(t)\, h_r e^{-it}\, dt = \int_0^{t_s} (y - pt)\, h_r e^{-it}\, dt + \int_{t_s}^{t_1} [y(1-q) - pt] h_r\, e^{-it}\, dt \,.$$

Evaluating the integrals in the above expression, we have

$$PW(HR) = \left[\frac{y}{i}(1 - qe^{-it_s}) + \frac{y}{i}(q-1)\, e^{-it_1} + \frac{P}{i^2}(it_1 - e^{+it_1} + 1)\, e^{-it_1} \right] h_r \qquad (7)$$

The holding cost component due to production is made up of the sum of two continuous cash flows, H_2 and H_3. The first cash flow, H_2, extends over the production period, from $t = 0$ to $t = t_1$, where the inventory starts at a zero level and increases at the rate of $P–D$ until it reaches a maximum level of $y_{\max}$. Accordingly, the holding cost increases with the finished products in inventory. The second cash flow, H_3, extends over the zero production period, from $t = t_1$ to $t = T$, where the inventory starts at a maximum level of $y_{\max}$ and decreases at the rate of P until it reaches a zero level. The two cash flows, H_2 and H_3, are shown in figure 4.

During the time interval $[0 , t_1]$, the number of items in inventory at time t is $\frac{y_{\max}}{t_1} t$. From (3), the present worth of H_2 is

$$PW(H_2) = \frac{(h_p + h_r) y_{\max}}{i^2 t_1} \left(1 - e^{-it_1} - it_1 e^{-it_1}\right). \qquad (8)$$

As for the second cash flow, the number of finished product in stock at time t, $t_1 \le t \le T$, is $y - \frac{y_{\max}}{T} t.$ Therefore, the present worth of H_3 production is

$$PW(H_3) = \frac{(h_p + h_r) y}{i^2 T} \left[iTe^{-it_1} - it_1 e^{-iT} - e^{-it_1} + e^{-iT} \right]. \qquad (9)$$

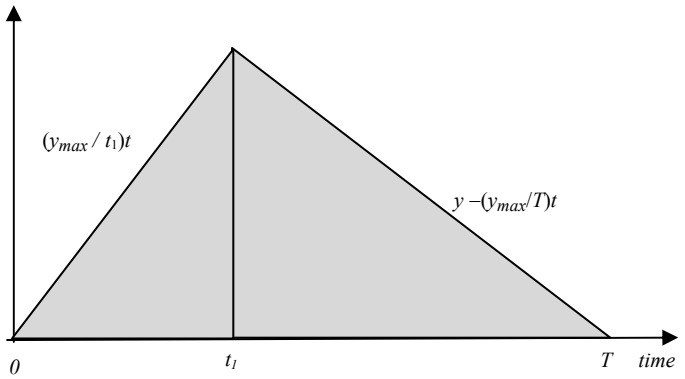

Figure 4: Holding cost due to production during the zero production period Finished

From (8) and (9), we have that the inventory holding cost due to production over the inventory period is

$$PW(HP)=\frac{(h_p+h_r)y}{i^2T}\left[iTe^{-it_1}-it_1e^{-iT}-e^{-it_1}+e^{-iT}\right]+\frac{(h_p+h_r)y_{\max}}{i^2t_1}\left(1-e^{-it_1}-it_1e^{-it_1}\right)$$

The remaining cost components, the ordering cost K_s, the setup cost K_p, and the purchasing cost of raw material C_ry are discrete cash flows occurring at the start of the inventory cycle. Therefore, the present worth of the profit per inventory cycle function as

$$\begin{aligned}PW=&S_ryqe^{-it_s}+\frac{sD}{i}\left(1-e^{iT}\right)-K_r-K_p-C_ry-\frac{CpD}{i}\left(1-e^{-it_1}\right)-\frac{C_sx}{i}\left(1-e^{-it_s}\right)\\&-\frac{(h_p+h_r)y}{i^2T}\left[iTe^{-it_1}-it_1e^{-iT}-e^{-it_1}+e^{-iT}\right]-\frac{(h_p+h_r)y_{\max}}{i^2t_1}\left[1-e^{-it_1}-it_1e^{-it_1}\right]\\&-\left[\frac{y}{i}(1-qe^{-it_s})+\frac{y}{i}(q-1)e^{-it_1}+\frac{P}{i^2}(it_1-e^{it_1}+1)e^{-it_1}\right]h_r\end{aligned}\qquad(10)$$

Multiplying equation 10 by the funds-flow capital recovery factor, $\frac{i}{(1-e^{-iT})}$, we obtain the total annual profit function

$$\begin{aligned}G(y)=&sD+\frac{S_rqye^{-it_s}}{(1-q)(1-e^{-iT})}i-\frac{C_ryi}{(1-e^{-iT})}-\frac{(K_r+K_P)i}{(1-e^{-iT})}\\&-\frac{CpP\left(1-e^{-it_1}\right)}{(1-e^{-iT})}-\frac{C_sx\left(1-e^{-it_s}\right)}{\left(1-e^{-iT}\right)}-\left[y(1-qe^{-it_s})+y(q-1)e^{-it_1}+\frac{P}{i}(it_1-e^{it_1}+1)e^{-it_1}\right]\frac{h_r}{(1-e^{-iT})}\\&-\frac{(h_p+h_r)y_{\max}}{it_1}\left(\frac{1-e^{-it_1}-it_1e^{-it_1}}{1-e^{-iT}}\right)-\frac{(h_p+h_r)y}{iT}\left[\frac{iTe^{-it_1}-it_1e^{-iT}-e^{-it_1}+e^{-iT}}{1-e^{-iT}}\right].\end{aligned}$$

The optimal solution is the maximizer y^* of the function $G(y)$. Since a closed form formula for y^* is impossible to obtain, a numerical solution is necessary.

NUMERICAL EXAMPLE

Consider a production process where the daily demand rate for an item is 5 units and the production rate is 10 units per day. The raw material used in production is ordered from the supplier where 30% of the items received are found defective. Screening for imperfect quality items of the raw material is conducted at a rate of 20 items per day. The ordering cost for the raw material is \$100 and the setup cost is \$183. The holding cost of raw material is \$0.01 per unit per day while the holding cost due to production is \$0.02 per unit per day. Hence, the holding cost of one unit of the finished product is \$0.03 per day. The purchasing cost of one item of raw material is \$5 and the unit production cost is \$10. The selling price is \$25 per unit. The imperfect quality items screened may be sold at the end of screening period at a discounted price of \$3. The parameters of the problem are D=5, P=10,q=0.3, x=20, K_S=100, K_p=183 , h_p=0.02, h_r=0.01,

C_r=5, C_p=10,S=25, *and* S_r=3. If the time value of money is ignored, the optimal order quantity is $y^* = 500.4 \approx 500$. The optimal number of items produced during a production cycle is $y^*(1-q) = 350$ units. The length of inventory cycle is $T^* = \frac{y*(1-q)}{D} = 70$ days, the production period is $t_p{}^* = \frac{y*(1-q)}{P} = 35$ days, and the screening period is $t_s{}^* = \frac{y*}{x} = 25$ days. The total inventory cost per day is \$93.79, the total revenue per day is \$131.43, and the maximum total profit per day is \$37.64.

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BENCHMARKING - AUTOMOTIVE FACILITY LAYOUT, JPH, AND OVER SPEED

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ABSTRACT

The process layout of any manufacturing facility plays a critical role in the level of effectiveness and efficiency that can be achieved. Process layout serves as a foundation for decisions taken by the manufacturer on issues such as competitive priorities, process strategy, quality, and capacity. The process layout varies from one manufacturer to the other based on the nature of work conducted and the products produced.

The following paper benchmarks the different process layouts utilized by automotive companies within North America. The paper will rank the layout based on Jobs per Hour (JPH) and over speed efficiency. Layout information and data utilized in this paper are obtained from each of the facilities during a benchmarking study conducted in 2010.

Keywords: Over speed, Assembly line, Jobs per Hour, Process layout, automotive industry.

INTRODUCTION

The current economic crisis presents great challenges for organizations in general and the auto industry in particular. In order to dodge financial crises, organizations typically take rigorous measures. These measures force these organizations to set priorities on investments, R & D, efficiency, quality, and others. It's long been understood and it's very well known, since the industrial revolution that manufacturing is the vehicle that drives economic development. Typically manufacturing generates wealth and reduces unemployment. Therefore, manufacturing is the foundation for economic power for any nation or organization in the past, present and future. The U.S. automotive manufacturing industry plays a significant part in the growth of the US economy. It accounts for almost 14% of the total value added for manufacturing making it one of the largest manufacturing sectors of the economy and one of the most significant export industries as well (www.bls.gov).

All eyes are on manufacturing firms to design facilities that are lean and flexible enough to handle fluctuations in customer's demand. Therefore, manufacturers see layout as an opportunity to maximize efficiency and productivity, and to reduce cost. When designing the layout within the production facility, manufacturers take into consideration "placement of departments, work groups within the department, work stations, machines, and stock-holding points" (Olsen, et.al, 2003). These elements are arranged in a way to ensure a lean and smooth workflow.

The following paper presents a benchmarking review of the process/line layouts utilized at several domestic automotive facilities in North America. The objective is to expose process layout efficiency and bottleneck (department and zones) based on JPH (job per hour) and over speed. The information analyzed will be utilized to determine the most efficient process layout.

LEAN MANUFACTURING

Lean production systems have long been adopted in manufacturing sector (Womack et al, 1990; Womack & Jones, 1996).Lean contains five primary elements: Manufacturing Flow, Organization, Process control, Metrics and Logistics (Feld, 2000). Process flow and layout are at the heart of lean manufacturing. The Lean story begins with Kiichiro Toyoda who opened the Toyota car manufacturing company (Bocock & Martin, 2011). Toyoda's vision was to create a company that can provide just in time while empowering workers to make any needed changes and adjustments without compromising quality. The Toyota Production System (TPS) enabled Toyota to compete against the American Mass production methods (Bocock & Martin, 2011). A Lean Manufacturing system is a comprehensive process or business model which centers on methodical identification and reducing waste that is embedded within the system/process (Motwani, 2003; Fathollah et al., 2004; Tapping, 2006; Narasimhan et al., 2006). Taj and Berro (2005) claim that many manufacturing companies waste over 70 percent of their resources. Bhasin and Burcher (2006) claim that implementing lean can reduce waste by 40 percent. The lean manufacturing objectives are to: improve quality, reduce time, and reduce/improve cost. These objectives are established through a system that is based on a robust foundation that focuses on achieving a quality controlled system.

Several research studies have shown that a lean strategy creates greater levels of quality and productivity and better customer responsiveness (Krafcik, 1998; Nicholas, 1998). The bearing on lean strategy is mostly based on empirical evidence that it advances the company's competitiveness (Oliver et al, 1996; Doolen & Hacker, 2005)

PROCESS LAYOUT

The process layout in the manufacturing facility affects the efficiency and utilization of a company. The objective of any process layout is to organize the company's physical facility in a manner that promotes an efficient use of people, equipment, material, and energy.

Process layout can be defined as the physical arrangement of machines, equipment, and people involved in a manufacturing and assembly process in order to produce a certain product. The foundation for making decisions on the physical arrangement of the process layout is guided by the nature and location of work required within the facility (relative and absolute location), the space required for each process and/or system, the capacity for each process, the physical shape of each process (start and finish stages), and the physical location of each stage within the sequence of processes to insure continuous and/or lean process flow (El-Khalil, 2009).

The manufacturing and assembly process flow at the automotive facilities is designed in a sequence flow pattern (line flow). There are three main stages/departments; each department is divided into several zones.

The paper focuses on two domestic companies addressed in the paper as D1 (Lansing, MI) and D2 (Detroit, MI) visited in 2010; the two facilities produce similar vehicle segments. These 2 facilities are the best in class for this benchmarking study. The following variables will be used to measure the performance and effectiveness of the process: JPH (actual/forecasted) and overspeed.

Domestic Automotive Facilities (D1 and D2)

The domestic facilities D1 and D2 are identical from process layout aspect. Each of the two facilities is capable of producing 2 different vehicles, 3 models each. The most significant differences are the following:

Shift pattern, number of lines, and products produced are illustrated in Table 1.

JPH for the two facilities shows significant difference, as illustrated in Table 2.

Body Shop Department: D1 facility performs single stage framing while D2 layered framing

Assembly Department: D1 facility performs IP, Exhaust system, and engine transmission assemblies while D2 does not.

Table 1: D1 and D2 number of products, shifts and capability

Facility	Number of Lines			Number of	Shift	Capacity
	BIW	Paint	Assembly	Products	Pattern	Jobs Per Hour (JPH)
D1	1	1	1	3	2	68
D2	1	1	1	3	2	37

Table 2: D1 and D2 JPH by department Forecasted Vs Actual

Facility	Jobs Per Hour (JPH): Forecasted (F) Vs Actual (A)					
	BIW (F)	*BIW (A)*	*Paint (F)*	*Paint (A)*	*Assembly (F)*	*Assembly (A)*
D1	80	69.4	74	65.3	68	60.7
D2	46	42.1	42	37.4	37	32.3

he overspeed gap between the two domestic facilities shows a 1 to 2 % difference, as illustrated in table 3. Overspeed calculation is determined as follows:

$$Overspeed = \frac{Gross\ JPH}{Net\ JPH} - 1 \qquad \text{---------- ----------} \quad (1)$$

Gross JPH = The JPH rate of a system when it is not down, blocked, or starved.

Net JPH = the JPH rate calculated after a period of time, including the effects of down, blocked, and starved time.

Table 3: Overspeed D1 and D2 facilities			
Facility	Overspeed % (Gross Vs Net)		
	BIW	*Paint*	*Assembly*
D1	13%	12%	11%
D2	8%	11%	13%

The overspeed for D2 facility is more efficient in BIW and Paint departments and D1 is more efficient than D2 in the Assembly department.

The detailed analysis for D1 facility reveals the following:

1. The number one bottleneck in the Body shop is the Frame line at 35%,
2. 2.The number one bottleneck in the paint shop is the Inspection station followed by color booth,
3. 3.The number one bottleneck stage at the assembly department is the trim department at 55%.

The detailed analysis for D2 facility, reveals the following:
The number one bottleneck in the Body shop is the Frame line 37%,
The number one bottleneck in the paint shop is the Inspection station followed by color booth,
The number one bottleneck stage at the assembly department is the trim department at 42%.
The domestic facilities bottleneck ranking is very similar (or identical) from the stage perspective of the assembly process.

CONCLUSION

From a gap standpoint based on table 2, the D1 facility is less efficient than the D2 facility. Based on the forecasted to actual production figures, the individual gaps between the two facilities favored the D2 facility by an average of 3%. JPH losses across all departments are driven by zones/areas that are highly labor intensive and in particular in the assembly departments as depicted in figures 3 through 8.Based on overspeed data in table 3, D2 is more efficient than D1 by an average of 2%.

Other variables not considered in this paper contribute to the inefficiencies in the facilities (e.g. Union, economical down turn, lack of liquidity, aging facilities, and high initial investment).

The future of the US automotive industry lies in the abilities of these companies to implement new manufacturing culture driven by improving quality, eliminating waste and reducing costs. The manufacturing facilities at the automotive industry (theoretically) should operate as a team. Management serves as the controllers of the process. They are responsible for organizing their equipment and technicians (skilled and non-skilled) and/or employees to provide consistent work flow through the process.

To improve the current systems, the automotive industry has to absorb significant cost to improve its efficiency and quality. Improving labor efficiency and making high initial investment in manufacturing will payback significantly in the long run (http://trade.gov/static/2011RApt1FINAL.pdf). The most important investment would start with

hiring and training qualified labor force on new technologies/systems and in particular embracing the lean culture. Only when the work force is properly trained and committed to the process, every new system that the company may adopt will in turn be successful. Future research will focus on gap analysis that benchmarks the best in class foreign companies such as Toyota and Honda.

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Upon Request.

INFORMATION ETHICS: A CROSS-CULTURAL STUDY OF ETHICAL DECISION-MAKING BETWEEN AMERICAN AND CHINESE BUSINESS STUDENTS

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ABSTRACT

The purpose of this study is to explore cross-cultural differences between American and Chinese business students in their rationales for ethical decision-making with respect to common information-related ethical dilemmas. We found that the dimensions (i.e., moral equity, relativism, egoism, contractualism, and utilitarianism) of the multidimensional ethics scale (MES) had varying influences on the ethical decision-making of the American and Chinese participants, even though these two groups had fairly similar intentions regarding undertaking the described unethical actions. Specifically, the ethical decision-making of the American participants was primarily related to the moral equity dimension, whereas the utilitarianism dimension heavily impacted the ethical decision-making of the Chinese participants. The implications of these findings for practitioners are discussed.

INTRODUCTION

Researchers have shown an increased interest in the tendency of employees to engage in unethical information-handling activities. Prior studies have identified numerous factors that potentially influence the ethical decision-making processes, such as the locus of control, job insecurity, and the social and legal environment. Despite significant research, studies with regard to information ethics are still rare. Furthermore, previous research has not explored the cross-cultural differences in the rationales for ethical decision-making.

This study is motivated by this concern with regard to the role of culture in information ethics. The purpose of this study is to explore the underlying rationale for ethical decision-making by examining participants' ethical judgments on the five dimensions (i.e., moral equity, relativism, egoism, contractualism, and utilitarianism) of the multidimensional ethics scale (MES).

The results should provide important insights to information system practitioners. Information ethics is significant within the increasingly globalized economy. Cultural differences produce many challenges for multinational companies as they try to address the unethical information-handling behaviors of employees with different cultural backgrounds. Understanding the ethical decision-making processes of employees from various cultures is crucial to globalized organizations. IT professionals can utilize the findings of this study to set localized moral education, training activities, and policies that are suitable to a specific culture.

LITERATURE REVIEW

Information ethics is defined as the ethical issues and dilemmas in the development and application of information (Mason, 1986). Mason (1986) has defined four basic information ethics issues: privacy, property, accuracy, and access.

Information ethics in China is a young academic field; few studies have examined the cross-cultural differences in this field. For example, based on Mason's four types of information ethics issues, Eining and Lee (1997) have examined the influence of culture on information ethics within the U.S. and three distinct Chinese cultures (i.e., Mainland China, Hong Kong, and Taiwan). They found significant differences between these cultures in their acceptance of the unethical behavior with regard to the issues of privacy, property, and access, but similar ethical attitudes toward the accuracy issue. Additional analyses suggest that American students tend to view ethical dilemmas from a rule-based and legal perspective, whereas their Chinese counterparts are more concerned with relationships.

Martinsons and So (2005) also utilized Mason's four ethical issues in a cross-cultural comparison between the ethical assessments of American and Chinese managers. They found that the ethical assessments between these two groups were similar but the processes used in their ethical assessments were significantly different. American managers have more legal and individual rights concerns, while Chinese managers place more importance on relationships, social norms, social responsibilities, and organizational needs.

The above two studies have found cross-cultural differences in overall ethical judgments between the U.S. and China in the context of information ethics. However, ethical judgment is a multidimensional construct (Reidenbach & Robin, 1988). It is not sufficient to only examine overall ethical judgments to understand unethical information-handling behaviors. To investigate cross-cultural differences with respect to the impact of multidimensional ethical judgments on behavioral intentions, this paper utilized the MES developed by Reidenbach and Robin (1988).

Utilizing the MES dimensions in cross-cultural studies facilitates predictions regarding the rationales for ethical decision-making. For example, Ge and Thomas (2008) have investigated the ethical decisions of Canadian and Chinese accounting students using the MES dimensions. Their study found that the Canadian accounting students used post-conventional MES dimensions (i.e., moral equity, contractualism, and utilitarianism) more frequently than their Chinese counterparts to make moral decisions in three out of four ethical dilemmas.

Based on Ge and Thomas's (2008) study, it was the premise of this study that American students might view some of the MES dimensions as more important than their Chinese counterparts and vice versa. Thus, to explore how American and Chinese students may differ in their judgments of the MES dimensions, which further influence their behavioral intentions, we propose the following hypothesis:

H_1 *There will be significant cross-cultural differences with respect to the impact of the MES dimensions on the behavioral intentions between American and Chinese business students measured by their willingness to*

undertake the described unethical actions in Mason's four information ethics issues.

METHOD

To evaluate the behavioral intentions of the participants to engage in Mason's four information ethics issues (i.e., privacy, property, accuracy, and access), we adapted four scenarios from Eining and Lee's (1997) study. After reviewing each scenario, the participants were required to respond to a few questions from Cohen, Pant, and Sharp (2001).

The participants were first asked to indicate the probability that they would undertake the described unethical actions in the same circumstances on a 7-point scale that ranged from 1 (high) to 7 (low). Second, the participants were required to indicate the probability that their peers would undertake the described unethical actions. This measure was used to control for potential social desirability bias (e.g., Cohen et al., 2001). Finally, the participants were asked to assess the described unethical actions in terms of the five MES dimensions (i.e., moral equity, relativism, egoism, contractualism, and utilitarianism).

A confirmative factor analysis (CFA) was conducted to examine the validity and reliability of the MES. All factor loadings exceeded 0.5, and Cronbach's alpha measures for each dimension exceeded 0.60; the above results suggest acceptable validities and internal reliabilities for each dimension. Item scores were thus averaged for each dimension.

The instrument was originally written in English. After translating it into Chinese, it was back translated into English. There were no significant problems in either the translation or the back translation.

RESULT

This study includes 105 business students (41 females and 59 males) from the U.S. and 93 business students (64 females and 34 males) from China. The average age of the American students was 21.1 years, and the average age of the Chinese students was 20.7. The average working experience of the American students was 0.3 years, and the average working experience of the Chinese students was 0.34 years. There were no significant differences in age and working experience between the American and Chinese students.

We regressed the behavioral intentions of the American and Chinese participants against their mean responses to each MES dimension using gender as a covariate. Overall, the results from the regression model indicated that the American participants primarily used the moral equity dimension for all four information ethics issues, whereas the Chinese participants predominantly used the utilitarianism dimension for all four information ethics issues.

The coefficient for the gender variable was only statistically significant for the privacy issue in the U.S. sample. This finding indicates that both male and female students tend to view the MES dimensions similarly in their ethical decision-making regarding the property, accuracy, and access issues. Taken together, the results reported above provide support for the important

role of cultural differences when using the MES dimensions in the ethical decision-making of American and Chinese business students.

CONCLUSION

This study found that American and Chinese students differ only slightly in their responses to the four unethical information-handling issues. However, even though the two groups share similar behavioral intentions to engage in unethical information-handling issues, significant cross-cultural differences exist with respect to their rationales behind their ethical decision-making. Specifically, American students tend to make ethical decisions using the moral equity dimension, while Chinese students focus on the utilitarianism dimension.

These results have important implications for practitioners who are attempting to enhance the knowledge regarding information ethics. The results can be used to develop the training areas for information ethics. Specifically, if practitioners want to reduce unethical information-handling behaviors, it is better to convey the consequences of the unethical behaviors to employees from China, while communicating the accepted standards of information ethics to employees from the U.S.

The results of this study should be interpreted with caution because it has some limitations. First, this study used four scenarios to elicit the behavioral intentions of the participants in a hypothetical context. Although this method has been used in previous research to explore ethical decision-making, this approach does not measure how respondents might actually behave in a real-world environment. The scenarios utilized in this study might not simulate the same pressures that the participants would experience in the actual environment. Future research could mitigate this limitation by investigating the actual behaviors of people who have experienced similar situations.

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EMOTIONAL INTELLIGENCE AND ENTREPRENEURSHIP

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ABSTRACT

In this paper the importance of emotional intelligence to the organization and to the individual leader will be discussed. Goleman (1998) defines emotional intelligence as the capacity for recognizing our own feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in our relationships. Several emotional intelligence theories will be discussed. These theories will be compared and contrasted with each other. Finally a plan is presented for developing emotional intelligence in leaders. A model for learning presented Boyatzis (2002) will be used to show how a leader can develop his/her emotional intelligence.

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ISSUES IN FORECASTING INTERNATIONAL TOURIST TRAVEL

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ABSTRACT

In this paper two popular time series methods for modeling seasonality in tourism forecasts are compared. The first uses a decomposition methodology to estimate seasonal variation. In this method seasonal variation is estimated with a ratio-to-centered moving average approach. Three different approaches in calculating the seasonal indices are analyzed. The deseasonalized series are then forecast using an ARIMA model. The second methodology uses a multiplicative seasonal ARIMA (SARIMA) approach to simultaneously model trend and seasonal variations. The two methodologies are compared and the accuracy and managerial advantages of each are discussed.

A MODEL FOR MANAGING RENTAL FLEETS IN THE NEW COMPETITIVE LANDSCAPE: MAINTENANCE, PRODUCTIVITY, BRANDING AND LEGAL IMPLICATIONS

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ABSTRACT

Rental companies across the United States are paying close attention to profitability. The current economic landscape has changed, and unfortunately it forces those companies to move away from the outdated model of utilizing rental cars between four and six months, after which they are disposed of on the used car market for high profits. An improved model is needed to address the dynamic changes in the new competitive landscape, which may significantly impact profitability and other business operational factors. The authors of this paper propose a model, examining maintenance costs, productivity, branding and legal implications for more effective management of rental companies.

DIGITAL HOME – SOCIAL AND ECONOMIC IMPLICATIONS IN A DEVELOPING ECONOMY

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ABSTRACT

Technology has engulfed our home lives. One way to synchronize the use of technology at home is to create a digital home management system where lighting, security, room temperature, and other sundry devices can be activated at a single point. The focus of this article is to determine whether such a home automation system can be applied to a developing economy. In particular, this paper reviews the social and economic complexities of setting up a digital home system in a low level economic environment as experienced in Nigeria.

Key Words digital home, home management system, developing country, Nigeria

INTRODUCTION

The Digital Home refers to a residence with devices that are connected through a computer network. It is a network of consumer electronics, mobile and computer devices that co-operate transparently to simplify usability in the home (Fasbender et al., 2008). A digital home synchronizes the use of technology at home where lighting, security, room temperature, and other sundry devices can be activated at a single point.

Currently in Nigeria the digital home consists of unconnected subsystems which conform to different standards. For a digital home to be viable in Nigeria a number of challenges need to be overcome. In this paper, we will review the social and economic complexities of setting up a digital home system in a low level economic environment as experienced in Nigeria.

The structure of this paper is as follows: In section 2, we will discuss the current state of the digital home in Nigeria. In section 3, we will discuss the social implications of introducing a digital home in Nigeria. In section 4, we discuss the economic implications of introducing a digital home in Nigeria. Conclusions are presented in section 5.

THE DIGITAL HOME

Currently the digital home in Nigeria consists of several unconnected subsystems which conform to different standards. For example, there may be satellite television system, personal

computer and telecommunication subsystems which are not connected and are controlled independently.

To address the problems of the current digital home, we need a single multi-platform network to connect the various subsystems together to make the digital home viable. (Oborkhale & Salatian, 2011) state that a digital home network must be a high-speed network capable of transporting and routing a multitude of services, including voice, data, video, and multimedia, on a common platform for applications and services that is accessible to the users across the entire home network, as well as, outside the network. The digital home network must include various technologies which are both wired and wireless that will control numerous devices, including security systems, lighting, home tele-care applications, and home entertainment systems. In Nigeria, these networked devices will require low-power, high-performance technology platforms that should be provided by a robust and reliable solution.

In order for a digital home to be viable and sustainable in a developing nation such as Nigeria, a number of social and economic complexities need to be overcome.

SOCIAL IMPLICATIONS

he social implications of introducing a digital home in Nigeria is directly related to cultural adjustments and the education level of the residents and end-users of the digital house.

Hofstede (1997) states that culture is an accumulation of knowledge, experience, beliefs, values, attitudes, hierarchies, religion, concepts of time, roles, spatial relations, philosophies of the universe, and material objects and possessions acquired by a group of people over a period of time. It is consequently expected that varying groups of people will have diverse notions of culture. This cultural diversity can have a huge impact on the introduction of digital homes in a developing economy because families in these settings try to preserve their cultural traditions; they respect privacy and cherish family bonding and communication. If the digital home is constantly monitored and interpersonal communication at home is replaced with intercoms then the traditional values, that they value so much about, will be lost.

Cultural unity and conformity is closely tied to ethnicity and religious affiliations. Nigeria has over 200 ethnic groups and two main religious sects. Within these cultural boundaries, traditions further delineate its people by its customs, languages and dress code. Technology is often seen as a ‘western’ imposition against tradition and is considered a form of friction to the traditional way of life. Consequently, technology is not always easily accepted nor integrated into the daily personal or work life of the average Nigerian. As an example, a recent technology initiative, the OLPC (One Laptop Per Child) initiative that was supported by OLPC Association and the Cambridge-based OLPC Foundation came with many challenges. The OLPC launched a program to distribute “technology and resources to targeted schools in the least developed countries” (Buchele & Owusu-Aning, 2007). Countries such as Ghana, Sierra Leone, Rwanda with similar living conditions to that of Nigeria were part of this initiative. Officials in some of these countries challenged its appropriateness to cultural emphasis and priority to other basic amenities of people in poor living settings. Despite the program offering training programs

for those children that received the laptop, many of the cultural sensitivities were ignored and were in conflict which hindered the program goals.

The lifestyle patterns brought about by inhabiting a digital home are often at odds with the local culture in developing countries. In Nigeria, the culture values highly close family ties which are maintained through regular face to face interaction that maintains and enforces bonds between family members. However in digital homes, the incidence of physical contact is drastically reduced by the presence of technology because one does not necessarily have to physically encounter another person in order to communicate and elicit a response.

Also, access to multimedia and the internet offers a means of recreation and personal entertainment which will be at the cost of spending quality time with family members. In the absence of such technology, leisure time is usually spent playing traditional board games, or listening to stories told by the older generation. This may result in the alienation of the older generation from the youth and aggravate the effects of the generation gap.

The second notable social implication of introducing a digital home is the education level of the residents of the digital house. In 2006, the literacy rate in Nigeria was recorded at about 57 percent which is one of the lowest in Africa. This hardly constitutes a society that is ready for modern and sophisticated technology use. There is little to show in the way of literacy readiness; in fact, the literacy rate has declined to 64 percent in 1999 from 72 percent in 1991 (Igbuzor, 2006).

ECONOMIC IMPLICATIONS

Although there are three main economic implications of introducing a digital home in Nigeria: growth, sustainability and disparity.

Technological advancement has been proven to encourage economic growth and we can safely predict that the introduction of digital homes in developing economies would follow this norm. Digital homes utilize a wide range of consumer electronics and computing devices. In a capital market economy, which is the economic system employed in many developing nations, IT companies would compete to supply the most up-to-date technology for digital homes which provide a substantial market for such goods. Such competition is healthy for a growing economy.

A common feature of developing economies is a high rate of unemployment. As a direct consequence of the introduction of digital homes, ICT services and marketing companies would be in greater demand which would lead to a boost in employment opportunities in the IT sector.

In a developing economy, it is the national infrastructure that can limit the full development and sustainability of the economy including its people. It is not uncommon in Nigeria that homes and workplaces only have 1-2 hours of electricity a day, or that bore holes of water run dry, or roads are flooded. These issues have a huge impression on the success of introducing new technologies into ones home. Establishing a sustainable and enduring framework for a long lasting effective digital home management system is multi-complex and cuts across all social, economic, political and environmental barriers. For example, a well-coordinated and effective supply chain management process needs to support the business process and with current trends in eco-friendly efficiency and globalization, it seems that this

developing nation has a huge undertaking to ensure that technology is being optimized for the users.

Disparity is the inequalities between groups including the knowledge of information and communication technologies. Technology is creating divisions on a global level and within a nation. It is also evident that technology is accessible, affordable and usable to a small percentage of the entire population. Indeed, (Bürén et al., 2011) claims that with a population of around 155 million people, just over 73 million Nigerians have mobile phones and less than 45,000 are considered regular internet users. With 80 million Nigerians living in secluded areas without access to electricity and good roads, it is hardly imaginable to think that these rural dwellers would be in a position to digitize their home. Indeed, (Adimorah, 1990) states "our information services are still elitist, serving only 20% of the educated elite group while that 80% illiterate rural dwellers wallow in information deprivation."

A digital home management system has important implications for Nigeria as the distribution and accessibility of technology and information is unevenly distributed and accessible to a small group of people. This unevenness may have subsequent repercussions because it does not create equal opportunities for all its citizens. This disparity may contribute to the unsustainability of such an initiative at this time. Until a nation is able to close the gap, or bridge the divide, the economic implications will continue to hinder the progress of technology and information in an economically starving environment.

CONCLUSIONS

Currently the digital home in Nigeria consists of various unconnected subsystems which cannot communicate with each other. For a digital home to be viable in Nigeria, it will require a number of the challenges to be overcome. In this paper, we discussed the social and economic complexities of setting up a digital home system in a low level economic environment as experienced in Nigeria. If these complexities can be addressed, then Nigeria can reap the benefits of operating an automation home digital system that has endless possibilities for economic growth.

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USING ASYNCHRONOUS ONLINE INSTRUCTION TO MAXIMIZE LEARNING

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ABSTRACT

Information and management science has increased in meaningfulness with the advance of online asynchronous pedagogy. According to IDEA (2004), all students with or without disabilities should be placed in a Least Restrictive Environment (LRE) to ensure that they have access to the general education curriculum to the greatest extent appropriate. The purpose of this paper is to exam factors that influence the least restrictive environment for online course instruction, and its benefits to students with disabilities.

INTRODUCTION

A least restrictive environment may not necessary mean a physical environment as a classroom. It can be virtual. This form of assistive technology pedagogy can achieve this requirement. Assistive technology is a term used to describe any piece of equipment, from the simplest to the most complex that is modified or customized, and can be used to increase or maintain current functional capabilities (Sze, & Cowden 2009). An example of this is online learning. Attending an online course can serve as a virtual resource room. The acceptance of online courses is on the rise in academic settings. Within this virtual media, there exist many types of instructional delivery models such as fully online, hybrid, synchronous and asynchronous pedagogy. Digital pedagogy, for many, is the practice of asynchronous communication.

Asynchronous communication has attained prevalence with digital pedagogy. To practice asynchronous communication is to create an environment where communication takes place at different time intervals and/or over a certain period of time. Within this environment, digital exchanges between instructors and students are frequently enacted asynchronously, rather than in real time dialogue, which can add a restrictive element to the learning environment.

Asynchronous digital pedagogy can therefore be justified as a feasible learning process. To add to this, Yukawa (2007) concluded that social factors such as professional background, prior experience and relationships, learning style preference, and learning environment were a consideration when constructing web-based asynchronous communication collaborative software. Yukawa's findings indicate that the factors influencing online communication styles are multifaceted. While asynchronous digital pedagogy may open up new ways of learning, one needs to ensure that this venue contains frequent self-assessment, and active learning experiences rich in emotion and personal relevance (Miller, 2009).

By discussing and reflecting on their assumptions, the student is encouraged to participate within the confines of a flexible virtual world. Using asynchronous digital pedagogy that promotes student engagement and participation, students are encouraged to reflect their and others similarities and differences in feelings towards different issues presented in the course. In so doing the instructor creates a meaningful, safe and the least restrictive environment where all students can participate.

FACTORS TO CONSIDER

As the literature concerning online education is somewhat contradictory, with reports of both positive and negative learning outcomes, it is important that we assess this research with the view that online learning presents new challenges for administration, faculty and students. It is not necessarily the same as traditional learning. As such the way we conduct the course may be different and as such may need to be assessed through different lenses.

Asynchronous digital learning is a form of transformative pedagogy which can assist in students their learning. Meyers, (2008) believed that the effective use transformative pedagogy, creates a safe environment; encourages students to think about their experiences, beliefs, and biases; uses teaching strategies that promote student engagement and participation; poses real-world problems that address societal inequalities; and helps students implement action-oriented solutions (Meyers, 2008). Asynchronous digital transformative pedagogy does this in a manner which is user and time friendly to the student. Interactions can occur at any point in the day and be either individual, one on one or group interaction.

In support of this, Küçük, Genç-Kumtepe, and Taşcı (2010) examined relations between students' learning styles and factors influencing students' participation in asynchronous communications in online courses. The most popular support service was found to be pedagogical and social guidance for all types of learning styles while the least preferred support services were the administrative and technical.

Incorporating an already accepted mode of communication into an asynchronous digital transformative pedagogy brings learning into the real world environment. Hill and Nelson (2011) examined the experiences of undergraduate university students in response to the employment of video podcasts to support learning and teaching. It was determined that the podcasts were effective in supporting learning and teaching environments by offering flexible and visual learning experiences The empirical investigation that linked verbal and visual reasoning with patterns of internet use was conducted by Johnson, (2008). Online learning is not simply the ability to control a set of software applications; it is the ability to execute a set of cognitive reasoning functions to maximize learning.

While the use of online courses is on the rise in academic settings, a major obstacle in the practice of this milieu is the limited understanding of learners' characteristics and perceptions about technology use. Thus there is a need to understand the relationship between students' learning styles and their preferences for instructional strategies.(Saeed, Yun, & Sinnappan, 2009). Blogs, podcasts and social bookmarks are part of the day to day life of many students. These individual differences in learning preferences can suggest how instructional learning styles

can be best designed to support the learning preferences within an asynchronous digital pedagogy.

In approving an online course, it is important for the administrator to understand the above when determining the proper size of the class in order to ensure that optimum learning can occur. Once a course becomes meaningful for students through effective learning strategies, there is the real possibility that many students will wish to take the course. Lynch (2010) looked at several possible disadvantages for conducting online discussions with a class size larger than 10 students. He concluded that large group discussions often cultivated different issues, creating a rambling strand that may discourage both understanding and participation. Lynch (2010) also concluded that protracted discussions discourage meaningful reflections. If the university does not have a cap on the number of students, there is a risk of diluting the proper milieu for a meaningful shared learning environment.

However, a major complication in the practice of online courses is the limited understanding of instructors and learners' characteristics and perceptions about using this pedagogy. For example, those students who have lesser organization and time management skills, or have a mindset of being spoon-fed by instructor, might feel that the asynchronous model has left them in the cold, unattended, and disconnected. In order to create a least restrictive environment, there is a need for the students to understand and be able to navigate within an *a*synchronous communication digital pedagogy, where digital exchanges between instructors and students are frequently enacted asynchronously rather than in simultaneous or in real time dialogue.

ADVANTAGES OF AYSNCHRONOUS DIGITAL PLATFORM

Generally, the less opportunity a student has to interact and learn with peers without disabilities, the more the placement is considered to be restricted. Within an asynchronous digital platform, students have the freedom to interact without time and/or location constrains. It provides a level-playing field and ensures meaningful engagement and participation for students with or without disabilities. This ease of access along with student work schedules allows online education to become increasingly popular.

Advantages of using an asynchronous digital pedagogy model are numerous. The most noticeable effect is the role of the instructor in the pedagogy of learning. Students are no longer in the classroom and the instructor is more of a facilitator and mentor. This brings about the issue of learner participation. Olofsson (2007) stated that due to the change in role of the instructor, students often had to rely on and trust each other. Since with online learning, each student needs to be active and hold an inclusive attitude towards the other group member, This requires that every student who is planning on taking an asynchronous digital online course to be schooled in this approach before they start the online course. This can be achieved through various approaches such as being part of the colleges orientation procedures, having a hybrid part of the online course, or providing the student with an instructor video imbedded in the syllabi which explains and give exemplars of how the course is to be conducted.

Educators participating in asynchronous digital pedagogy instruction can monitor learners' progress, in non-intrusive ways, in order better to follow their learning process and appraise the online course effectiveness (Petropoulou, Altanis, Retalis, Nicolaou, Kannas, Vasiliadou & Pattis 2010). Examining the learning process in online atmospheres is an important ingredient for supporting the effectiveness of the pedagogy. Studies support the belief that online reflective communication can be an effective tool. Lineweaver (2010) stated that students who are involved in online discussions reported understanding lectures better. Persico, Pozzi, and Sarti (2010) looked at the interactions within online student communications to identify indications of the participative, social, cognitive, and teaching dimensions of the learning process. The data analysis supported the applicability of reflective practice as the most effective learning approach. While there is a need to ensure that asynchronous digital pedagogy contains frequent self-testing, well-spaced, structured study sessions and active learning experiences rich in emotion and personal relevance, as empirically supported pedagogical strategies; using reflective pedagogy as an integrated part of the course allows the teacher to visually see the students growth.

While analysis and constructive feedback by one student on another or by class responses to individual submissions can be a useful tool to assist in the reflective practice through the feedback process, it should only be used as a formative assessment at regular intervals of a student's progress in order to help to improve the student's performance and never as part of any student grade. In doing so the instructor creates a meaningful, safe and least restrictive environment where all students with or without disabilities.

CONCLUSION

Managing cyber information is a science. As universities struggle with enrollment and move towards a more user friendly online classroom environment, instructors are beginning to examine how this new reality works and how to understand the differences that occur within this educational milieu. Factors that influence the least restrictive environment for online course instruction are indicators for best practice in an asynchronous pedagogy model. The benefits to students with disabilities are numerous and are in line with creating a LRE for students with or without disabilities.

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MANAGING VARIANCE IN A MULTIPLE FILL-HEAD PROCESS USING SAMPLE SIZE AND PROCESS CAPABILITY

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ABSTRACT

Many firms continue to face significant problems in correctly applying control chart techniques, especially, when dealing with outputs from multiple fill-heads. These problems can either take the form of overreacting to false alarms, or delaying detection of genuine errors due to assignable causes, or failing to detect process errors, or even misapplying the statistical process control methods. If a multi fill-head process begins to drift away from the target due to an assignable cause, it is important that such changes be detected as soon as possible and corrective actions taken. We suggest that the selection of an appropriate sampling size in a sampling plan can have strong bearing on the sensitivity of detecting these process changes. In this paper we investigate the effect of sample size on the sensitivity of detecting undesirable process variance due to assignable cause in a multiple fill-head production process under alternate sampling methods.

Keywords: Stratified, Random, Sample Size, Power Curve, Control Charts, Monte Carlo Simulation

INTRODUCTION

Traditionally, most practitioners of control charts have used "three sigma" control limits to minimize false alarms of undesirable change, known as Type-1 error (α-value). However, setting control limits at "three sigma" limits results in the control charts becoming insensitive to detecting small shifts in the production process by increasing Type-II error (β-value). For "kaizen" or continuous quality improvement initiatives to succeed, it is imperative for companies to be able to detect with greater statistical power even those assignable causes that lead to small changes in the process. Wheeler (1983) defines statistical power as the likelihood of a sample statistic falling outside the control limits on the first sample taken just after the occurrence of a shift in the process. It is to be noted that greater the statistical power to detect a process shift, lower is the probability for Type-II error since statistical power is given by $1-\beta$.

Osborn (1990) suggests several approaches for reducing Type-II error, thus increasing the sensitivity of the control charts in detecting process shifts. The first approach is to set control limits at less than 3-sigma limits, say at 2-sigma level. However, this approach runs the risk of

increasing Type-I error, thus the likelihood of more false alarms. The second approach for increasing the sensitivity of control charts is to use cumulative information contained in quality run charts based on patterns formed by taking several sequential samples. This approach would incur delays due to multiple sampling. The third approach to enhance the sensitivity of control charts relates to the sample size used in developing them. As the sample size is increased, the control limits tend to become tighter, thus increasing the statistical power of the control charts to detect process shifts without the detrimental effect of increasing false alarms. To quantify the statistical power of the control charts for detecting process shifts, power curves or operating characteristic (OC) curves may be used.

Much of the literature on statistical process control has focused on single fill-head production processes. Scheffe (1949) and King (1952) provided operating characteristic (OC) curves for x-bar and R charts with rational samples for "standard-given" cases. For "no-standard" given cases, Olds (1961) offers insights regarding characteristics of control charts when rational sampling is used. While still focused on rational samples, beginning in the 1980s and into the 1990s, we see a change in the literature. There is a clear recognition of the need for methods which can detect slight to moderate shifts in the process. For example, employing multiple detection rules for the average process shift, Wheeler (1983) and Palm (1990) demonstrate tables of the power function for the x-bar chart. Following suit, Davis et al. (1993) also utilize the "statistical power" of an x-bar chart.

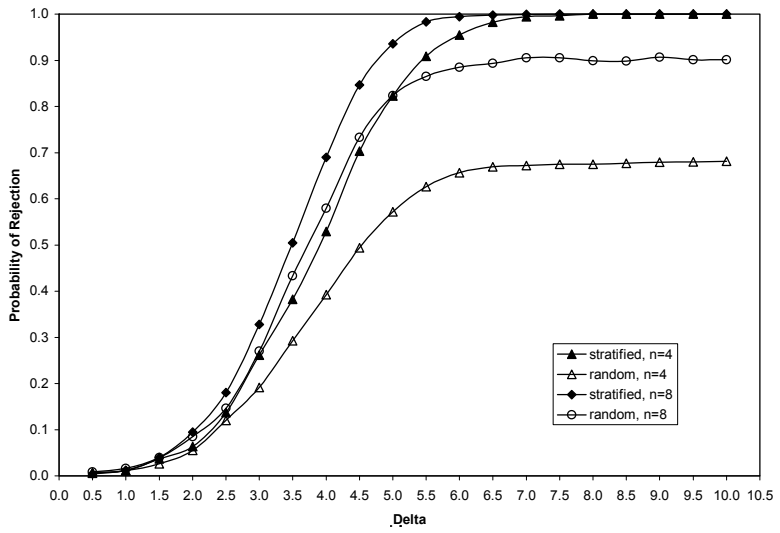
However, with manufacturing increasing in complexity production processes often consist of multiple fill-heads. With increased complexity, late detection of even slight shifts in the process can exacerbate costly specification error and scrap. According to Caulcutt (1995) and Evans (1993), in such cases, choosing an appropriate sampling plan both in terms of sample size and method becomes a primary issue for the control charts to function effectively. Wheeler (1983) and Osborn (1990) further highlight this view point by asserting that the control chart will be sensitive enough to detect even minor process shifts without setting off false alarms if QC staff use the correct method and correct sample size. There is limited literature on statistical methods to effectively monitor production processes with multiple fill-heads. More recently, Lanning et al. (2002) employed an adaptive fractional approach to processes with a relatively large number of populations. Other researchers recommend multivariate techniques (Runger et al., 1996), paired Shewart and CUSUM charts (Mortell and Runger, 1995), group control charts (Montgomery, 1982), and plots of raw data, residuals methods, and analysis of variance to examine multiple fill-head machines (Otto & Snee, 1973).

Therefore, the objective of this paper is to investigate the effect of sample size on the sensitivity of control charts in detecting undesirable process variance due to assignable cause in a multiple fill-head production process under alternate sampling methods. Note that the changes in process variance, as compared to those in process mean, are more detrimental for quality output and difficult to correct. Since sampling distribution for range statistic is difficult to define, this paper uses Monte Carlo simulation to develop probabilities for detecting changes in process variance under alternate sampling methods.

POWER CURVES FOR R CHART

Today, many production processes involve multiple fill-heads for production systems. For example, a production process involving multiple fill-heads would require filling an equal number of vials at a time to a specified weight. When a batch of vials is filled, an equal number of new batches will replace it. Measurements are derived from an equal number of different strata. In designing a process control system utilizing R-chart, a quality control professional must then determine whether it would be better to sample N vials at random from the process or sample one from each fill-head for a total of N. Figure 3 shows the comparative power curves for R-chart under both the stratified and random sampling methods for sample sizes 4 and 8.

Figure 3: Comparative power curves for R-chart under random and sampling method for n=4, 8



It again confirms that the statistical power of detecting a stratum shift increases with increasing sample size. Since sample size is usually controllable, a practitioner must choose a sample size such that it detects a stratum shift with a specified level of probability. It is interesting to note that as sample size increases from 4 to 8, the relative difference in sensitivity for detecting process changes between stratified and random sampling methods diminishes significantly.

Figure 3 also shows the interplay between sampling cost (economics), sampling convenience, and the desired sensitivity of a control chart for shift detection. Note that for stratum shift levels such that $3\sigma_x \leq \delta \leq 5\ \sigma_x$, random sampling at n=8 provides higher likelihood of shift detection as compared to stratified sampling method at n=4. Thus, if the marginal cost of sampling is low and random sampling is more convenient, then it may represent a better trade-off

from a practical standpoint. Alternately, if the marginal cost of sampling is high due to either higher cost of each sampled unit or the destructive testing involved, then a stratified sampling at lower sample size may represent a better trade-off.

(References Available Upon Request)

DESIGNING SERVICE LEARNING PROJECT IN SYSTEMS ANALYSIS AND DESIGN COURSE

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ABSTRACT

Service learning is to promote real-world relevance through the application of classroom knowledge to problems in the business community. Study shows that service learning is a valuable instructional methodology and has been applied to many disciplines and areas. However, little is applied in Information System education. The purpose of the paper is to present the design of a service learning project to an undergraduate systems analysis and design course in a Computer & Information Technology program. The service learning project partners the enrolled students with a local Chamber of Commerce to develop a new information system housed on Microsoft Access database. The course design, student service learning activities, student reflection and assessment are presented in details. The impacts of the service learning education to the students, educator, community, department and university are discussed as well in the paper.

Keywords: Service Learning, Information Systems, Systems Analysis and Design, Course Design

SCAPEGOATING HUMANS, SCAPEGOATING TECHNOLOGIES: EXAMINING ANOTHER SIDE OF INFORMATION SYSTEM PROJECT CONTROL

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ABSTRACT

A large number of information system (IS) projects are considered to be failures for not achieving the objectives set for them. One means to improve success of these projects is adequate control. While a growing body of studies have examined IS project control, researchers have given little attention to two issues, project stakeholders' understanding of: 1) the roles of scapegoating in IS project control and 2) the roles of information technologies involved in IS project control. Using an interpretive case study of a series of related IS projects, this study investigated these issues. Results show that project stakeholders may exercise and interfere with IS project control by drawing upon the practice of scapegoating. Furthermore, information technologies may play multiple roles in IS project control beyond their mere use as control mechanisms. These technologies may serve as objects of scapegoating, while interfering with project stakeholders' efforts to exercise control through the practice of scapegoating.

STUDENTS PERCEPTION OF QUALIFICATIONS FOR SUCCESSFUL SOCIAL MEDIA COORDINATOR

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ABSTRACT

Social media has grown explosively and become very popular in recent years. In addition, the average time spent on social media is increasing steadily, especially among young people. Organizations, public or private, have realized the importance of social media as a powerful tool for establishing relationships with citizens or consumers. Although potential benefits from social media could be enormous, organizations face a big challenge in taking advantage of social media, since the old way of managing traditional media does not work for social media and numerous social media platforms make the issue of managing social media complicated. More and more organizations want to hire some professionals, as an attempt to manage and utilize social media effectively for their businesses or projects. Job titles commonly posted in the job market are Social Media Coordinator, Social Media Specialist, Social Media Manager, Online Community Manager, Public Relations Specialist, and so on. A latest report by US Department of Labor estimated the number of jobs Public Relations Specialists in 2008 to be about 275,000 and projected jobs to grow over the next decade 24% which would be much higher than other occupations. Universities need to prepare a curriculum for students who want this job. The authors of this paper surveyed about 400 students at a business school regarding various aspects of social media and qualifications and skills for a successful Social Media Coordinator.

MODELING AND PREDICTING TRAFFIC ACCIDENTS AT SIGNALIZED INTERSECTIONS IN THE CITY OF NORFOLK, VA

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ABSTRACT

This paper is an extension of the previously completed study of accident-patterns in the City of Norfolk (Maheshwari & D'Souza, 2006). The multiple-regression model developed in the previous study was based on variables related to intersection geometry. In this study, additional intersection factors are accounted for, which include speed limit, road signage, vegetation and traffic light data. Despite the expanded data set, many other factors like signal type, signal policies, road closures, road conditions, and condition of road signs which could possibly impact the traffic accidents, were not available at the time of the study. The motivation behind this research is based on the literature that indicates that the intersection topography/design factors and traffic management rules might contribute to the traffic accidents.

The objectives of this research were to develop comprehensive statistical exploratory and predictive models for intersections accidents in the City of Norfolk, VA. The research analysis was conducted in three phases. First, a linear regression model was developed using the same techniques applied in the previous study. This was done to establish a baseline model for a comparison of results. At the second stage, an exploratory data analysis technique (two-step cluster method) was used in which the study sample of 58 intersections was divided into two separate groups of clusters according to the type of roads meeting at the intersection arterial, collector and/or local roads. The first cluster consisted of the intersections between a major arterial road and a collector or local road, whereas the second cluster was made up of intersections of a major arterial road with another arterial or a large collector road. Two separate linear regression models were developed for each cluster.

An independent sample of 15 intersections was used for validation of these regression models. All three models, showed about 15% to 21% variation between actual and predicted accident rate values. In each case, however, the deviation between actual and predicted accident values was statistically insignificant. The second cluster deviation was the least, suggesting that the regression model for the intersections between major arterial roads or large collector roads had a somewhat better predictive power than the model for intersections between major arterial roads and collector or local roads.

INTRODUCTION

The main objective of this research was to study the signalized intersections in the City of Norfolk to delineate intersection geometry, road signage and other design factors which may be contributing significantly to traffic accidents. This research project is an extension of the previously completed study on the accident-patterns in the same city in which a multiple-regression model was developed on a selected set of intersections for the City. The City of Norfolk is one of the largest and oldest cities in the Hampton Roads region; and is home to roughly quarter million people. It is one of the most congested cities in the region by the population density. Furthermore, in 2006 the Hampton Roads had the highest crash incidents in the state compared to other regions on the basis of millions of VMT (vehicle mile traveled) (Nichols, 2007). The City of Norfolk contributed roughly 17% of those crashes in the region with annual traffic accident count of approximately 5,400. These data suggest that the traffic safety study could be useful to the City and to the Hampton Roads region.

There is evidence in the literature suggesting that road design factors could impact the traffic safety. Several highway engineering factors like lane widths, shoulder widths, horizontal curvature, vertical curvature, super-elevation rate, median and auxiliary lane were estimated and designed based on some traffic safety considerations. Additional factors like road signage, vegetation, line of sight of a traffic signal, horizontal and vertical curvature, and number of driveways close to an intersection have also been reported to have an impact on traffic safety. To study the impact of these factors along with traffic control rules, researchers have utilized a variety of statistical models (Maheshwari & D'Souza, 2010; 2006). The most popular model is the multivariate regression model where the dependent variable is generally based on traffic accidents and a set of independent variables include roadway design, traffic control, demographic variables and more. To mitigate the impact of large variability among the accident rates on different intersections, a negative binomial model was employed in the regression analysis. Regardless of statistical techniques used, research results show a relationship between the various roadway design and control factors with traffic accidents. Research also indicates divergence on the importance of individual factor on traffic safety. There is also a reported difference based on the regional demographic factors indicating regional accident rate differences due to interactions between design and control factors and the local driving population. Therefore, this study was designed to investigate the impact of the road design factors on the traffic accident rate in a local area.

The previous multiple regression model established a relationship between road design factors and accident rates but the predicted value from the model showed significant variability from the actual accident rate (Maheshwari & D'Souza, 2010). To improve upon the results from previous study, both, the data set (expanded independent variables) and statistical techniques were modified. Data on speed limit, vegetation and road signage were included in the dataset, along with exploratory statistical method and cluster analysis to enhance the predictive power of the regression model. Road signage data was limited to speed limit, name of the next street, turn lane, next signal, chevrons and other safety related posting. The objectives of this proposal were to:

- Develop an exploratory statistical model that would provide a valid explanation of traffic accidents. A set of geometric, design, control and road signage factors would be used as independent variables for model development.
- Validate the statistical model developed at step one.

LITERATURE REVIEW

Provided Upon Request.

RESEARCH PROCEDURE

The following steps were proposed and completed in the research work:

Data Collection: Data collation was conducted at 73 intersections in the City which included intersections with high as well as low incidents rates during the study period of 2000 through 2004. This sample set was divided randomly in two samples of 58 and 15. The larger sample was used to develop statistical models for accident rate and the smaller sample was used for validation of the model. At each intersection, data was collected on road geometry, road signage, and other related factors.

Analysis: Development of statistical models used data collected from intersections and accident database. Linear correlation, cluster analysis and regression methods were used to analyze the data. The statistical models were developed to establish relationships between physical factors and accident rates as well as to predict the future accident rate based on those physical factors.

Validation of Models: Validated statistical models developed in the previous step to determine the accuracy of models. Despite a large variation between predicted and actual values, differences between predicted and actual values from the models were statistically insignificant.

Review of Results and Models: A review of results showed that there is a large variability in the difference of the predicted accident rates from the models and actual values of accident rates.

METHODOLOGY

This research is a continuation of an earlier study by Maheshwari & D'Souza, (2010) which focused on intersections with high accident rates. In this research, the stratified data sampling technique was used. The set of signalized intersection was divided into two groups of intersections based on the total reported accidents during 2000 to 2004. Our of a total of 73 intersections selected of which 39 were from high accident rates (average accident rate of more than 10 per year) and rest of the intersections was selected from the low accident rate group (average accident rate of less than 10 accidents per year). The sample of 73 intersections was randomly divided into two parts of 58 and 15 intersections. The larger sample was used to develop statistical models and the smaller sample was used for the validation of these models. Also unlike the previous study where several data points were discarded due to lack of traffic volume data--Average Daily Traffic (AADT), in this study the entire dataset was used. As traffic volume data was highly correlated to the geometric design factors such as total number of

lanes, turn lanes, etc., its effect on the regression model, therefore, is not significant after the total number of lanes and turn lanes were included in the regression model.

The City of Norfolk has accumulated traffic accident data in an electronic format for the past 11 years from 1994 through 2004. Only accidents related to single vehicles were considered in the study due to technical limitations of importing multi-vehicle information into the available database. The City's accident database was developed from individual police accident reports that currently included the type of accident, road conditions, traffic signs and corresponding signals, drivers' actions, vehicle(s) conditions, demographic data, nature of injuries, and other related information, all of which are subsequently entered in the City's accident database. The traffic accidents without a police report were not included in this database therefore those accidents were excluded from this study.

The traffic volume data, Annual Average Daily Traffic (AADT), was not available for many intersections. Annual Average Week day Traffic (AAWDT) for 2003 and 2004 was available instead. The traffic count data on the several local and feeder roads were also not available.

The accident models were developed using a generalized linear model (GLM). First, a regression model was created using the entire data set. To refine this model, a two-step cluster analysis was performed. This analysis created two clusters of intersections. The membership in these clusters was largely based on the type of intersection. One cluster made up the intersections of two major arterial roads and the other cluster was generally made of a major arterial road and a local road. Two separate regression models were developed for each cluster.

RESULTS AND ANALYSIS

Although topographical data for each leg of the intersection was collected, the accident data was not available for each leg due to missing and/or incomplete information on the police reports or the datasets that was provided to the research team. Therefore, composite topographical variables were created for each intersection by adding values of a variable from each leg of the intersection, i.e., instead of the total number of lanes on the each leg of the intersection, a composite variable was created by adding all lanes on each leg of the intersection. The length of left turn lanes (LNLN) and length of right turn lanes (LNRN) were calculated using a scoring system for lane length. The lane length scores (between 0 and 5) were assigned based on the length of the lane at a given leg of an intersection and then the assigned score was multiplied by the number of turn lanes at that leg of the intersection. Certain variables, like shoulder, overpass, underpass, etc., were excluded from the study as very few intersections in the study had those physical attributes. These composite variables were inputted into the regression models as well as in the cluster analysis as the independent variables.

Simple exploratory data analysis technique (two-step cluster analysis) was used to further analyze the dataset. Clustering was performed to create statistically significant groups of intersections. The categorical variables used for the cluster analysis were the total number of sides with median (MEDN), total number of sign for turn lane (SGTL), total number of signs for the next street (SGNS) and total number of legs with restricted light for left turn (LTLT). Two

statistically different clusters were formed. Cluster 1 has 31 intersections and cluster 2 has 27 intersections. A closer look at these clusters shows that cluster 2 was largely made up of the intersections of two major arterial roads, and cluster 1 was made up of intersections between a local/feeder street and an arterial road.

It is clear with some knowledge of the City of Norfolk road network that two clusters represent two different types of intersections. Cluster 1 is generally made up of the intersection of a local and a major arterial road and cluster 2 is made up of two arterial roads. One predictive model may not work for these two clusters the same way. Therefore, two different regression analyses were performed, one for each cluster.

To perform the regression analysis for each cluster, a similar process was followed as in the previous model. First, Pearson correlation coefficients were calculated to delineate variables significantly associated with the accident rate. Both clusters show a different set of independent variables to be significantly associated with the accident rate.

The maximum speed limit is the most important factor for the intersections of a local road and a major arterial road (cluster 1). The factors other than speed limit like total number of lanes, length of left turn lanes and the number of commercial driveways are also significantly associated with the accident rates for cluster 2 (intersection of two major arterials roads). Regression models for clusters 1 and 2 are presented below. Both models are statistically significant with p-values <0.0001 for the ANOVA testing of the models. R-square for cluster 1 is 0.53 and for cluster 2 is 0.52.

Regression Model 1 for cluster 1

ACCT = -83.19 + 3.78*SPLM -9.50*LTLN + 3.30*TOLN----------(1)

Regression Model 2 for cluster 2

ACCT = -35.41 + 3.44*SPLA + 4.05*TOLN + 1.34*LNLN----------(2)

CONCLUSIONS

Some of the major findings are listed below:

i. The maximum speed limit on any leg of an intersection between local road and arterial road is the most significant factor. Other topographical factors contributed explain little variability of the accident rate and therefore contribute little to the regression model.
ii. When designing an intersection between a major arterial and local road, maximum speed limit of all legs approaching the intersection should be kept as low as possible to reduce accident rates.
iii. Total number of lanes, length of left turn lanes and average speed of all legs of an intersection are significant factors when two major arterial roads intersect each other.
iv. When designing an intersection between two major arterial roads, the following road design factors should be considered to reduce accident rate:
    a. Reduce speed limit on each leg of the intersection,
    b. Increase total number of lanes, and
    c. Increase the length of left turn lanes, wherever possible.

Despite some significant results, this study had many clear limitations:

i. Accident data is 6 years old compared to the recent data collection on the roadways.
ii. All three regression models were unable to account for more than 40% of accident variations.
iii. Predictive capabilities of the models were statistically significant, but it has a limitation. The statistical significance was influenced due to high variability in the predicted and actual accident rate, i.e., standard deviation of the difference of predicted and actual accident rate was very high.
iv. Impact of the controllable factors could be better studied if data was collected over time to capture the effects of the changes made at the intersections.
v. Many design factors and other data were not available. These factors could have an impact on the accident rates (e.g., signal policy, road closure, etc.)
vi. Sample size was still very limited: 58 intersections for modeling and 15 intersections for validation.

ACKNOWLEDGEMENT

The authors thank the City of Norfolk, Division of Transportation for providing data and inputs during the conduct of the study and acknowledge HRPDC's assistance in providing traffic count data. Study was funded by US Dept. of Transportation.

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Provided Upon Request.

NEURAL NETWORK, SUPPORT VECTOR MACHINE AND ITS ENSEMBLE MODEL FOR PREDICTION OF DIFFERENT CATEGORIES OF DERMATOLOGY DISEASES

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P. Pujari, Guru Ghasi Das Central University

ABSTRACT

In this study, we present Artificial Neural Network (ANN), Support Vector Machine (SVM), and its ensemble technique for classification of different categories of erythemato-squamous diseases. The hybrid model of ANN and SVM is built using confidential weighted voting scheme. The classification performance of all models and its ensemble model are presented by using statistical performance measures like accuracy, specificity and sensitivity as well as gain chart and Receiver Operating Characteristics (ROC). The model is tested with dermatology data set obtained from UCI machine learning repository site. Our results show that the ensemble model has achieved a remarkable performance with the highest accuracy of 98.99% on test dataset, which is a competitive technique in the problem of classification of different categories of erythemato-squamous diseases.

INTRODUCTION

Dermatology is a kind of skin disease which is some time very complex and difficult to diagnose and ultimately may cause of skin cancer .The six different categories of these diseases share the similar clinical features of erythema (Güvenir & Emeksiz, 2000; Elsayad, 2010). Several authors have used data mining techniques for the diagnosis of erythemato-squamous (Güvenir, 1998; Güvenir & Emeksiz, 2000; Nanni, 2006; Elsayad, 2010). Classification is a robust technique in medical mining. Even though most studies are conducted in the field of classification to diagnose erythemato-squamous diseases, still researchers are working to find the best classifier for this kind of dataset (Übeyli, 2008 & 2009; Elsayad, 2010).

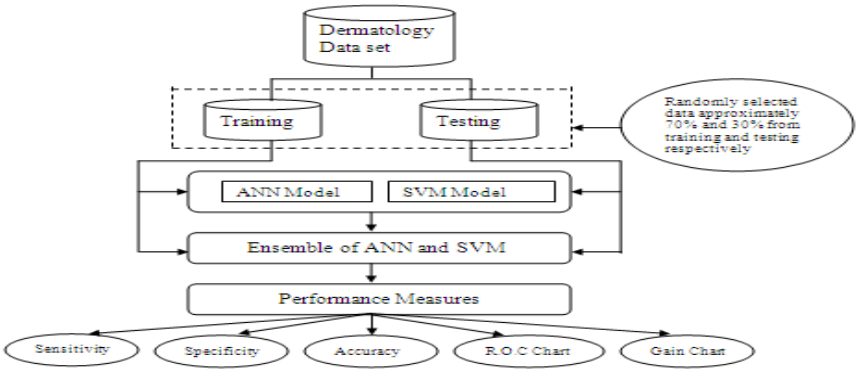
This study presents a comparative study of Artificial Neural Network (ANN), Support Vector Machine (SVM), and its ensemble technique for the prediction of different categories of erythemato-squamous diseases. The dataset (http://archive.ics.uci.edu/ml/datasets.html), used to train and test the model is taken from machine learning repository site of the University of California Irvine (UCI). Each instance of the dataset is categorized into 6 different classes: (1) psoriasis, (2) seboreic dermatitis, (3) lichen planus, (4) pityriasisrosea, (5) chronic dermatitis, and (6) pityriasisrubrapilaris. The dataset contain 35 numbers of attributes out of which the first 34 attributes are taken as input attributes and the 35th attribute is taken as target class output. The target output contains the above six categories. There are 365 instances in the dataset containing all the six classes. Out of 365 instances 112 instances belongs to psoriasis class, 60 instances belongs to seboreic dermatitis class, 72 instances belongs to lichen planus class, 49 instances

belongs to pityriasisrosea class, 52 instances belongs to chronic dermatitis class and 20 instances belongs to pityriasisrubrapilaris class.

PROPOSED MODEL

Different data mining techniques used to meet the objective of this piece of research work was explored herewith. ANN and SVM based classification algorithms are considered to classify the dermatology dataset. Figure 1 describes the detail architecture of the proposed model. Two mutually exclusive datasets a training dataset comprising 70% of the total dermatology dataset, and a testing dataset of 30% is created by using partitioning node and balanced node partitioning techniques. Classification techniques are applied to this dataset. Out of 365 numbers of instances 266 instances are taken as the training dataset and 99 instances are taken as the testing dataset. Data mining techniques used in this model are explained below.

Figure 1: Architecture of proposed Model



ANN, SVM and its Ensemble

ANNs are simple models of the way the nervous system operates and is widely used for classification problem. In this research work, ANN is trained with Error back propagation algorithm (EBPA) with default control parameters. SVM is also used as classifier as it is a robust classification and regression technique (Mitra and Acharya, 2004) that maximizes the classification accuracy of a model without over fitting the training data. The above two techniques are combined together to form an ensemble model. Ensemble combines the output of several classifiers produced by weak learner into a single composite classification (Pal, 2007). The two models are combined by using confidential weighted voting scheme (Elsayad, 2010) where weights are weighted based on the confidence value of each prediction. Then the weights are summed and the value with the highest total is again selected. The confidence for the final selection is the sum of the weights for the winning values divided by the number of models included in the ensemble model.

PERFORMANCE MEASUREMENT

Performance of each individual classifier and ensemble model can be evaluated by using some very well-known statistical measures (Elsayad, 2010) classification accuracy, sensitivity and specificity. These measures are defined by true positive (TP), true negative (TN), false positive (FP) and false negative (FN) cases. The statistical measures are calculated as follows.

Classification accuracy = Total hits / Number of entries in the set = (TP + TN) / (P + N) (1)

Sensitivity = Positive Heats / Total positive Heats = TP/ (TP+FN) (2)

Specificity = Negative hits / Total Negatives =TN/ (TN +FP) (3)

EXPERIMENTAL RESULT AND DISCUSSION

After presenting training dataset and testing dataset to each classifier along with ensemble model, a confusion matrix (Zurada and Lonial, 2005) is obtained to identify true positive, true negative, false positive, and false negative values. Based on these data accuracy, sensitivity and specificity are calculated (Anyanwu & Shiva, 2009) using equations 1, 2 and 3 respectively and results are tabulated in Table 1 for testing dataset. From this table, it is clear that all the three statistical measures are almost 100% except for some of the classes for example in case of ensemble model sensitivity for Seboreic dermatitis is 100%, specificity is 98.79% and accuracy is 98.98% where for class Psoriasis all statistical measures are 100%.The statistical measures for all the classes of ensemble model are either high or equal as compared to an individual model. This shows the highest performance of ensemble of SVM and ANN model. Another way to compare the performance of different classifier is gain chart and ROC (Zou et al., 2007). The gains chart (SPSS Clementine help file) plots the values in the gains percentage using the following equation:

(Hits in increment / total number of hits) x 100% (4)

Cumulative gains charts always start at 0% and end at 100% as we go from left to right. For a good model, the gains chart will rise steeply toward 100% and then level off. For example Figures 2 (a) and (b) show the cumulative gain chart for all models for training and testing dataset respectively for the class of Seboreic dermatitis. The higher curve is of the ensemble model for class Seboreic dermatitis. ROC (SPSS Clementine help file) chart plots the values in the Response (%) column by using the following equation:

(Responses in increment / records in increment) x 100 (5)

ROC chart is a plot of sensitivity on the vertical axis and one minus the specificity on horizontal axis for different values of the thresholds. ROC charts usually start near 100% and gradually descend until they reach the overall response rate (total hits / total records) on the right edge of the chart. For a good model, the line will start near or at 100% on the left, remain on a high plateau as we move to the right, and then trail off sharply toward the overall response rate on the right side of the chart. For example Figures 3 (a) and (b) shows the ROC chart of two models and its ensemble model for training and testing dataset for class Seboreic dermatitis respectively. If we examine Figures 2 (a), (b) and Figures 3 (a), (b) line for three different models are almost overlaps. This is due to more or less equal values of accuracy, sensitivity and specificity.

Table 1: Comparative statistical measures for different models for testing dataset				
Model	**Class of Disease**	**Sensitivity (%)**	**Specificity (%)**	**Accuracy (%)**
ANN	Psoriasis	100.00	100.00	100.00
	Seboreic dermatitis	98.71	98.71	97.97
	Lichen planus	100.00	100.00	100.00
	Pityriasisrosea	91.66	98.85	98.97
	Chronic dermatitis	100.00	100.00	100.00
	Pityriasisrubrapilaris	100.00	100.00	100.00
SVM	Psoriasis	100.00	100.00	100.00
	Seboreic dermatitis	100.00	96.15	96.96
	Lichen planus	100.00	100.00	100.00
	Pityriasisrosea	75.00	100.00	96.96
	Chronic dermatitis	100.00	100.00	100.00
	Pityriasisrubrapilaris	100.00	100.00	100.00
Ensemble of ANN and SVM	Psoriasis	100.00	100.00	100.00
	Seboreic dermatitis	100.00	98.79	98.98
	Lichen planus	100.00	100.00	100.00
	Pityriasisrosea	91.66	100.00	98.98
	Chronic dermatitis	100.00	100.00	100.00
	Pityriasisrubrapilaris	100.00	100.00	100.00

Figure 2: Gain chart for two models and its ensemble model for class Seboreic dermatitis.
(a) Left - For training dataset (b) Right - For testing dataset

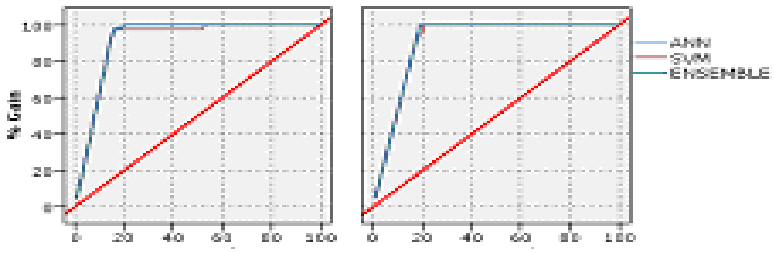
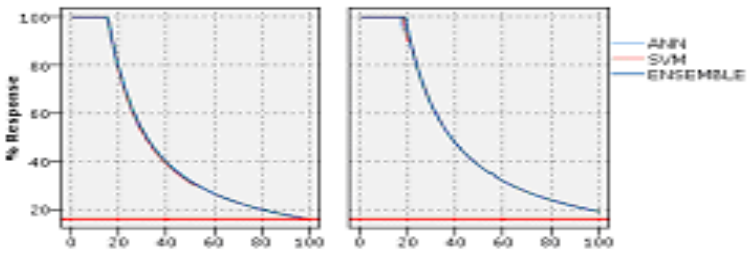


Figure 3: ROC chart for two models and its ensemble model for class Seboreic dermatitis.
(a) Left - For training dataset, (b) Right - For testing dataset

(b)



CONCLUSION

In this study, we applied two different data mining techniques: SVM and ANN on a dermatology dataset. By combining scores of these two models, a more precise ensemble model is obtained. They are all combined by using confidential weighted voting scheme. The overall accuracy on training data set in case of ANN, SVM and ensemble model is 97.37%, 99.25% and 99.25% respectively while it is 97.98%, 96.97% and 98.99% respectively on testing data set. Hence, the accuracy of ensemble model is higher than all other individual models. Performance of each model has also been investigated with the help of gain chart and ROC chart for both training and testing dataset. Figures 2 and 3 clearly show that accuracy of ensemble model is higher than that of any individual model for classification of dermatology dataset. In all respects, ensemble model is performing well for the dermatology dataset. Hence, this model can be recommended for the classification of the dermatology dataset.

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(A complete list of references is available upon request from Dinesh K. Sharma at dksharma@umes.edu)

STOCK MARKET INDICES PREDICTIVE MODEL BASED ON ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

In this study, we propose a stock index predictive model based on Artificial Neural Networks/Multi-Layered Perceptron (ANN-MLP). In this approach, we model the input feature vectors to the MLP network as k-element vector of stock index close day entries. The classes of vectors are modeled as the last entry in each vector after mapping them to a suitable representation that meets MLP input output layer requirements. The data of Dow 30 and Nasdaq 100 indices were used for training and testing of the proposed model. The results strongly support the effectiveness of the model.

INTRODUCTION

Stock market prediction involves the interaction of many variables, making forecast very difficult and complex. Various techniques like the traditional statistical methods and expert systems have been used to predict stocks. However, because these models require some basic assumptions or continued review and refinement as economic condition change, they have not proved to be very reliable (Trippi and Turban, 1996). Artificial Neural Networks (ANNs) have demonstrated its capability of addressing problems with a great deal of complexity. An ANN specifically designed to take a pattern of stock price data and generalize from it, enhances an investor's forecasting ability (Trippi & Turban, 1996; Sharma & Alade, 1999).

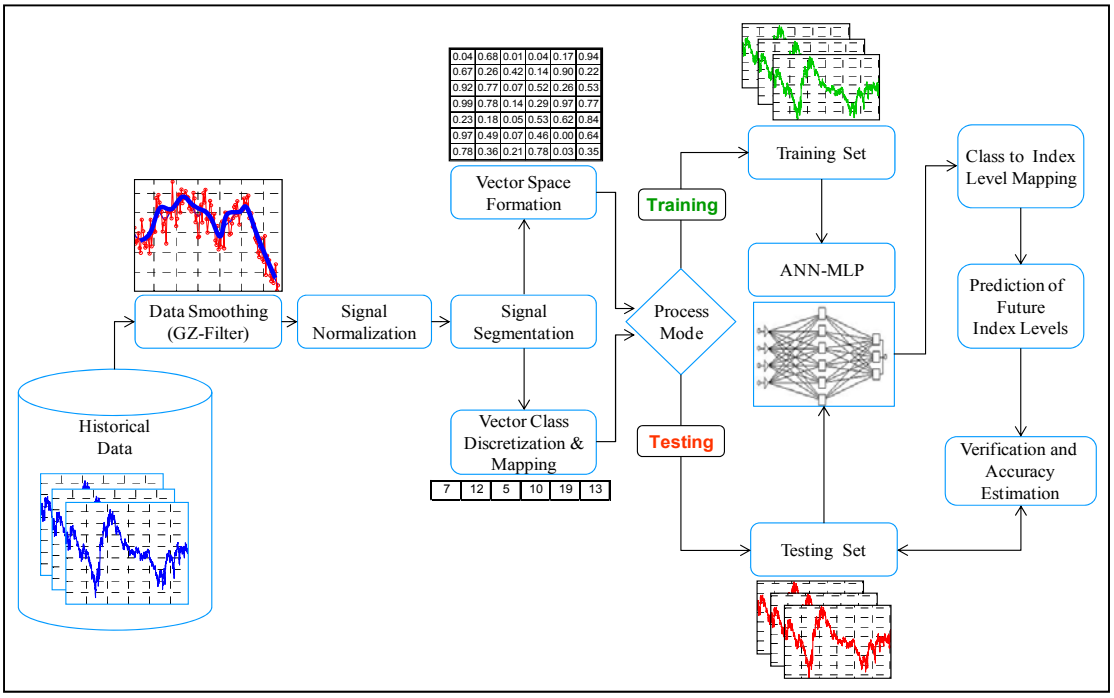
Literature is replete with studies using ANNs for stock forecasting problems. White (1988) investigated an ANN to perform time series analysis on the IBM common stock daily returns. Trippi and DeSieno (1992) applied technical analysis to investigate the effectiveness of a specific neural network trading system for S&P 500 index futures contracts. Lin and Lin (1993) used ANNs to forecast Dow Jones Industrial average. Lam (2004) presented the ability of ANNs, specifically, the backpropagation algorithm, to integrate fundamental and technical analysis for financial performance prediction. Recently, Manjula et al. (2011) applied ANN models to predict the daily returns of the Bombay Stock Exchange Sensex.

This study presents the robustness of Artificial Neural Networks and combines it with signal processing techniques to propose a stock index predictive model, which utilizes the input feature vectors to the MLP network as k-element vector of stock index close day entries. The classes of vectors are modeled as the last entry in each vector after mapping them to a suitable representation that meets MLP input output layer requirements, that is an integer class labels. An archived data of Dow 30 and Nasdaq 100 indices for more than twelve years were used for training and testing the proposed model. The results strongly supported the effectiveness of the proposed model with an overall average prediction accuracy of 96.7%.

THEORY AND TECHNICAL APPROACH

This section will present the theoretical concepts and the mathematical modeling of the proposed approach. The process of the proposed approach is depicted in Figure 1. The process illustrated in the block diagram of Figure 1 is discussed as follows: *Historical Data*: the historical record of any stock index that is needed to be processed by this approach. We used an online source (http://finance.yahoo.com/) to acquire data for more than twelve years.

Figure 1: Architecture of proposed Approach

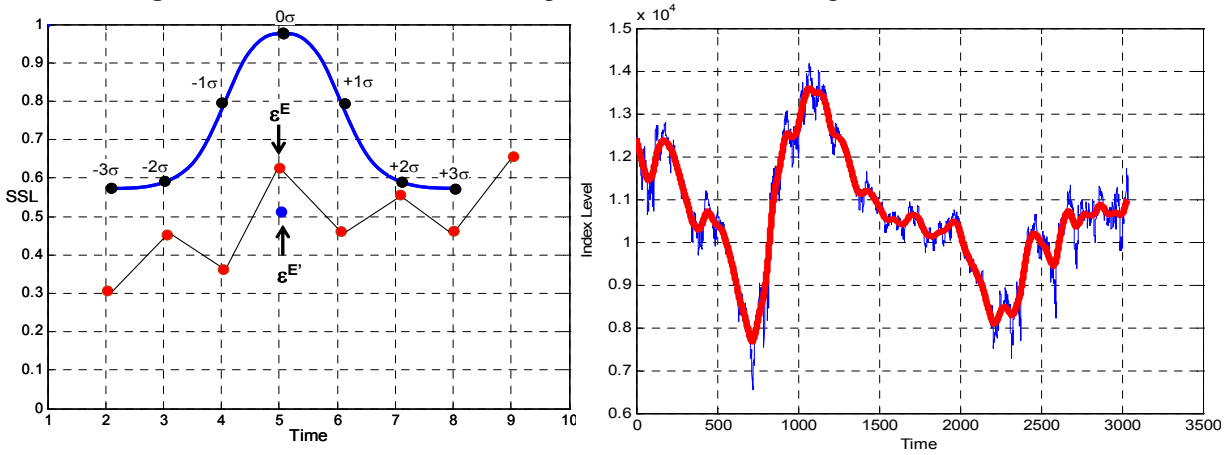


Data Smoothing: As it is the case for any stochastic process prone to different inherent and random sources of error, we propose signal filtering model that we proved to be effective in smoothing the localization estimates. GZ-Filter (Gaussian Zero-Phase Shift) digital signal filter was used to refine the localization estimates. The concept of GZ filter is to account for an interval of time before and after a particular sample point in a signal. In the Figure 2, this sample point is taken as sample number 5 and the time interval is ±3 units. Therefore, the Gaussian probability distribution function (GPDF) is super imposed on that interval aligning its mid-point with the sample point to be filtered. After that, the output signal is computed as a linear combination of all contributions of each data point within the interval (5±3 units) in the example of the Figure 2 according to the formula (1) below:

$$GZ(S(t),\Delta t)=\sum_{t-\Delta t}^{t+\Delta t} G_{pdf}(t)S(t) \qquad (1)$$

Where, $S(t)$: the input noisy signal, t: time, Δt: time interval considered to compute the de-noised signal, G_{pdf}: Gaussian probability distribution function.

Figure 2: Left- the GZ filer kernel, Right - Index Data Smoothing Results with GZ-Filter



Signal Normalization: in this step, the data is normalized to the range [0 1]. This is important since the (Artificial Neural Network – Mluti-Layered Perceptron) ANN-MLP model requires normalized input vectors. Mathematically, the normalization is expressed as:

$$S(i) = \frac{S(i)}{\max(S)} \tag{2}$$

Where, *S(i)* is the signal level at index *i* and *S* is the entire signal and *max* is the maximum level of the signal. *Signal Segmentation*: the signal is then segmented into m-sized vectors that represent the feature vectors used to train and test the ANN-MLP model. *Vector Space Formation*: in this step, the first m-1 elements in the segmented vectors are used as input feature vectors and the m^{th} element is used as the vector class in supervised training. *Vector Class Discretization*: After normalizing the signal level to the range [0, 1] and segmenting it into vectors, we need to assign each vector a class label. The range [0, 1] is continuous, therefore, depending on the desired resolution; a set of k-classes can be established. In this work, we assumed 20 classes as follows: [0, .05) → class 1, [0.5, 0.1) → class 2, …, [0.95, 1] → class 20. The formula to map the index level into a discrete training class is given as:

$$S_{\min} = \min(S),\ S_{\max} = \max(S),\ D_{index} = \frac{S_{\max} - S_{\min}}{k} \tag{3}$$

$$C(i) = \left\lfloor \frac{S(i) - S_{\min}}{D_{index}} \right\rfloor \tag{4}$$

Where, D_{index} is the uniform increment in index levels, *k* is number of levels/classes, *C(i)* the mapped i^{th} class from the i^{th} index level *S(i)*.

MLP training: At this point, the data is conditioned to be fed into the training stage where, typically 80-90% of the data is utilized for training the MLP and 10-20% of the data is used for testing. *Multi-Layer Perceptron (MLP)*: Artificial neural networks are very well documented in the literature (Rababaah, 2009). The MLP outputs one class [1-20] corresponding to a particular index level [0, 1], which is the *Class to Index Level Mapping*. In the *Verification and Accuracy Estimation* step, the output of the MLP and the true index levels are compared to estimate the classification accuracy, hence the prediction accuracy of the proposed model. The prediction accuracy is expressed as:

$$Accuracy = 1 - \frac{\sqrt{\sum_{i=1}^{n} [\, C_T(i) - C_P(i) \,]^2}}{n} \quad (5)$$

Where, C_T is the true class of the i[th] vector, C_P is the predicted class of the i[th] vector and n is number of sample vectors in the testing set.

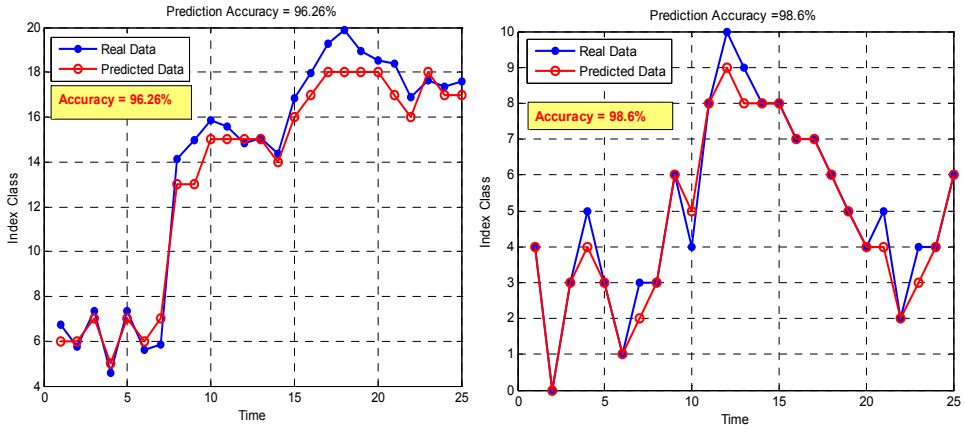
EXPERIMENTAL WORK AND RESULT ANALYSIS

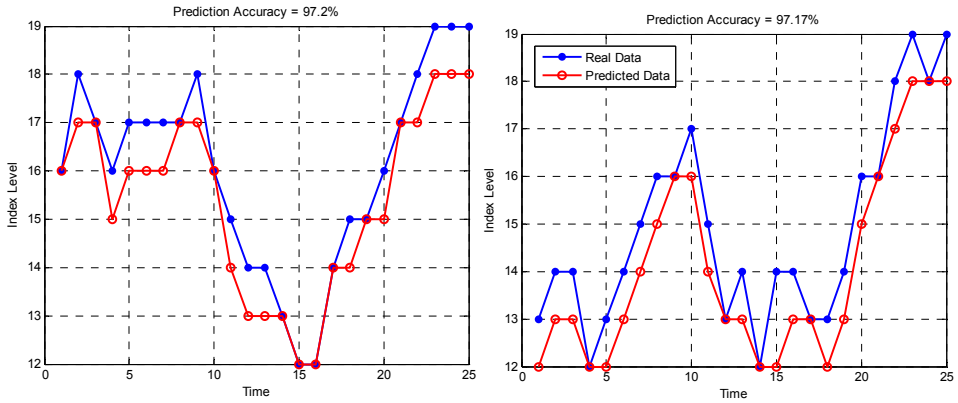
To test and verify our proposed model, we used archived data of the Dow 30 and Nasdaq 100 indices for about twelve years (1/3/2000 - 1/13/2012) (http://finance.yahoo.com/). The data set has 3038 data points of close date index. The data set is segmented into 10 consecutive data points each for different time intervals, 1000 segment at a time. 75% of each 1000 data points segment was used for training while the other 25% was used in the testing stage. Four sample results are shown in Figure 3, where the model demonstrated an impressive average accuracy of 96.7%.

CONCLUSION

We have presented a stock index predictive model based on Artificial Neural Networks/Multi-Layered Perceptron (ANN-MLP). The proposed approach models the input feature vectors to the MLP network as k-element vector of stock index close day entries. The classes of vectors are modeled as the last entry in each vector after mapping them to a suitable representation that meets MLP input output layer requirements, that is an integer class labels. An archived data of Dow 30 and Nasdaq 100 indices for more than twelve years were used for training and testing the proposed model and the results strongly supported the effectiveness of the proposed model with an overall average prediction accuracy of 96.7%. Our future work includes applying this approach to a variety of finance applications such as stock buy-sell decision making, etc.

Figure 3: Sample Results of the MLP Predictive Model (Top: Dow index, Bottom: Nasdaq index)





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(A complete list of references is available upon request from Dinesh K. Sharma at dksharma@umes.edu)

SHEDDING LIGHT ON GLOBAL COMPUTER SECURITY

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ABSTRACT

Today, we live in the world of electronic connectivity called the Internet. It is a world inundated with malevolent subjects, as well as objects like viruses. Electronic eavesdropping, electronic fraud, electronic spying, malicious hacking and vandalism have become the order of the day. Lucidly, security is vital for maintaining and using the Internet. The Internet, which can be viewed as a global connection of different network systems, is often, and unfortunately, being compromised due to the relentless efforts of these malevolent entities. It is important to note that today's computers and network systems are far more complex than they have ever been. What is also true is the fact that they will even be more complex in the years to come. Ironically, as systems get more complex, they become less secure. This paper sheds light on global computer security and proposes some steps to abate present and future threats.