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LEARNING TELECOMMUNICATIONS: TCP/IP CONFIGURATOR

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ABSTRACT

This paper outlines the design and development of a tool to help students master the concepts for correctly configuring a TCP/IP network. Concepts such as assigning IP addresses and configuring the appropriate subnet mask for a simple network using the TCP/IP v4 suite of protocols or a more complex TCP/IP network utilizing many subnets are explored. This tool, TCP/IP Configurator, was developed using the Visual Basic.NET programming language and is currently being utilized as a teaching/learning tool in a required courses for Information Technology Management (ITM) students in Telecommunications and Networking. In addition, this tool can be used by any network administrator who manages a TCP/IP network. We begin our discussion by briefly reviewing the importance of mastering TCP/IP network design and configuration for the ITM student. Next, we discuss the issues relating to the design and development. Finally we present preliminary conclusions based on our experience using this tool in the classroom.

CURRENT APPLICATIONS OF CHAOS THEORY IN BUSINESS DISCIPLINES

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ABSTRACT

Many processes exhibit elements of chaotic behavior. Such processes should be analyzed using methods appropriate for chaos theoretic analysis. Here we discuss the basic characteristics of chaotic systems and offer illustrative examples. We conclude by discussing future research opportunities in chaos theory. Emphasis is placed on applications in finance, statistics, and industrial engineering/management science.

Key Words: Chaos theory, time series, Stable Paretian Distribution, Coherent Market Hypothesis, control chart.

CATEGORIZING EFFICIENT XML COMPRESSION SCHEMES

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ABSTRACT

Web services are Extensible Markup Language (XML) applications mapped to programs, objects, databases, and comprehensive business functions. In essence, Web services transform XML documents into and out of information technology systems. XML has become the language of web services. Unfortunately, the structure of XML results in extremely verbose documents, often 3 times larger than ordinary content files. As XML becomes more common through Web services applications, its large file sizes increasingly burden the systems that must utilize it.

XML compression addresses some of the problems of Web services via XML by reducing the size of XML documents transferred between a server and client, thereby conserving bandwidth and reducing user perceived latency. Although there is a wide variety of potential hardware/software solutions to remedy XML's performance problems, many developers and researchers are resorting to a variety of tactics to improve the performance of XML processing and transmission. Many of these approaches simplify certain aspects of XML to reduce document size via compression, improve parser performance, and speed the mapping of XML document components to application objects (Schmelzer, 2002).

This paper provides a qualitative overview of existing and proposed schemes for efficient XML compression, proposes three categories for relating XML compression scheme efficiency for Web services, and makes recommendations relating to efficient XML compression based on the proposed categories of XML documents. The goal of this paper is to aid the practitioner and Web services manager in understanding the impact of XML document size on Web services, and to aid them in selecting the most appropriate schemes for applications of XML compression for Web services.

Keywords: Compression, Web services, XML

GRADUATE SCHOOL SELECTION: A CASE OF FUZZY ANALYTICAL HIERARCHICAL PROCESS

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ABSTRACT

Master and Doctoral degree awarded by universities in US is recognized all over the world. Students often apply for more than one university to increase the likelihood of getting into a school of his/her interest depending on various criteria. The students get into a dilemma of choosing the school when they get admission letters from various schools. This paper aids students in decision-making process of selecting the most appropriate school to pursue his/her career. The fuzzy analytical hierarchical process is employed in deciding the right school for the right student based on different criteria. The problem of decision making for such a situation is illustrated with an example.

1.01 INTRODUCTION

Graduate students are a boon to any country as they possess high level of knowledge. The graduate degree program from an American University is recognized all over the world. Therefore, students from all over the world apply for graduate programs in the U.S. to pursue his/her career. It is also important to note that international students contribute nearly \$12 billion dollars to the U.S. economy, through their expenditure on tuition and living expenses (IIE Network, 2003). The Department of Commerce data describe U.S. higher education as the country's fifth largest service sector export (Hasselmo, 2004).

Selecting a graduate school for graduate studies has always been a dilemma for ambitious students aiming to pursue a graduate degree in the U.S. Both domestic and international students compete for seats in prestigious institutions. While applying for graduate school, most students are recommended to apply for more than one school (Foreign Born, 2005). Most students apply between three to ten schools to increase the likelihood of getting enrolled into at least one of the schools. This paper presents a process that assists a student in the selection of school after he/she gets admission letters from the various schools applied. This paper assumes the following when a decision is made:

- The student receives the admission letters from more than one school and limits the maximum number to nine.
- The student knows well in advance the program of his/her study.
- The student has background knowledge of all the criteria of the various schools in regards to expenses, research activities and other details as described in section 3.1.

According to Counseling and Career Services, University of California, Santa Barbara, the best way to select a graduate program is to develop a set of criteria based on one's own individual academic, professional, and personal goals (University of California, Santa Barbara, 2005). The quality of the program, costs of the program (tuition, books and living expenses), reputation of the faculty, reputation of the department and the employment opportunities are the most important factors.

From the Global MBA Graduate Survey, the four dimensions underlying student's decision making were: 1) The quality and reputation of the school 2) Financial cost 3) Personal fit 4) Locality. The selection of school varies from person to person. Studies (GMAC, 2004) have shown that the selection of school also varies with gender, race/ethnicity, domestic and international students. The focus of this paper is to solve a student's problem when he/she is faced with selecting a graduate school to pursue his/her career. The problem becomes complex when he/she has a choice of more than three schools. However, this paper limits the number of choices to less than nine as normal human beings find it difficult to compare more than nine items at a given instance (Saaty, 1980). The authors of this paper have not found any literature with tools applied to solving such a problem to the best of their knowledge. One of the best ways to solve such kind of problems is by incorporating the fuzziness based on entropy weight into Analytical Hierarchical Process (AHP).

2.0 DECISION MAKING WITH FUZZY DATA

It is a common problem for many students to decide upon which school to enroll for graduate studies. He/She is in a state of fuzzy for making this decision.

The AHP of Saaty (1980) is a popular method of solving multi-criteria analysis (MA) problems involving qualitative data. Generally, in a decision making process, the individual expresses their preferences in linguistic terms which are nothing but imprecise values. To deal with such fuzziness, fuzzy group decision making approaches have been proposed. Buckley(1985) and Laarhoven and Pedrycz (1983) have extended Saaty's AHP to deal with imprecision and subjectiveness in pair wise comparison process. Therefore, fuzzy characteristics along with AHP will aid solving the problem of a student selecting a graduate school. In this paper, we have incorporated the fuzzy characteristics into AHP so as to solve the case of graduate school selection decision-making process.

1.03 PROBLEM STATEMENT

The problem is to select a graduate school from a maximum of nine given a set of alternatives. Here, the maximum limit of nine, termed as the alternatives are denoted by " A_i " varying from 1 to 9. The decision criteria for each of the alternatives (limited to maximum 9) varying from 1 to 7 are denoted by " C_j " for this problem in hand.

3.1 DECISION CRITERIA

The various decision criteria for choosing the graduate school are:

1. Reputation (Criteria 1): This criterion includes the recognition of the university as well as the program.
2. Faculty (Criteria 2): The credentials of the faculty and their expertise are the main emphasis of this criterion.
3. Cost (Criteria 3): This criterion includes the expenses such as tuition and living expenses, availability of funds, loans scholarships and internships.
4. Facilities (Criteria 4): The library and other physical facilities such as fitness centers, cafeteria are the main focus of this criterion.
5. Philosophy of Education (Criteria 5): This criterion includes the average duration of the entire program and the opportunities available in ones area of specialization.
6. Geographic Location (Criteria 6): This criterion is very important in regards to ones choice based on whether the school is located in an urban area or a small town.

7. Career Assistance (Criteria 7): This criterion encompasses issues such as availability of career planning and job search assistance, employment leads and library resources.

4.0 CASE EXAMPLE FOR SELECTION OF GRADUATE SCHOOL

If a student gets admission letters from four schools and he/she wants to select one among them to pursue graduate studies, he/she can employ the fuzzy technique described below provided he/she knows the information about these four schools and the importance of his/her criteria on school selection.

Step1. A fuzzy decision making matrix (\bar{D}) is constructed to determine the extent as to how each alternative satisfies the criteria. In addition, weighting vector (\bar{W}), which compares the importance of each criteria is also constructed. The comparisons for (\bar{D}) and (\bar{W}) are in linguistic terms which have been found intuitively easy to use (Guangquan and Jie, 2003).

The linguistic terms for the fuzzy decision matrix used in this paper are Very Poor (VP), Poor (P), Fair (F), Good (G), and Very Good (VG) where as the linguistic terms used for the weighting vector are Least Important (LTI), Less Important (LSI), Important (I), More Important (MEI) and Most Important (MTI). Triangular fuzzy numbers are used to represent the approximate value of linguistic terms and these values range from 1 to 9 as shown in Table 1 (Mon, Cheng and Lin, 1994).

Table 1
Triangular Fuzzy Numbers

Fuzzy Number	Characteristic Function
1	(1, 1, 3)
x	(d-2, d, d+2) for d=3, 5, 7
9	(7, 9, 9)

Table 2
Fuzzy Decision Making Matrix

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇
A ₁	G	VG	P	G	G	G	F
A ₂	F	G	VG	G	G	VG	F
A ₃	VG	VG	VP	VG	VG	F	G
A ₄	F	G	G	G	G	P	F

The fuzzy decision matrix is then obtained as shown in Table 3, where 5, 7, 9 is the triangular fuzzy number for criterion 1-school A and 7, 9, 9 is the triangular fuzzy number for criterion 3-school A and so on. Table 5 shows the corresponding triangular fuzzy numbers for the weighted vector.

Table 3
Triangular Fuzzy Number for \bar{D}

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	5,7,9	7,9,9	1,3,5	5,7,9	5,7,9	5,7,9	3,5,7
A_2	3,5,7	5,7,9	7,9,9	5,7,9	5,7,9	7,9,9	3,5,7
A_3	7,9,9	7,9,9	1,1,3	7,9,9	7,9,9	3,5,7	5,7,9
A_4	3,5,7	5,7,9	5,7,9	5,7,9	5,7,9	1,3,5	3,5,7

Table 4
Weighted Vector \bar{W}

C_1	C_2	C_3	C_4	C_5	C_6	C_7
3,5,7	7,9,9	3,5,7	3,5,7	3,5,7	1,1,3	3,5,7

Table 5
Triangular Fuzzy Number for \bar{W}

C_1	C_2	C_3	C_4	C_5	C_6	C_7
I	MTI	I	I	I	LTI	I

Step2. The total fuzzy judgment matrix \bar{A} is determined by multiplying fuzzy subjective weight vector \bar{W} with the corresponding fuzzy judgment matrix \bar{D} . Therefore, for the problem in hand, we have the fuzzy judgment matrix as shown in Table 6 below.

Table 6
Total fuzzy judgment matrix (\bar{A})

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	15,35,63	49,81,81	3,15,35	15,35,63	15,35,63	5,7,27	9,25,49
A_2	9,25,49	35,63,81	21,45,63	15,35,63	15,35,63	7,9,27	9,2,49
A_3	21,45,63	49,81,81	3,5,21	21,45,63	21,45,63	3,5,21	15,35,63
A_4	9,25,49	35,63,81	15,35,63	15,35,63	15,35,63	1,3,15	9,25,49

Step 3. The interval performance matrix is determined using α -cut on the matrix \bar{A} obtained in Step 2 (Kaufmann, 1988).

Table 7
Interval Performance Matrix

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	16, 61.6	50.6,81	3.6,34	16,61.6	16,61.6	5.1,26	9.8,47.8
A_2	9.8,47.8	36.4,80.1	22.2,62.1	16,61.6	16,61.6	7.1,26.1	9.8,47.8
A_3	22.2,62.1	50.6,81	3.1,20.2	22.2,62.1	22.2,62.1	3.1,20.2	16,61.6
A_4	9.8,47.8	36.4,80.1	16,61.6	16,61.6	16,61.6	1.1,14.4	9.8,47.8

Step 4. The degree of optimism λ of the decision maker is used to obtain a crisp judgment matrix A with fixed α as shown in Table 8 (Mon, Cheng and Lin, 1994).

Table 8
Crisp Judgment Matrix

	<i>Real values</i>	<i>Normalized values</i>
A_1	2.67052223	0.250179
A_2	2.723905437	0.25518
A_3	2.615155808	0.244992
A_4	2.664865968	0.249649

Table 9
Entropy Results

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	38.8	65.8	18.8	38.8	38.8	15.5 5	28. 8
A_2	28.8	58.2 5	42.1 5	38.8	38.8	16.6	28. 8
A_3	42.15	65.8	11.6 5	42.1 5	42.1 5	11.6 5	38. 8
A_4	28.8	58.2 5	38.8	38.8	38.8	7.75	28. 8

Step 6. The Shanon entropy (G.L. Klir and T.A. Folger, 1988), a measure of uncertainty in information formulated in terms of probability theory is calculated. The entropy results for the problem in hand are shown in Table 9. The resultant entropy weight is normalized and the alternative with the highest entropy weight is the selected school for his/her higher studies.

8.0 CONCLUSION

The presented solution to solve the problem at hand is very helpful for students pursuing higher studies to decide as to which school to choose given the assumptions described earlier. The indecision phase for a student is eliminated employing the fuzzy characteristics to the model as presented. It can be also employed for undergraduate studies as well, provided one knows the criteria in advance.

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A FRAMEWORK FOR GENERATING CONCEPT DEFINITIONS TO AID IN INFORMATION GATHERING

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ABSTRACT

When gathering information, it is critical to specify an appropriate expression to accurately distinguish the relevant from the irrelevant. Concept-based information retrieval aims to ease this burden of specifying such an expression by allowing information gatherers to select the concept of interest from a set of pre-defined concepts. The limitation of such a system is that a large number of concepts must be defined. In this paper, we present a framework which enables users to generate concept definitions themselves—whether or not they are familiar with the technical aspects of concept definition.

INTRODUCTION

The problem domain we assume is that of information gathering. This may be in the form of retrieving information from a collection that exists—such as a document collection of interest—or it may be filtering information that is constantly being generated—such as in newsgroups. In either case, the major issue is that we wish to retrieve the information with high precision and high recall—with the ultimate goal being retrieval of all relevant information (perfect recall) and only relevant information (perfect precision). However, it is often difficult for users to specify exactly the right query expression to achieve this goal; therefore, users often have to manually filter through much irrelevant information while information of relevance is often missed.

CONCEPT-BASED INFORMATION RETRIEVAL

One attempt to solve this problem is found in concept-based information retrieval. In concept-based information retrieval, users issue retrieval requests by selecting a concept—as opposed to specifying a boolean expression or set of index terms. The concept-based retrieval system uses the selected concept to generate one or more appropriate boolean search requests. Such a system greatly relieves the user from the burden of specifying appropriate queries—as they simply choose the concept of interest.

This type of retrieval system was first introduced in [McCune 1985] with a system called Rule Based Retrieval of Information by Computer (RUBRIC). With RUBRIC, the user-selected concept is represented by a tree structure. The tree structure used in this system, called a rule-based tree, represents a concept as a boolean (AND/OR) combination of subconcepts and index terms. Consider the concept human health science represented as a rule-based tree as shown below.

AND: Human Health Science

-OR: Human

--TERM: “man”

--TERM: “woman”

-- TERM: "human"
 -OR: Health Science
 -- TERM: "Health Hazards"
 -- TERM: "Biological Effects"
 -OR: Molecular and Genomic Science
 --- TERM: "Genes"
 --- TERM: "Genet*"
 --- TERM: "DNA"
 -- TERM: "Risk Assessment"

Notice that human health science is defined as a conjunction of the subconcepts human and health science. Furthermore, these two subconcepts are further defined. Each intermediate node in a rule-based tree is either a conjunctive (AND) or disjunctive (OR) representation of some subconcept, and each terminal node represents an index term.

In RUBRIC, rule-based trees are used to retrieve documents by applying bottom-up processing for each document in the document collection. Leaf nodes are given values of 1 or 0 which are propagated up through subconcept nodes and finally to the root concept node. Based on the value propagated, the system decides whether or not the document is retrieved (whether or not the document matches the root concept).

However, it can be very expensive to retrieve documents in this way. Alsaffar et.al. [2000] recognize this shortcoming and propose preprocessing the rule base to speed up retrieval requests. In their solution, an AND/OR tree is converted into a group of Minimal Term Set (MTS) expressions. A MTS expression is simply a minimal set of terms that may be used to represent the root concept. That is, if all of its terms are found within a document, then the document satisfies the root concept and should be retrieved. Any one of the MTS expressions in the group may be satisfied in order for the root concept to be satisfied. Only when none of the MTS expressions are satisfied do we say that the document does not match the root concept.

The set of MTS expressions for the concept Human Health Science (corresponding to the rule-based tree above) is as follows:

```
{“man”, “Health Hazards”},
{“woman”, “Health Hazards”},
{“human”, “Health Hazards”},
{“man”, “Biological Effects”},
{“woman”, “Biological Effects”},
{“human”, “Biological Effects”},
{“man”, “Genes”},
{“woman”, “Genes”},
{“human”, “Genes”},
{“man”, “Genet*”},
{“woman”, “Genet*”},
{“human”, “Genet*”},
{“man”, “DNA”},
{“woman”, “DNA”}, {“human”, “DNA”},
{“man”, “Risk Assessment”},
{“woman”, “Risk Assessment”},
{“human”, “Risk Assessment”}
```

Notice that {man, genes} is one MTS expression. Therefore, if the terms man and genes both appear in a document, then we know that the root concept human health science is satisfied. Reexamine the example rule-based tree we have illustrated and notice that the term man satisfies the subconcept human and the term genes satisfies the subconcept health science. Together these two subconcepts satisfy the root concept human health science. In the same way,

satisfaction of any one of the MTS expressions listed will similarly result in satisfaction of the concept human health science.

CREATING RULE-BASED TREES

Conceptual retrieval systems based on this rule-based tree idea will only be successful if the concepts that users are interested in retrieving are represented in the system's rule base. Therefore, a large number of rule-based trees is typically required of the system. Unfortunately, each of these rule-based trees must be composed by an expert who is familiar with the document collection and the index terms used therein. The expectation of having experts define rule-based trees for every concept in which users may be interested is unreasonable. The costs in terms of time and money would be extremely prohibitive.

Kim, et. al. [2000] recognize this problem and propose a solution for automatically generating concept definitions in the form of rule-based trees. However, their approach requires the existence of a machine-readable thesaurus. This may be appropriate for some domains; however, it will not be applicable in many others. In [Fanguy 2003], an alternative is presented which is based on first generating decision trees and then converting them into rule-based trees. In this paper, we present an alternative solution that is based, instead, upon first generating production rules for the concept of interest and then structuring them as a rule-based tree.

SYSTEM FRAMEWORK

Our system for generating rule-based trees for conceptual retrieval is described in this section. It is based on the close relationship between MTS expressions and typical production rules. Although the definition and format of an MTS expression does not exactly match that of a typical production rule, the basic function of an MTS expression is nearly identical to the functioning of production rules in typical production-rule-based systems. Typical production rules may be viewed as rules having the form: IF conjunctive-condition THEN consequent. MTS expressions may be viewed in the same way, where the conjunctive-condition is composed of the terms making up an individual MTS expression, and the consequent is the associated root concept. Therefore, in our system, we rely on the work done in the area of production rule generation to aid in the generation of concept definitions. The high-level steps which must be performed by the system are as follows. First, a subset of the information of interest is labeled by the user as being either relevant or irrelevant to concept. Next, the patterns in the subset are analyzed to generate production rules for the concept. Finally, the production rules are structured as a rule-based tree for the concept. In the following sections, we examine each of these steps in greater detail.

Production rule generators typically require a training set of data with which to work. Therefore, before we can generate production rules, we must prepare a training set. In the current context, a training set is a set of labeled attribute vectors describing the set of information we wish to retrieve or filter. The attribute vectors describing each unit of information include the index terms associated with the document collection and perhaps other document data that are available. The labels associated with each attribute vector are obtained from the user. The user will select an appropriate label to indicate whether each document in the training set is or is not relevant with respect to the current concept of interest.

Once the training set is prepared, it will be used as input to the system component responsible for generating production rules. See5, the Windows version of the popular decision tree/production rule generator c4.5 [Quinlan 1993], is the program we use to perform this step. By identifying the patterns in the data which are useful for distinguishing the documents

associated with the concept of interest from documents that are not, See5 constructs a set of production rules to represent each concept.

STRUCTURING PRODUCTION RULES

Once the production rules for a concept are generated, our system structures those production rules as a rule-based (AND/OR) tree. We have developed three approaches to carrying out this step: a simplistic approach, a popularity approach, and a co-occurrence approach. Let us examine each of these approaches.

The first approach we present is based upon a simplistic, straightforward structuring of a set of production rules which defines a concept. Since a single production rule is satisfied only when all of its component terms are satisfied, it may be represented as a tree with a root AND node whose children are the individual terms within the production rule. A concept may typically be associated with several production rules—any one of which may be satisfied for the concept itself to be satisfied. In a very straightforward manner, this logic may be captured by adding a single OR node as the parent of each individual production rule which satisfies the concept.

The problem with this approach is that it has a very high potential for replication among the leaf nodes of the resulting rule-based tree. Consider a concept defined by the following set of three production rules: $\{\{A, B, C\}, \{A, B, D\}, \{A, E\}\}$. The simplistic approach will repeat the term A three times and the term B twice—in a tree representing the following logical expression (A AND B AND C) OR (A AND B AND D) OR (A AND E). To overcome this problem, we present the popularity approach. This approach analyzes the terms that appear in the production rules, and includes them in the structure based on the number of times they occur. In this case, A is most popular among the set of production rules—it appears three times. Therefore, A will appear at the top of the tree with an appropriate conjunction of the remaining terms. Since B is the next most popular term, it is included next. In this way, the tree constructed will be equivalent to the following logical expression: A AND (B AND (C OR D)) OR E. For this example, the repetition of terms that results from the simplistic approach is not present.

While the popularity approach is an improvement over the simplistic approach, there are times when even this approach will structure the rules with a high degree of repetition. Consider the case of a concept associated with the following set of production rules: $\{\{A, C\}, \{A, D\}, \{B, C\}, \{B, D\}\}$. In this case, all of the terms appear the same number of times, and any attempt to include one term at a time in a rule-based tree will necessarily lead to duplication. In this case, the popularity approach would generate a tree whose logical semantics would be something akin to “either (A along with C or D) OR (B along with C or D).” The “C or D” portion of the tree would be repeated twice.

A better solution in this case is to realize that a more complex pattern exists among the production rules. For the example being considered, the pattern is that we must have one term from $\{A, B\}$ and one from $\{C, D\}$. If this pattern is recognized, the tree may be structured much more succinctly as (A OR B) AND (C OR D). We believe that the ability to identify this type of pattern is key to effectively structuring rule-based trees in this type of situation.

CONCLUSION

Concept-based information retrieval and filtering has the potential to improve the effectiveness of information gathering efforts of individuals. However, in order for such a system to be usable, a large number of concept definitions are necessary. In this paper, we present a framework for generating these concept definitions. This framework is based upon

first generating IF-THEN production rules for the concept and then structuring them as a concept.

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AN EMPIRICAL EXAMINATION OF THE IMPACT OF GENERAL AND SYSTEM-SPECIFIC SELF-EFFICACY ON COMPUTER TRAINING OUTCOMES

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ABSTRACT

Recognizing the multilevel nature of the computer self-efficacy (CSE) construct, this study distinguishes between general and system-specific CSE and examines the effects of both levels of CSE on two key training outcomes: reactions and learning performance. Reactions were examined with respect to perceived ease of use and perceived usefulness, whereas learning performance was examined in terms of near-transfer and far-transfer learning. The results of a field experiment revealed that general CSE had significant effects on perceived ease of use and far-transfer learning. Conversely, system-specific CSE demonstrated significant effects on near-transfer and far-transfer learning. The results of this study provide several valuable research and practical implications for IS training and systems acceptance and usage.

GUIDED DESIGN SEARCH AS A DECISION SUPPORT TOOL IN NETWORK ANALYSIS

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ABSTRACT

A new approach for the solution and analysis of mixed integer programs is presented and applied to a difficult optimization problem found in robust telecommunications network design. This new approach, called Guided Design Search, uses experimental design techniques and Taguchi methods to derive the estimated effects of binary decision variables on an objective function to be maximized. These estimated effects are used in guiding the optimization search as well as providing additional problem structure information as part of a decision support system. Results from successfully applying this approach to the path restoration form of the joint capacity allocation network design problem are presented, with this new method finding better solutions faster and proving optimality faster than the industry standard solver.

ATTRI-VAR QUALITY CONTROL METHODS: A NEW APPROACH

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ABSTRACT

Sampling inspection methods used in industrial quality control normally take the form of inspection-by-attributes or inspection-by-variables methods. Inspection-by-attributes sampling plans are noted for their robustness with respect to any distributional form of the characteristic of interest. Inspection-by-variables sampling plans, on the other hand, are designed on the basis of an assumed continuous distribution (usually a normal distribution) and therefore are not necessarily robust as departures from this assumed distribution are encountered in practice but do permit relatively smaller sample sizes than would be required under an equivalent attributes sampling plan.

In this paper we provide a new method for sampling inspection. The sample size levels and robustness of the new method lies in between the two classical inspection-by-variables and inspection-by-attributes sampling plans. The new method will be designed and explained, and its equivalence to the classical methods will be established. The sample size performance is thoroughly investigated and compared for the traditional and equivalent new methods. Their robustness will be discussed at a preliminary level.

FORECASTING KEY STRATEGIC VARIABLES IN THE CASINO TOURISM INDUSTRY

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ABSTRACT

We examine the issues of forecasting industry gross revenue models in the casino gaming industries of Nevada, Mississippi and Atlantic City. Industry gross revenues are used as benchmarks for casino performance, a major source of state tax collection, an important part of a state's tourism industry and an important point of consideration for states contemplating legalizing gambling. We improve upon Preez and Witt's (2003) approach of aggregating or pooling multiple time-series tourism research. Our model divides the time-series forecasts into two separate components, seasonality and trend. The results show all three states have distinctly different monthly seasonal patterns. The states with multiple geographic reporting regions, Mississippi and Nevada, had conflicting seasonality effects. The two regions in Mississippi have no significant differences with seasonality. Nevada's eight reporting regions, on the other hand, all follow different monthly seasonal patterns. These findings require that Nevada's seasonality be addressed at the individual reporting region level, while Mississippi and Atlantic City can be analyzed at the aggregate state level. If a panel was constructed combining the individual Nevada regions or the aggregate Nevada state data with Mississippi and Atlantic City erroneous seasonal patterns would result. Moreover, combining area specific seasonal indices offsets one another resulting in forecasts with grossly underestimated seasonal fluctuations. Trend forecasting models and the presence of interventions such as September 11 are also shown to vary by region. In Mississippi, September 11 had an insignificant effect on either regions casino gaming revenues. The effects of the September 11 intervention vary by region in Nevada. Six of the eight regions within Nevada do not conform to the overall Nevada state model. Aggregating time series data between states or within Nevada will lead to more complex, less accurate forecasts. The results indicate that in most cases aggregated or pooled time-series data should not be used in estimation models centered on forecasting revenues for casino and gaming establishments.

INTERVENTIONS IN TOURISM MARKETS: A COMPARISON OF THE UNITED STATES AND EUROPE

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ABSTRACT

This research analyzes the use of interventions in ARIMA models to capture the effects of significant events on tourism markets in the United States and Europe. Two tourist destinations are used for comparative purposes; Las Vegas Nevada and Palma de Mallorca. The time series variable in both series is air passenger traffic, via the major airport serving the tourist destination.

More than 35 million tourists visit Las Vegas each year, 48% arrive by air travel. The data for Las Vegas covers the time period from December 1996 through August 2004. Las Vegas serves primarily a domestic United States market. Palma de Mallorca is a tourist destination in the Balearic Islands off the coast of Spain. Approximately 19 million tourists visit Mallorca each year, 99% arrive by air travel. Mallorca serves primarily European tourists with significant draw from Great Britain and Germany. The local government of Mallorca has changed parties twice during the period of this research. The Mallorca time series covers the period from December 1996 through December 2003, the last reported period as of the date of this research.

During the time period studied a significant event negatively affected Las Vegas casino revenues, September 11, 2001 (Moss et. al. 2004). This research focuses on a related event, the decline in air traffic after September 11, 2001. The results from Las Vegas are compared to Mallorca to determine if European tourist destinations suffered similar problems after September, 2001. The findings show there is a significant intervention for 911 in the Mallorca series. However, much more dramatic and interesting interventions occur in the Mallorca series around tourist tax policy changes by the local government. The tax policy changes occur when the "green party" comes into power and is subsequently voted out of power in Mallorca. The results clearly show tourists reaction to the tax changes. The impact of the tax changes is shown to far outweigh any concerns over air travel after 911.

The model used in this research is a Box-Jenkins ARIMA with multiple interventions required. The interventions in Las Vegas and Mallorca require different structural forms. This is a result of a surprise event for Las Vegas and both the unexpected event of 911 and expected events for tax policy changes effecting Mallorca. When the event is expected, e.g. the repeal of a tourist tax, interventions occur on both sides of the date of the tax repeal.

THE IDEAL CHOICE FOR OBJECT-ORIENTED PROGRAMMING COURSE - JAVA AND VB .NET: A COMPARATIVE STUDY

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ABSTRACT

The objective of this research is to determine which programming language among Java and VB .NET is the ideal choice for the Object-Oriented Programming (OOP) course in the Information Technology major. After discussing the fundamentals of OOP, this study compares both OOP languages, Java and VB .NET, with other procedural languages. It formulates six criteria, such as a) the ease of development, b) increased performance, c) rapid application development, d) runtime possibilities e) application integration and f) cost-efficiency for a comparative study of Java and VB .NET. The differences between the two languages according to each criteria are discussed in this study. This research reveals that both languages possess strengths and weaknesses in each criteria. Java's strength lies in its increased performance, runtime environments, application integration within the same enterprise and between enterprises, and in cost-efficiency. VB .NET excels in the ease of program development and rapid application development thereby culminating in a reduction in time-to-market. At the present time, both Java and VB .NET are full-pledged OOP languages. Both are excellent choices for learning OO Programming. The specific choice of either one for the Object-Oriented Programming course is dependent upon each university's Information Technology Environment.

INTRODUCTION

Object-Oriented Programming (OOP) is one of the core courses taught in Information Technology (IT) at many universities. Initially, OO COBOL was taught as an OOP language at Duquesne University, but about five years ago, Java was selected as the programming language for the OOP course in the IT/ISM major. As the university progressed toward a Microsoft environment, our institution switched from Java to Visual Basic .NET in the 2004 Fall-Semester. The objective of this study is to determine which programming language among Java and VB .NET is more suitable for the Object-Oriented Programming course in the Information Technology major.

RESEARCH METHOD

This study theoretically discusses and illustrates the: 1) Fundamentals of Object-Oriented Programming consisting of a short history, the OOP concept; 2) Comparison between OOP and other procedural languages, which includes the benefits of OOP languages over the other Third Generation Languages, and the main features of OOP, such as encapsulation, inheritance, polymorphism and interface. Then it formulates six criteria, such as a) the ease of development, b) increased performance, c) rapid application development, d) runtime possibilities e) application integration and f) cost-efficiency for a comparative study of Java and VB .NET. This author provides theoretical explanations relating to the differences between these two

languages according to each specific criteria. This research combines classroom experience with a theoretical support.

FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING

History: During the 1960's in Norway, OO programming began with the development of the Simula programming language. As years passed, more OOP languages were created and developed including Small Talk, C++, and OO COBOL. In 1995, Sun Microsystems built Java as a pure OO Programming language. Eventually, Microsoft added Object Oriented features to its existing Visual Basic and turned it into a full-blown OOP language in the Microsoft .NET framework. Although there are many OOP languages, this study is limited to Java and Visual Basic .NET.

Concept: The OO program consists of a collection of objects that work together in performing a task. An object is a self-contained part of the program. Objects are added to the existing program as needed. This procedure facilitates debugging. Moreover, once objects are created, they may be used indefinitely as one desires in any program. The reuse of objects is one advantage of the OOP.

COMPARISON BETWEEN OOP AND OTHER PROCEDURAL LANGUAGES

In the real world, an object has attributes and behavior. For example, a customer is an object. The customer bears a name and address as attributes. The way in which a customer makes a new order is referred to as behavior. Similarly, objects in OOP have attributes known as data, and behavior defined as methods. In OOP, the objects maintain their own data and methods. In other procedural languages, the data may be a separate file and the procedures in the program may interact with the data-files. OO programs have higher speed in development and runtime than procedural languages, such as Pascal, COBOL, etc. Moreover the OOP languages, such as Java with HTML, VB .NET with ASP, make the creation of Web applications easy, which is not possible with other procedural languages. Java and VB .NET have class libraries which hold a significant amount of prewritten codes and are used in any program written by a programmer.

The main features of the OOP: Features (Deitel, H.M, & P.J. Deitel, 2003) that distinguish the OOP from other procedural languages include encapsulation, inheritance, polymorphism and interface. Encapsulation: is the process of deliberately hiding information about the server-class codes and data, from a client class; however, some information may be available to the client class in a controlled environment. This feature of encapsulation increases the reliability and stability of the coding in OOP.

Inheritance: is the process of inheriting attributes from a super-class by a sub-class. Sub-classes do not need coding for inherited data, which increases the development speed of OOP.

Polymorphism: is the process of inheriting a method from a super-class by a sub-class. Each sub-class overwrites the inherited method with a different meaning. The runtime system invokes the appropriate sub-class through dynamic binding. This facilitation is one of the powerful features of OOP that saves a multitude of coding.

Interface: is the process of inheriting behavior from multiple super-classes. This process appears insignificant or trivial at first sight; but it is unusually successful in integrating methods and saving time and codes. These features contribute to making the OOP superior over other procedural languages.

JAVA AND VB .NET – COMPARATIVE STUDY

Although Java and Visual Basic .NET are current OOP languages, their origin is different (Doke, Satzinger, Rebostock Williams, & Douglas, 2003; Doke, Satzinger, & Rebostock Williams, 2003). Sun Microsystems built Java intending for it to be an OOP language with Internet capabilities from the start. Java runs on any platform. Microsoft created Visual Basic as a procedural language tool for Windows applications. When Sun Microsystems introduced Java, Microsoft created C# (“C Sharp”), a language similar to Java. Eventually, Microsoft included Visual Basic in the .NET framework and in the Visual Studio .NET. Even the Visual Basic 6.0 version, introduced in 2002, was not purely Object Oriented, and programmers encountered difficulty with it until the introduction of Visual Basic .NET.

CRITERIA FOR EVALUATION

Six criteria (Keene, David, 2002; Survyer, Jacques, 2003), such as a) the ease of development, b) increased performance, c) rapid application development, d) runtime possibilities, e) application integration, and f) cost-efficiency, formulated for evaluating Java and VB .NET.

Ease of Development: Java program be typed in Notepad or WordPad and is run from the C> prompt. A few students liked this feature of Java. Java is case sensitive, meaning that some words may begin with an upper case letter while others in lower case. Students encountered difficulties with Java, especially when they made a mistake. All students liked the Windows application and they unanimously expressed that “GUI with the Windows application facilitates program development”.

Both Java and VB .NET have visual components for program development, however; Microsoft’s Windows application with the GUI (Graphical User Interface) has a superior advantage over Java’s GUI. Java’s programming design is more advanced than VB .NET’s. Consequently, the programmers require more time in learning the Java-fundamentals and OOP design before they are able to write programs (Hoobler, Roy C., 2003). Both Java and VB .Net have numerous APIs (Application Programming Interface) to help with program development. Comparatively, Java possesses more APIs. The problem lies in not the lack of APIs, but in the shortage of valid and accurate documentation. Java contains excellently organized documentation with quick reference examples, while

VB .NET’s documentation is rather lengthy and disorganized lacking many quick reference examples. Both Java and VB .NET have an abundance of books available for self-training and are difficult to learn, however; VB .NET is comparatively easier to learn and develop programs than Java.

Increased Performance: The ultimate problem in the point is creeping bugs. Programmers spend numerous hours killing bugs and correcting their programs. Although it is possible for both Java and VB .NET programs to have bugs, VB .NET appears to be worse in this case despite its automatic syntax checker. The creeping bugs problem worsens due to lack of information regarding fixing the bugs. Another downfall is reliability and stability in APIs and database access methods. APIs are adequate, but the ever-changing nature of APIs in both languages make some of the older ones obsolete within a short period of time. This situation becomes problematic in API stability. Moreover, Microsoft’s Active X poses a security problem. Another difficulty is the large number of data access routines in VB .NET. It is an overwhelming task to select a reliable and stable routine from the numerous data access methods. One feature of Java’s strength in reliability is “event handling” with “try and catch” the error. VB .NET has introduced “event handler” as in Java. Java supercedes VB .NET slightly in increased performance.

Rapid Application Development: The rapid application development depends upon the IDE (Integrated Development Environment) and editors, debugging capabilities, and the handling of large scale projects. The IDE enables students to increase the speed of program development. Both Java and VB .NET possess their own IDE and third party tools. For example, Java programmers use Forte, JBuilder, Visual Age, JDeveloper, etc. VB .NET programmers utilize the Visual Studio.NET development environment. Moreover, Java's EJB, JDBC, JSP, and JCA Web Servlets facilitate the development and running of large scale projects on multi-tier client-server systems. Microsoft's IDE excels as the top performer in the business world. Microsoft is exemplary in setting text-editor standards for better performance of program development. Microsoft is the definitive leader in rapid application development.

Runtime Possibilities: Java is portable on any platform. It is achieved through byte-code and an interpreter called the Java Virtual Machine. One can write a program without knowing the type of computing platform on which it runs. This inadvertently is a valuable advantage of Java. The .NET framework is a new computing platform which has two main components, such as the .NET Common Language Runtime (CLR) and the .NET framework class library. The CLR allows programmers to write programs in any .NET language. It also allows the programs to run on different platforms without recompiling. Of course, there are limitations. Java is more platform independent than VB .NET. Regarding deployment options, both Java and VB .NET are component-oriented. Both contain web servlets. Java's applets are more advantageous on the server. VB .NET allows its user to stop program running for debugging and to resume its running. Students favor Java's applets and animation despite their difficulty in learning to use them.

Application Integration: The Java technologies, such as EJB, Java Servlet, JSP, RMI-IIOP, JMS, JTA/JTS, JDBC, JNDI, Java Mail, Java-XML, and JCA, enable companies to eliminate their endless struggle for connecting heterogeneous systems, and to meet the integration solution challenges, such as application-to-application integration, web-based applications with back-end EIS application integration, and business-to-business application integration. Microsoft .NET platform offers numerous features for integration solution (Vawter and Roman, 2001), such as the Host Integration Server for legacy integration, COM TI for mainframe integration, MSMQ for legacy system integration through message queuing, and BizTalk for B2B integration. These tools provide only partial and limited integration solutions. Moreover, these tools are not VB .NET tools. Java technologies are "better than" Microsoft.NET in providing application integration within and between enterprises.

Cost-efficiency: Microsoft provides free software through the school for the students registered in the course. A hard copy of VB .NET documentation costs an extra \$150. Java has cost-efficiency in application integration through Java technologies mentioned above in application integration.

CONCLUSION

Both Java and VB .NET possess strengths and weaknesses. Java's strength lies in its increased performance, runtime environments, application integration within the same enterprise and between enterprises, and in cost-efficiency. VB .NET is advantageous in the ease of program development, rapid application development thereby culminating in a reduction in time-to-market. The students prefer VB .NET due to its easy program development ability with GUI in Windows application. This author favors Java due to its component capabilities of running large scale projects on multi-tier client/server systems on any platform, and application integration within and between enterprises. Presently, both Java and VB .NET are full-fledged languages and both are excellent choices for learning OO Programming. The specific choice of

either for the Object-Oriented Programming course depends upon a particular university's Information Technology Environment.

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EXAMINING THE DIFFERENCES OF GENDER PERCEPTION IN THE USE OF SPEECH RECOGNITION AS A TOOL IN GROUP SUPPORT SYSTEMS

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ABSTRACT

Group Support Systems (GSS) technology is recognized as a tool with advantages for facilitating, improving, and speeding communication between the different members in a meeting session. One innovation that could enhance the efficiency and effectiveness of GSS technology is speech recognition. While the concept of human speech interaction with computer-based information systems is not novel, Speech Recognition (SR) technology presents an opportunity to reduce the challenges in human-computer interaction. One of the advantages that Speech Recognition offers is the ability to capture a larger amount of text/data over traditional keyboard entry. This is of interest as one of the limitations of GSS performance and end user satisfaction has been attributed to keyboard-based comment entry challenges. Simply put, people talk and think faster than they can type. This paper reports the results of an experiment using a prototype voice-based Group Support System. Fourteen groups of five subjects each submitted speech-synthesized comments into the system and read others' comments visually on computer screens. This prototype seeks to maximize the relative efficiencies of speaking and reading to generate the most ideas in the shortest amount of time while maintaining accurate transcriptions. Results of this study illustrated some interesting differences between genders. First, male subjects reported spending too much time on idea generation while female subjects reported a higher level of understanding of decisions made. Females also reported a higher level of satisfaction with both the decision outcome and the process. These results provide evidence that Speech Recognition may be a viable tool for decision-making processes where gender issues play an important role.

ALTERNATIVE COURSE DELIVERY TECHNIQUES: AN ANALYSIS OF THE EFFECTIVENESS OF AN ON-LINE INTRODUCTORY INFORMATION SYSTEMS COURSE

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This paper discusses the design, implementation and preliminary evaluation of an on-line introductory information systems course compared with a traditional face-to-face course (f2f). Many obstacles face the adequate implementation of a pure on-line information systems course. Whether these obstacles are human or technological, many academics have been slow to develop on-line courses. In addition, research has been inconclusive regarding the overall effectiveness of on-line courses. Two courses were offered, one being on-line and the other face-to-face. Included in this research is a discussion of the various components and technological tools used in the on-line course. At the conclusion of both courses an analysis was undertaken to determine students' attitudes toward the two techniques, along with a comparison of students' performance on various assessment measures. Results indicate that students preferred the on-line model over a traditional (f2f) information systems course. However, results varied based on various demographic measurements (e.g. age, prior academic success, computer literacy...) Student performance measurements showed no significant differences between the two techniques. One of the implications of this research is that a well designed on-line information systems course may be effective in delivery course content to most students, but alas not to all.

OPTIMAL PURCHASES PLANNING FOR A RENTAL CAR COMPANY

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ABSTRACT

This paper addresses the issue of purchase planning in a car rental company. For most rental cars, the vehicles have a short life span within the company. The vehicles generally are used for a period not exceeding three years, after which they are sold as second hand cars in the used car market. In reviewing the revenue generated by these companies, it becomes evident that the sale price of the used vehicles plays a major role in the revenue and profit structure of the companies. In this particular application, the company's main profit is the return from the used car sales. In other words, whatever the company generates during the operation of the car is only used to cover the expenses. Furthermore, different cars have different classes, and thus have different purchase values, resale values, maintenance requirements, and lease options, to mention a few of the variables of analytical importance. This paper attempts to develop a purchase planning approach with the goal of maximizing the long-term company's profit, while keeping all of these inter-related and complex variables in perspective.

Key words: stochastic programming, decision rules, multistage stochastic programming, stochastic dynamic programming, car rental.

SOFTWARE ERRORS: RECOVERY RIGHTS AGAINST VENDORS

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ABSTRACT

Businesses that experience problems with physical products they have purchased find that the legal system provides adequate redress for their grievances. Large verdicts or out of court settlements are not unusual for product liability in business-to-business transactions. Software vendors routinely immunize themselves from such product liability by including exculpatory language in the agreements to which users must agree as they install the software. This paper examines the rights of companies to collect damages from software vendors when their products introduce errors or fail to perform transaction processing tasks correctly. The paper also outlines future trends in this area.

INTRODUCTION

Software vendors regularly ship software that has defects that are known to the vendor and that the vendor does not disclose to the purchaser (Kaner and Pels, 1998). Some of these defects are quite serious. For example, in the case of *Mortenson v. Timberline* (2000), Mortenson used Timberline's Precision Bid Analysis Software to prepare a bid for construction of a medical center. The software contained errors that caused Mortenson to bid the job approximately \$2 million lower than it should have bid. Bills (2002) reports a software glitch at the Bank of America that processed automated clearing house payments incorrectly, resulting in unauthorized charges to thousands of customer accounts.

The true danger of the current situation is made clear by studies of the extent to which accounting software is plagued by errors and by estimates of the dollar impact of these errors. Financial Executive's News (2002) presented a feature report on a series of common errors in mid-level accounting software packages. Goodwin (2002) reports the results of a study of 45 financial software applications. The study found that more than half of the applications contained errors that could have been fixed easily if they had been detected during the design of the software. Estimates of the annual cost to U.S. businesses of software errors is approximately \$60 billion (Jusko, 2002; Trembly, 2002).

The way that software errors enter the software production process and the final software product is also enlightening. If software errors were the inevitable outcome of a complex process, which some researchers have argued in the past (Foster, 2003; Nakashima and Oyama, 1999; Roush, 2003), then there might not be much that legal reform could do about the problem. Although it is true that some software error situations are probably beyond the control of software vendors (for example, the rapid development cycles of annual revisions of tax preparation software might make them the exception to the rule (Johnston, 2001)), most business software developers do not work on tight deadlines and rapidly changing tax rules.

Kaner and Pels (1998) report that some software publishers track the number of errors that are discovered in their software after it has been released, calling these bugs their "surprises." They only include errors in this category that had not been detected in the software

development process by programmers, quality assurance technicians, or by their own customer support staff. A common experience among these companies is to have fewer than five “surprise” bugs surface after the software is released. Many of them report only one or two such “surprise” errors.

This means that the large number of bugs identified in the industry press is not a true reflection of some innate condition in software development. In fact, it suggests that most software vendors know about the vast majority of the bugs that exist in the software they release. They just are not telling their customers about the errors.

An increasing number of writers are reporting that business managers and IT staff members are coming to believe that tolerating software errors is no longer necessary (Foster, 2003; Hunter and Boscher, 2003). They argue that improving software design tools and software design methods offer hope for higher quality software. As companies realize the cost of error-laden software, they are demanding that internal software developers use these design tools and methods to improve the quality of the software developed in-house (Hayes, 2003). The number of companies that have reached the limits of their tolerance is growing. Since there is ample evidence that the tools now exist to produce software that is less error-laden than that being currently produced, a logical place to turn for recourse is the legal system.

CONCLUSION

The limited liability of vendors for direct and consequential damages is a problem that is causing growing concern among business users of software. For accounting software in particular, the problem of consequential damages is becoming a significant element of companies’ exposure to unforeseen liabilities. Specific legislation that addresses direct and consequential damages for software products is a possible solution.

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A QoS STRATEGIC PRICING METHODOLOGY FOR INTERNET SERVICE PROVIDERS

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ABSTRACT

This research proposes a methodology to examine the influence of a Quality of Service (QoS) pricing strategy for Internet Service Providers (ISPs). The approach employs a Bertrand duopoly price competition model to determine a customer's willingness-to-pay and Internet usage patterns. The model also makes use of a two-part tariff consisting of a fixed rate for Best Effort (BE) service, and a usage-sensitive rate structure for premium QoS. Initial results indicate that an equilibrium market position for each ISP depends on a customer's preference for QoS and the price of BE service. Upon implementation through simulation, this methodology provides an analytical framework for iterative, short-term, future QoS Internet pricing strategies.

2+2 TIER BANDED FRAMEWORKS OF INTERCONNECTEDNESS: INDUSTRY STRUCTURE DETERMINANTS

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ABSTRACT

The Internet industry is generally considered to be vertically structured with the Internet Backbone Provider (IBP- long distance service carrier) in the upstream and Internet Service Providers (ISP) in the downstream. Although there are many ISPs and IBPs in each stream, both markets are considered independent oligopolies in that there are a few dominant providers for both ISPs and IBPs. The market leaders in each market create their own hierarchical tier and it is generally accepted that the Internet industry structure has evolved into a four-tier hierarchical structure. To understand the Internet industry, it is necessary to understand interconnection between ISPs and IBPs. The key element as an industry structural determinant is peering interconnection and the relationship created by that interconnectedness. Peering interconnection occurs within the same tier and the transit interconnection between the different tiers. This paper examines the internet industry structure using market share and interconnection strategies.

EMBRACING INFORMATION TECHNOLOGY OUTSOURCING

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ABSTRACT

Americans currently are obsessing about the continuous loss of Information Technology (IT) related jobs to overseas markets. The Bureau of Labor Statistics data shows that nearly 160,000 IT jobs have disappeared in the past three years, while the IT unemployment rate has nearly doubled since 2000. By 2015, the U.S. is expected to loose about 3.3 million “business-service” jobs to other countries – resulting in about US\$136 billion of lost wages.

While the above statistics are real, they only reveal a part of the outsourcing phenomenon. Outsourcing to offshore economies has created many advantages and opportunities to organizations which are willing to adapt to the new realities of global commerce. Recent data suggests that the exodus of American IT jobs to countries such as India, Russia, Romania, and China shows no sign of declining, and that this trend might even accelerate as U.S. companies fully understand and embrace offshore outsourcing..

The purpose of this paper is to objectively analyze offshore outsourcing in the Information Technology sector. It will identify the major advantages and opportunities of offshore IT outsourcing, and its impact on U.S. organizations and economy. The paper will prove beneficial to business managers as it allows them to better analyze the impact of outsourcing decisions on their organizations. Academic researchers in the business or information technology discipline will become more knowledgeable and will develop new research methodologies for studying the IT outsourcing phenomenon.

FORECASTING KOREAN STOCK PRICE INDEX (KOSPI) USING NEURAL NETWORK MODEL AND SARIMA MODEL

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ABSTRACT

Korean Stock Price Indices are forecasted using a back propagation neural network model and a seasonal autoregressive integrated moving average (SARIMA) model, in this study. The SARIMA model is a combination of a moving average model and an autoregressive model adjusted to the seasonal change. The Neural Network model is trained using Levenberg-Marquardt algorithm to minimize its forecasting errors. Then, KOSPI forecasts from the above-mentioned models are compared with actual KOSPI to examine the accuracy of the forecasts and which is the better one between the two forecasting models.

Keywords: KOSPI, SARIMA, Neural Network, Levenberg-Marquardt Algorithm, Financial Forecasting.

INTRODUCTION

Prior to the economic crisis of 1997, Korea's impressive growth performance was part of what has been described as the East Asian miracle. Korea has changed from one of the poorest agrarian economies to the 11th largest economy and exporting country in the world, which is culminated in its accession to the Organization for Economic Cooperation and Development (OECD) in 1996. Korea's rapid development was driven by very high rates of savings and investment and a strong emphasis on higher education. After the crisis in 1997, Korea has developed a sounder economic infrastructure. Korea once again becomes one of economic centers in Northeast Asia, with ample investment opportunities. Korea's rich human resources, history of miraculous development, and unyielding commitment to liberal democracy all attest to its potential to recreate a robust economy in the decades to come.

Nowadays, many foreign investors are interested in Korean Stock Market which is the 14th largest capital market in the world. Foreign investors' dividend remittance overseas has been nearly doubled to \$2.5 billion during 2004. The Bank of Korea attributed the increase to foreign investors' growing interest in local blue-chip stocks, which pumped up last year's dividend repatriation to \$2.49 billion from the previous year's \$1.34 billion. Foreign players own a combined 54 percent of shares in Korea's top 10 companies listed in the Korea Stock Exchange (KSE), witnessing their active roles in Korea's equity markets. With an introduction of Korean Future Market whose main product is KOSPI based, forecasting KOSPI becomes a major issue. Increased number of Korean mutual funds established in foreign countries pronounces the importance of forecasting KOSPI, too.

The objective of this paper is twofold. First, we investigate a future trend of the Korean stock market index using two different methods: Seasonal Autoregressive Integrated Moving Average (SARIMA) and Back Propagation Neural Network (BNN). Second, forecasts from these methods are compared to find which method is the more accurate and reliable one.

METHODOLOGY

1. BACKPROPATION NETWORK MODEL

The neural network can be applied as a multivariate nonlinear regression map to analyze and predict financial data such as stock and money market variables. Unlike other modeling approaches such as polynomial fitting, the neural network has a physical basis to the behavior of variables under consideration and is more suitable to modeling physical dynamical systems. This extends well to the interaction of macroeconomic variables and thus provides a valuable alternative to the conventionally used linear systems in econometrics [2].

Neural networks take a different approach to problem solving than that of conventional methods. Conventional methods use an algorithmic approach: i.e. conventional method follows a set of instructions in order to solve a problem. Unless the specific steps to follow are known, the conventional method can not solve the problem. In other words, conventional method uses a cognitive approach to problem solving where specific unambiguous instructions to solve problems must be given. But, the network is composed of a large number of highly interconnected processing elements working together to solve a problem. Neural networks do not need specific instructions to solve problems.

Today, the backpropagation is by far the most commonly applied neural network training method. An informal count indicates its use in more than 85% of published applications. Backpropagation is a systemic method for training multilayer artificial networks and has its property of capturing high order structure inherent in the data. But the accuracy of the network depends on many factors such as network topology selection, network learning parameter selection, maintaining rotation and translation invariant feature, extraction of teaching patterns, and completeness of representation of the problem space in the teaching pattern.

The central idea of the backpropagation is best described with reference to a feed forward network containing one hidden layer of neurons. This method can extend easily to multilayer networks as well as to recurrent networks. The goal of this method is to adjust the synaptic weights so as to minimize an error E , defined at output of the network as

$$E = \sum_p E^{(p)} = \sum_{p,k} \left(d_k^{(p)} - y_k^{(p)} \right)^2$$

where $y_k^{(p)}$ is the actual, observed output at the k th neuron in the output layer and $d_k^{(p)}$ is the desired output at same neuron. The superscript refers to the p th input-output pair applied to the network.

In the paper, we will train Neural Network using Levenberg-Marquardt algorithm [4], which uses the steepest descent method when far from the minimum, but changes to the inverse Hessian method as the minimum is approached. The steepest descent method of selecting the direction is calculated using

$$d^{(k)} = -\nabla f(x^{(k)})$$

where $d^{(k)}$ is the direction of the step that is necessary to improve the value of f and $\nabla f(x^{(k)})$ is the gradient of f evaluate at $x^{(k)}$.

Past experience indicates that this method can be more than two orders of magnitudes faster than the steepest descent method, and is capable of avoiding some relative minima's. We

will use the network with the topology 10-X-1, where X is the number of hidden nodes. The ten input nodes represent binary coded integers. The binary representation is preferable to decimal since the input data are discrete quantities [3]. We have found that the Neural Network is capable of interpreting this sequence as a time axis. The single output node represents the difference between two adjacent index values. The difference is taken instead of the share price because any systematic background noise is eliminated. After convergence is achieved, the result is converted back to the original price denomination.

2. SARIMA MODEL

The SARIMA model is a combination of a moving average model and an autoregressive model which are two basic models of the Box-Jenkins forecasting methodology. The moving average model assumes that the future forecast is simply the linear combination of past errors. The autoregressive model assumes that the future is a linear combination of the lagged past values multiplied by regression coefficient plus residual terms, random events not explained by this model. The regression coefficients are found by using a nonlinear least square method. The SARIMA also incorporates season changes [1].

SARIMA model has emerged as one of the most important statistical methods for time series analysis. It is a highly refined curve fitting device that uses current and past values of the dependent variable to produce accurate short-term forecasts. The SARIMA methodology is appropriate if the observations of time series are statistically dependent or related to each other. In this project, we will use SARIMA method to forecast the index of Korean stock market.

DATA

We will use KOSPI for 10 years from January 1995 to December 2004. The index data will be obtained from <http://finance.yahoo.com/q/bc?s=%5eKS11&t=1d&c>.

IMPLEMENTATION

We will use an MATLAB for BNN model and a STATISTIX for windows 2.0 for SARIMA model. After the training of the forecasting models is completed, KOSPI will be forecasted using the trained forecasting models. Then, the predicted results using BNN model and SARIMA model will be compared with actual KOSPI to examine the precision of the forecast. The precision of forecasts from the two models will be compared each other to see if which one of the two is the better forecasting model for KOSPI.

CONCLUSION

In this paper we will use a back propagation neural network model and a seasonal autoregressive integrated moving average model to predict stock indices in Korean Stock Exchange. We will find which model is more accurate and reliable for the stock indices' prediction. However, the prediction of the stock indices is not easy, because stock market indices are influenced by many other unpredictable factors such as government policies, industrial regulations, and political stability.

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USING IT TO MITIGATE ORGANIZATIONAL SILOS

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ABSTRACT

Much has been written about the dysfunctionality of organizational silos and the resulting hoarding of information, knowledge, and power. IT is routinely recognized as playing a supporting role in mitigating organizational silos, but such a goal has not been used to help justify IT investment. This work investigates how IT can be used to support this cause and how the cause can be used to help justify IT investment.

INTRODUCTION

Justifying investments in information technology (IT) has become more complex and difficult while the demand for doing so has been on the rise. Senior management sees IT investments as one category of potential corporate investments, all of which compete for scarce corporate resources. In previous times many IT investments were fairly simple to justify with cost savings. Most modern IT investments tend to be difficult to justify in cost savings because of their size, scope, and enabling nature compared to the simpler cost-savings systems of the past.

JUSTIFICATIONS BEYOND COST-SAVINGS

Many justifications have been used beyond cost-savings in the past. One of the most common is infrastructure or platform improvements to be shared by multiple systems. An organizational network is an excellent example of a significant infrastructure or platform project which provides little or no cost savings. Organizational networks are considered essential infrastructure by most modern organizations, but not because of cost savings. The benefits are generally in the form of enabling technologies such as e-mail, electronic file transfer, concurrent work, etc.

Performance-enhancing systems are another type of project which is generally not cost-justified. A customer service system is a good example of this type of system. The primary goal of these systems is not to do it for less, but to do it better. There are many examples of these types of systems.

Modern IT investments frequently involve many justifications. Cost-savings is no longer the dominant justification, but is certainly to be considered. Enabling technologies and performance-enhancement are to be included when justifying IT investments.

ORGANIZATIONAL STRUCTURE AS A JUSTIFICATION FOR IT INVESTMENT

Many organizations have been moving towards "flatter" organizational designs with fewer layers of management. The motivation for this design includes cost-savings, but the primary motivation is generally to create a more flexible and responsive organization. This design is almost always supported with IT investment in workflow management and communications supported by various organizational networks.

Using IT to impact organizational design brings an interesting question about organizational silos. Organizational silos are named for vertical components within the organization which contain organizational power and knowledge. The name implies that this power and knowledge tend to be hoarded and not shared with other organizational units. Could IT be used to mitigate these organizational components?

USING INFORMATION TECHNOLOGY TO MITIGATE ORGANIZATIONAL SILOS

One characteristic of many current large IT projects is that they tend to enable cross-functional work within the organization. Cross-functional work often requires information that was historically kept within the organizational silo to be available outside the silo, at least for a short period. Generally this information would not be captured as an organizational resource, but used and filed.

This could be a missed opportunity to capture this information and add it to the organization's knowledge available to all who need it. In fact, this could help justify some modern systems – uncovering or creating needed information in support of the contemplated IT investment would provide a contribution to organizational knowledge in addition to the system's other purported benefits. This benefit requires some formal system for capturing, storing, disseminating, and safeguarding organizational knowledge.

Such a formal system might, in fact, be the big win. Much of the knowledge management literature focuses on teaming and the use of teaming to support the dissemination of knowledge. This work does not mean to discount that perspective, but to take the concept one step further – formally capturing, storing, disseminating, and safeguarding organizational knowledge.

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