



CAHSI

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***Building a Diverse and Innovative
Workforce***

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Artificial Intelligence

P1: Classification of Learning Object's Web Pages under the Elementary, Middle, and High School Educational Levels

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The World Wide Web has become the largest source of educational resources over the last decades. Recently, the educational level has raised as an important property of educational materials according to the 21st century pedagogical needs and interests of academicians. How-ever, this property has to be manually annotated and most online educational materials still lack of this description. In this paper we address the task of automatically determining the educational level property of an educational material based on its web page on-page features. By experimenting on a data corpus of pre-labeled web pages of educational materials under the K-12 educational levels, we demonstrated that the determination of the Main Categories (Elementary School, Middle School, and High School) can be automated by a computerized system using supervised learning techniques.

P2: Binary Classification for Conceptual Change Assessment

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Binary classification has been applied in an attempt to automatize the detection of engineering student misconceptions in the topics of diffusion and heat transfer. According to Educational Engineering experts analyzing the verbs used by students to describe science concepts can systematically assess the presence of misconceptions. Modern misconception assessment is based on the ontological categorizations of concepts where each category is accompanied by the different verbs used to describe these concepts. This systematic analysis is called the predicate test. The predicate test has proven to be successful for conceptual change assessment but has not been automated with the use of modern computing systems. The main goal of this research is to show that conceptual change assessment can be considered a task of text classification. The J48 binary classifier has been used to build a prediction model using the results of predicate tests, which have been previously annotated by Educational Engineering experts.

P3: Tracking Multiple Near-Identical Objects

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Tracking multiple near-identical objects (such as insects) can be accomplished by finding the locations of each object in each video frame and then establishing object correspondences across all frames. This tracking approach has to deal with the challenges that arise from these two steps. On one hand, the tracking system has to be robust enough to correctly identify object locations in each frame despite the similarities between the objects. On the other, the system must find the correct object correspondences across frames, even with the occasional lack of detection or false-positive detection. In this paper, we present a two-step approach to track multiple near-identical objects that move freely in a controlled environment. We first identify object locations in each frame using a robust background subtraction algorithm. After the locations of the objects have been identified, we find object correspondences across frames using the Hungarian algorithm. This tracking system demonstrates outstanding performance when tracking flies that move freely in a transparent container.

P4: Help Robotic System (HRS001)

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The purpose of this project was to design, implement and program a robotic hand named HRS (Help Robotic System). This robotic system has the appearance and ability to behave similar to a human hand. It was developed using concepts from robotics and biomechanics. Our focus was to develop a HRS prototype that has the ability to attach objects for a period of 10 seconds. We used the Arduino Uno ® microprocessor and implemented basic algorithm of motion. Other electronic components were used to facilitate the movement of the hand in addition to the microprocessor. For example, the use of servomotors, that are responsible for the movement of the fingers of the HRS. In this first stage we designed, constructed and tested the prototype (HRS001) which supports our hypothesis. The external part of the system was made with Puerto Rican mahogany wood. As future work, we expect to improve current design and produce new versions of Help Robotic System, a robotic hand that can be used as part of a robotic prosthesis for children and young people, allowing them to do used as a real hand.

P5: Detecting Drowsy Driving

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Drowsy driving is a serious problem. Although the problem is well-studied, few devices that measure drowsy driving (such as EEG or pulsemeasuring devices) are easily accessible and comfortable for the layperson. We developed an Android application that employs pupil tracking and machine learning to determine when drowsiness sets in, at which point the driver may be alerted. The application can be positioned with a common GPS phone stand. We hypothesized that pupil movement differentiates drowsy driving from attentive driving. The application employs a Random Forest machine learning algorithm. For our experiment, we were supplied seven hour-long videos of participants navigating a driving simulator in an environment conducive to drowsiness. After merging the data from all of the videos, the algorithm achieved an accuracy of 81.8% for a 2/3 training-testing split

P6: Explaining Restaurant Ratings by Topic Sentiment Analysis

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Online reviews of restaurants contain insights on topics that ratings alone cannot express. These topics can give owners clues on specific issues of the restaurant. Extracting such insights from online text presents many challenges due to noise in the data and the presence of irrelevant information. For instance, online reviews usually have misspellings and informal language. Potential customers can review the text and find certain topics that are positive or negative, which can ultimately influence their decision. Such topics can alter the restaurant's overall ratings, which can hence affect the restaurant's revenue. In this study we explore extracting topics and sentiments from restaurants' online reviews in the Yelp's Challenge Dataset and find the correlation between topics sentiment to restaurants' ratings. We apply basic pre-processing techniques and extract sentences from each review. Sentiment analysis was applied on each sentence with Stanford's Recursive Neural Tensor Network (RNTN) model. Then, online learning LDA from Vowpal Wabbit was used on each sentence for topic modeling, with the assumption that each sentence contains at least one topic. Finally, we

found there was a correlation between the sentiment towards topics and restaurant's ratings. In our preliminary results we found that topics' sentiment had a positive correlation to star ratings

P7: A Bridge to Communication Using Gesture Recognition for Sign Language

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Signers communicate with one another through Sign Language, but this language is not understood by most of the population. Technology is now ready to provide a solution for the gap of communication between signers and non-signers. We have studied how to use gesture recognition with a Kinect device to recognize the hand-shapes from the depth image provided by such sensor. This system was evaluated experimentally on a dataset we recorded. This dataset contains videos showing the user performing basic handshapes that are used throughout all sign languages in the world. From these videos the handshape image is extracted and classified as their respective handshape using recognition features. These results are the first step in a larger system aimed at translating the gestures to non-signers.

Big Data

P8: Lunar Surface Microwave Observations of Brightness Temperature Collected with the Chang'E 2

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Chang'E is a series of spacecraft missions to study the Moon surface supported by the China National Space Administration. A multi-channel microwave radiometer on board Chang'E 2 (CE-2) has the purpose of measuring the microwave thermal emissions from the lunar surface [et al. Gong and Jin 2012] with working frequencies of 3.0 GHz, 7.8 GHz, 19.35 GHz and 37.0 GHz. Studying the Moon allows us to expand the scientific knowledge with new discoveries; also Moon's exploration plays a critical role in understanding our Solar System and the Universe. Obtained observations from the CE-2 microwave radiometer about the lunar surface have been analyzed. Brightness temperature (T_B) is defined as the temperature a blackbody would be in order to produce the radiance perceived by the sensor (see, e.g., Goddard Earth Science Data and Information Services Center website of the National Aeronautics and Space Administration). By the use of the Interactive Data Language (IDL) the datasets of T_B were ingested of eight Moon's periods. The extracted T_B data values were plotted with their coordinate's points of longitude vs. latitude. To reconstruct the T_B , the data points were interpolated in order to generate a mapping plot with distributed colors of the T_B from the lunar surface, known also as a contour plot. The returned values were a two-dimensional floating point array. The 37.0 GHz channel of microwave data reflect better the lunar surface. Afterward, the landing sites ranges of Apollo 11 and Chang'E 3 were used to display a contour plot of the reconstruct T_B .

P9: Techniques for Anomaly Detection in Network Flows

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A general method for detecting anomalies in network traffic is an important unresolved problem. Using Network Flows it should be possible to observe most anomaly types by inspecting traffic flow. However, to date, there has been little progress on extracting the range of information present in the complete set of traffic flows in a network. Anomaly detection is a method that searches for unusual and out of the ordinary activity in traffic flow packets. In this research, however, we are classifying as flow anomalies those packets with an inexplicable amount of bytes. We collected flow data using SiLK from the UPR's Science DMZ, a high-performance network for data science. We start using the subspace method to detect anomalies in the following different types of traffic flows: bytes, packets and IP-flow counts. Analyzing the flow data with FlowBAT. Our next step is to implement the Benford's law to detect any type of anomalies affecting TCP flows, including intentional intrusions or unintended faults and network failures in general, those anomalies can be detected by investigating the first-digit distributions of the inter-arrival times of TCP SYN packets.

P10: SmartStorage: A Deduplicated and Distributed Datastore

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Datastores contain redundant copies of information, like identical files or sub-file regions, possibly stored on a single host, on a shared storage cluster, or backed-up to secondary storage. Deduplication storage systems take advantage of this redundancy to reduce the underlying space needed to contain the file system. The purpose of this paper is to present the design and implementation of a distributed datastore using deduplication. Scalable, highly reliable distributed systems supporting data deduplication have recently become popular for storing backup and archival data. The concept of filerecipe is central to this approach. The filerecipe for a file is a synopsis that contains a list of data block identifiers: each block identifier is a cryptographic hash over the contents of the block. Once the data blocks identified in a recipe have been obtained, they can be combined as prescribed in the recipe to reconstruct the file. Files can be replaced by the corresponding filerecipes. Data deduplication systems discover redundancies between data blocks. Our approach divides data into 8KB chunks and identifies redundancies via fingerprints. This will improve the storage capacity by increasing the storage efficiency ratio (bytes of actual file / bytes used to store). We will reexamine traditional choices and explore new design points. We discuss some aspects of the design and implementation.

P11: Visualization of Dengue Fever Statistics Using SalHUD

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In this project we have extended SalHUD to visualize the data from the Dengue Fever published by Puerto Rico's Department of Health. This government entity releases weekly reports regarding life threatening diseases. One of them is the Dengue Fever. The data for this diseases is stored in a PDF file. The purpose of this project was to improve the design of SalHUD and implement an epidemic curve. This helps into visualizing the data easier by year. The Health Department can act accordingly by visualizing the data provided by SalHUD instead of doing it manually.

P12: An Interface Design for Automating Shale Strata Identification

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The Ocean plug-in, Oil Shale, analyzes and compares the confusing data on well logs, by using some of the most important and common measurements from bore holes such as gamma ray, neutron porosity, density, caliper, deep and medium resistivity, and photoelectric effect to automate shale strata identification. The plug-in uses the Fast Fourier Transformation to filter and signal deconvolution to minimize the effect of noise, by removing the high frequencies to sharpen the data and create a smoother line for analysis. An interface was created to give the user the flexibility to adjust the selection criteria assigned to the logs if needed, but also allows a default of reliable values for fast and efficient analysis. An additional separate track was added and color coded to the standard well log that allows businesses to quickly and effectively determine where the shale strata is, within a 75 percent or greater probability. This makes the difficult task of reading these complicated well logs quick and easy, reducing the time to minutes. In turn, this will save businesses valuable time and money when it comes to expensive outside consultation and make well logs and their interface more user friendly.

P13: Multivariate Time Series Analysis

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A Univariate time series is an ordered set of p real-valued values measured over time. A collection of these time series that represents the state of an entity over time is known as a Multivariate Time Series. Symbolic Aggregate ApproXimation (SAX) and Bag of Patterns (BoP) are representations of univariate time series. SAX converts a window of time series data to a symbolic representation. By using a sliding window on a large times series SAX can convert it to a collection of SAX representations and reduce its dimensionality. BoP measures the frequency of these SAX representations for each time series. On the other hand, Stacked BoP and Multivariate BoP are representations of multivariate time series derived from the above univariate representations. These representations require the use of several parameters. Our objective in this future research will focus on automating the finding of the optimum parameter values for these representations to obtain the best result when classifying the data. The final goal of this work is to reduce the dimensionality of data to be able to store it and later compare it with other data to find time series which are similar.

P14: HSI Web Portal

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STEM-Hispanic Serving Institution (HSI) grants are funded by the United States Department of Education under Title III STEM/Part F-HSI. These grants fund various Science, Technology, Engineering and Math projects in colleges and universities throughout the country. A problem faced by grant receiving institutions is that there has never been ways for grant directors to communicate with each other in a centralized way. In order for ideas to be shared amongst grantees, a communication channel between them was needed. Thus, the creation of a system that categorized STEM grantee objectives into type of projects, successful strategies, and assessed versions of successes and failures was created to provide valuable information for all STEM grantees and minimize redundancies collectively within the programs. Successful objectives and strategies can now also be collected as a group to assess their overall STEM program productivity. In short, the purpose of the HSI-STEM web portal is to serve as a communication link between STEM-HSI grantees. It allows grantees and directors to view and share grant objectives and goals between them, thus, stimulating the creation of new exciting STEM projects.

Cloud Computing

P15: Data Replication in Cloud Computing Data Centers with Performance Guarantee

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Energy consumption in data centers networks is a growing concern as the size and scope of data center networks increases. Higher energy consumption is concerning for both monetarily and environmentally costs as most of the world's electricity is still generated through the use of fossil fuels which have detrimental greenhouse effects. Efficient data replication across data center networks can reduce network traffic and allow built-in power saving features to take effect, reducing energy consumption. We design a data replication algorithm with performance guarantee. Using FTCloudSim, a cloud computing simulator for fat-tree data center networks, we'll show that our data replication algorithm performs better than other existing heuristic algorithms for data replication in cloud computing. The findings will show that through the designed data replication algorithm with performance guarantee, energy consumption can be decreased, lowering monetary costs and even improving data center performance by reducing network response times, decreasing bandwidth usage and intelligently managing data replicas.

P16: A Cloud Based K-means Implementation for Large Dataset Processing

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K-means clustering is a popular unsupervised learning algorithm used to partition data points into clusters. With today's abundance of data, datasets can easily reach sizes where local processing using the standard algorithm becomes an impossibility. In this paper, we present a cloud-based processing approach to implement K-means in order to handle datasets whose size prevents processing on a single machine.

P17: Building and Painting the Cloud Rubik's Cube

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Cloud computing is a new technological paradigm that provides ubiquitous computing. NIST supports government agencies' adoption of cloud-based information systems by providing a methodology of identifying the functional capabilities an agency needs for its cloud-based system, and by identifying the security controls necessary to securely implement these capabilities. We supplement NIST's current work with the Cloud Rubik's Cube Tool (CRCT) that enhances the methodology by providing aggregation and analysis of the data pertaining to a cloud-based information system. The CRCT consists of a back-end database that supports the data aggregation and analysis, a front-end manager and a set of visualization tools. Cloud consumer's data could consist of a comprehensive set of cloud functional capabilities, associated security controls necessary to secure these capabilities, security indexes assigned for selected capabilities, or associated Trusted Internet Connection (TIC) capabilities, to list a few of the supported data. Consumer's data is organized and stored in the back-end database using the front end manager. Agencies can analyze and update their data using the CRCT manager, and generate reports with different views of this data. The visualization capabilities Enhance the analytical power of the CRCT by processing the generated reports and "painting the facets" of the CRC. The visualization tools are reproducing the Cloud Security Alliance's Enterprise Architecture that provides a graphical representation of the cloud functional capabilities and generate color-coded maps of different views of the data aggregated by the CRCT, allowing users to visualize, in different ways, the information aggregated by the CRCT. For

example, our visualization tools can be used to generate: maps of the confidentiality, integrity or availability security indexes, maps of particular security controls and the functional capabilities they implement, or maps of different mandatory TIC. These “heat maps” allow users to visually identify capabilities that require attention based upon the “heat” of their color.

Computer Education and Outreach

P18: The Tech. Carnival: A Proposed Outreach Program for Creating Awareness of STEM Fields in High School Students

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The purpose of this research is to develop an interactive method of promoting STEM related college programs in Puerto Rico's public High Schools. Due to the poor promotion of STEM in Puerto Rico's public schools, many of the students that graduate do not move on to a higher education causing low rates of admissions in Puerto Rico's Colleges and Universities. In order to address this issue, the creation of an outreach program aimed towards this population is being developed. For our initial stage, the program will focus on students who are currently attending public High Schools. The outreach program is set to consist of a series of interactive workshops that will help students build a series of arcade/carnival games as a means of providing exposure to different areas of STEM such as computing, electronics, engineering, and mathematics. To measure the success of the program, an assessment plan that exposes the level of interest and knowledge students acquired throughout the prepared activities will be developed

P19: Integrating Different Teaching Styles to Increase Interest in Computer Science

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Since 2006, the Young Women in Computing (YWIC) program at New Mexico State University has blossomed into a program where bright minds are challenged. YWIC has utilized informal teaching styles during annual summer camps to increase student's knowledge and interest in Computer Science (CS). During the 2015 summer camp surveys were distributed to the students to determine their preferred teaching method. Five teaching methods were compared: lecture style, along-side instructor, team-based, one-on-one, and individual work. Surveys listing each of the teaching styles and techniques were administered to students before camp instruction began. Students were asked which techniques they receive at school and which techniques they prefer. Results showed middle and high school girls prefer team based learning over all, and liked lecture style the least.

P20: Effective Teaching Methods

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The number of women in computing and other technological fields is exceedingly low, leaving females in computer science a definite minority. This has led me to a research process of finding the most effective method to grasp the attention of young students and help them become interested in computer science fields. The main focus of this experiment is to help boost the confidence of young girls and other minorities and to recruit them successfully. I, along

with another colleague, conducted research to decipher whether middle school students from grades 6th-8th prefer drag-and-drop coding versus a more hands-on approach with EV3 Robotics. This data will help in determining a useful recruiting tool to interest middle school aged children (especially female) into computing and eventually into computer science related degree programs. For research, I taught a drag-and-drop coding program called SNAP! and EV3 Robotics at an all-girls summer camp. After each day, the girls would answer a multiple questioned survey about what camp activities they enjoyed the most or which lessons they understood the most. Also, before the camp, the students were required to answer a survey about their knowledge of computer science terms and ideas. They began camp with very minimal confidence, knowledge, and understanding of these ideas about technology. After the camp, the students took one last survey, and this proved that the girls were much more intrigued by the hands-on activities. They also were able to identify a significantly larger amount of computer science terms. The surveys proved that many girls who enjoyed the Robotics and SNAP! activities, were also interested in pursuing a future career in a computer science field. With the data from the surveys, my colleagues and I are determined to include more hands-on activities that promote computer science and other technological fields and use the most effective methods in future lesson plans.

P21: Nanotechnology Videogame for Middle School Students

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Some middle school students experience a lack of interest to pursue college studies in Science, Technology, Engineering, and Math (STEM) fields due to socio-economic factors that affect their academic career. In the past years, the UPRM CREST Nanotechnology Center has been working toward increasing their interest in STEM fields by using the field of nanotechnology. Since gaming has shown potential value in education, this work's goal is to develop an educational nanotechnology video game, using Unity as platform, that is accessible and appealing to said students, to teach them about the subject of nanotechnology and that serves as a motivational tool to study STEM fields.

P22: Using Robotics with the Arduino Uno for Education in STEM

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The objective of this research work is to explore Arduino as a platform for education in science, technology, engineering and math (STEM). Effective ideas of how to use robotics with Arduino to attract K-12 and undergraduate students to the different areas of STEM will be presented. The effectiveness of utilizing the Arduino platform for robotics and embedded systems will be determined through research work and the use of references. Various simple electronics projects were developed using the Arduino Uno. These simple projects were created with the purpose of developing a better understanding of the different concepts and devices that are used while working with the Arduino platform and with robotics. All of these projects have progression, utilizing the concepts learned in the previous work to complete the next one. Programming, design and basic electronics skills are developed by working throughout the progression of these different projects. The final prototype for this research work would cover the culmination of each individual concept learned in the smaller projects to design, develop, and construct a working autonomous robot. Workshops were created based on the work and progression used in these projects. These workshops will be used by high school students and undergraduate students in our future work to determine whether the presented strategy impacts the students' perspective on computer science and on robotics by having them take pre and post-evaluation tests. Learn whether if the changes are positive, as found in our references, or not, and listen to the students' opinions on their experience and their attitudes towards careers in STEM. With these results we would be able to find our own empirical evidence in our future research project.

P23: Sol y Agua Project: Engaging Middle-School Students in Water Sustainability Issues through an Interactive Educational Game

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Between 2010 and 2012, only 19% of all college students nationwide were Hispanic. Only 6% of the STEM workforce is Hispanic[1]. Through NSF funding and a collaboration with the Smithsonian Latino Center[2], we aim to attract students to STEM fields by augmenting STEM learning modules with a culturally relevant educational game. The goal of the Sol y Agua project is to improve students' ability to learn, seek evidence, and modify or challenge beliefs through interactive game-play. The project is accomplishing this through the development of a prototype educational game for middle-school students. The game centers on data science with a theme of water sustainability and stewardship with an emphasis on information analysis, negotiation, and decision making. It will immerse students in regional issues concerning biodiversity, sustainability, and the human impact on the environment.

Software/Hardware Systems

P24: PAPI-NUMA: Middleware to Support Hardware Sampling

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PAPI is a widely used portable library for accessing hardware counters on modern microprocessors. PAPI offers both counting and sampling interfaces, but the sampling interface is extremely limited, consisting of a simple interrupt-driven interface that can periodically report processor state. In the past few years, the hardware and operating systems of modern processors have added support for new more advanced sampling features. These features enable information about non-uniform memory access (NUMA) behavior to be obtained. Currently, performance tool developers who want to provide sampling data to their users must make use of a complex low-level kernel interface, sometimes developing their own kernel patch to access the features they need. This paper reports on initial efforts to develop a middleware layer that will serve as a stable interface and enable tool developers to access sampling data through standard PAPI calls and to obtain data important for NUMA analysis.

P25: Evaluating Pair-Wise Testing through Analysis of Test Coverage

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As our dependency on computer-based critical systems increases, software systems will continue to grow in complexity and size. Thus, it is even more important to investigate techniques that decrease the number of defects within developed software systems while optimizing the verification process. Pair-wise testing, a black-box verification approach, is a promising approach for combinatorial testing problems. It is unclear, however, how effective the approach is. In this paper, we discuss our efforts to evaluate pair-wise testing through analysis of branch coverage on a software system that generates Linear Temporal Logic formulae from 31,000 different combinations of properties. The paper focuses on the evaluation approach and the insights that we hope to gain from the effort. In addition to gaining a better understanding of the value of pair-wise testing, the work also investigates the potential to use execution-traces to frame the location of

defects. A long-term goal is to increase the efficacy of pair-wise testing by defining a process that combines white-box defect detection capabilities with the ease of black-box test input generation.

P26: Human Robotic Interaction with a Semi - Autonomous Robot for Collapsed Building Situations

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To reduce the chance of injury for surveyors and rescuers, a ground robot is currently under development to be placed in a building for initial inspection and to add to current Urban Search and Rescue (USAR) research. The ground robot's model is a PhantomX AX Hexapod Mark II. The hope is to utilize the spider-like leg movement and analyze the model's feasibility for moving around uneven terrain. The ground robot is equipped with a Asus Xtion Pro Live camera to use the infrared, depth, and color image sensing to determine how the robot can navigate various types of terrain autonomously. Also, the ground robot will be equipped with a Raspberry Pi 2 model and OpenNI2 and OpenCV libraries that can implement a wireless camera feed for a human to view from a remote location in order to make a real time assessment of the situation and take over robot control if necessary. Different simultaneous localization and mapping (SLAM) methods and collision avoidance algorithms are being investigated for use with the Asus Xtion Pro camera to achieve efficient image processing.

P27: Semi Autonomous Surveyor and Rescue Robotics Platform

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The overall purpose of this project is to create a first response, search and rescue UGV by combining the PhantomX Hexapod Mark II, Raspberry Pi 2, and Asus Xtion Pro Live RGB, depth-sensing camera. The PhantomX Hexapod platform is to be used in conjunction with the Asus camera and the Raspberry Pi. The Asus camera has multiple sensing functions including, infrared sensors, depth sensors, color image sensing, and audio streaming. The Asus camera will communicate with the Raspberry Pi, which will process the data and stream the information wirelessly to a monitor or laptop. The two primary applications in which the platform can be implemented: 1) Urban search and rescue: In the event of a natural disaster or emergency situation where human lives may be at risk, the PhantomX Hexapod Mark II can be programmed to traverse different terrains and locate missing persons utilizing the Asus camera and it's sensing functions. Obstacles can be avoided with collision detection which can be achieved with the Asus camera and PCL (point cloud libraries). 2) 3D Mapping: Collapsed, unstable structures are dangerous for human surveyors to assess damage. The platform's purpose would be to survey the damage accurately, utilizing SLAM, PCL and various sensing functionalities of the Asus camera in place of a human. Currently the platform is semi autonomous with autonomous functionality being researched.

Cyber-Security

P28: Leveraging Cybersecurity for Securing and Testing Current and Future Unmanned Technologies

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In this new technology era, the security on highly dependable systems is constantly being tested to the limit on many ways. In order to ensure proper functionality and protection for these systems and users is necessary to test these to ensure safe operation under hazardous conditions or other kind of threats. Given that some technologies currently

implemented on these devices are fairly new, a whole new world opens for threats like attacks generated by malicious actors. One example of these highly dependable systems are: Unmanned Vehicles. Technology on these devices support several types of communications (mainly wireless) and other appliances. Unmanned Vehicles can be used for different civilian applications such as: law enforcement missions, mail transportation, environmental monitoring, and entertainment recording/broadcasting, in addition to other applications. Part of the problems faced when employing these systems can be solved by locating and testing thoroughly its various components. The focus of this work is using Cybersecurity as a possible implementation for improving these unmanned technologies by exploring its different vulnerabilities and creating possible testing vectors. Although this paper is a work in progress it still gives essential information to the user that could be used later on for creating their own cyber testing environments.

P29: Security Breach and Data Replication in NoSQL Database

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Recent technological advances in all components of data centers have caused a need for a new database management system to come into play; one that can work side by side with this new environment that is in need of storing large amounts of data. The distribution of SQL databases in this new environment is almost, if not, at all possible because the "older" databases are built for providing consistency and availability, which means that there is less tolerance for partitioning in the network. Because of this struggle, researchers have turned to continue expanding investigation in NoSQL non relationship database. Distributing data from a NoSQL database that can be found inside a resilient data center will be easy because this type of database allows for horizontal expansion rather than vertical. This horizontal expansion is also beneficial when dealing with Big Data. Though we know with what type of environment NoSQL will work best, security breach along with data replication is still a main concern for companies that want to use this new type of database. This paper will explore security methods currently used in SQL databases and how it can be modified to work with NoSQL along with exploring current security methods for the new types of data centers and how that will help secure the NoSQL database inside the data center.

P30: Techniques for Anomaly Detection in IPv4 and IPv6 Network Flows

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In a growing demand for web applications, it's important to make sure services in the net area are secure. One method that researchers are exploring to improve web security is anomaly detection in traffic flows. In this report, we examine how efficient are SiLK tools to detect flow anomalies and analyze IPv4 and IPv6 flow data. Then, we make and implementation that converts the IPv6 addresses to coordinates to make a 3-dimensional graph. With the help of these methods we were able to have graphical formats that help us see the amount of IPv6 addresses, both from the University Of Puerto Rico – Río Piedras campus (UPRRP)'s network and outside.

P31: A Semantically-Enabled Trust Model for Collaborative Environments

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In this article we describe our work towards a model to approach the problem of trust for web resources. Our model is inspired by Google's famous algorithm Pagerank. The algorithm takes into account users, credentials for said users, resources and tags pertaining to both; it deals with the exchange and propagation of trust. The system was implemented in the Virtual Learning Commons collaborative environment, developed and hosted by the University of Texas at El Paso.

P32: A Secure Embedded Student Attendance Monitoring System for Arduino

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There has been a recent trend to connect home automation devices to the internet, many of which could be vulnerable to cyberattacks. Our goal was to design an embedded system while considering security measures for the system. We present S.A.M.S., a Student Attendance Monitoring System, whose design process allowed us to explore some of the challenges faced when designing a secure embedded system [1]. We have implemented a S.A.M.S. prototype using an Arduino UNO and several inexpensive peripherals. Despite the performance and memory limitations of the chosen platform, the system is capable of registering and web-serving student attendance in encrypted form.

P33: Automated Anomaly Detection Within The Toa Network Flow Data Monitoring System

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Detecting network anomalies can help protect sensitive data, prevent attacks, monitor network performance, and strengthen network security. Toa is an open source, pseudo-real time network monitoring system (NMS) that provides an easy to deploy web interface for system and network administrators to monitor high volumes of network traffic. Anomaly detection through Toa is done with visualization, and the current work aims to develop an algorithm to optimize and automate the process of anomaly detection with adaptability to the context and situation, integrating this new feature into Toa. To this end, we implemented statistical algorithms that use distinct time ranges, and an exponential smoothing algorithm to facilitate anomaly detection.

P34: Mobile Malware Detection By Deception

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Smartphone adoption is increasing at a very high rate every year. Mobile malware is software designed to gain access to sensitive information stored in a mobile device. Mobile malware can also be used to commit cybercrime from a hijacked device. Smartphones application permissions provide the means for a malware application to get access to the files and capabilities of smartphones. Average smartphone users have difficulty identifying suspect malware. In this work we propose a method to detect mobile malware using decoys. The solution proposed to detect mobile malware also serves as protection against malware for mobile users.

P35: A Secure Routing Scheme in Unknown Networks Using A-star Algorithm

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In recent years, networks of unknown or changing topologies have become more widely used in a variety of applications. In such networks, each node only knows a part of the network topology which it is connected to. The most prevalent examples of such networks include wireless Ad Hoc Networks (AHN), sensor networks, and vehicular networks. As network security in general is receiving a very high level of attentions in recent years, the security of routing algorithms in networks with unknown or changing topologies are also becoming an area of active research. Open Shortest Path

First (OSPF) has been the primary routing protocol used in traditional networks. It utilizes Dijkstra's algorithm to find the shortest path between a source node and a destination node. Network packets follow the shortest path to travel through the network. Using the shortest path will get the packets to the destination in the shortest amount of time. However, OSPF makes the path chosen for the packet to travel very predictable because the shortest paths almost always stay the same in stable networks. Once an attacker knows the topology of a network, he/she can then find the shortest paths easily. By placing a compromised node or a sniffer on those paths, he/she gains access to the data travelling between any two specific nodes. So OSPF is not very secure against attacks such as sniffer attacks. Another weakness of OSPF is that it requires the complete network topology information, which is infeasible in networks of unknown or changing topologies. In this paper we propose an application of the A-Star algorithm in order to enhance the security of routing in networks of unknown or changing topologies against attacks that rely on the predictability of the path chosen, assuming that the network has been compromised. We modified the heuristic component of the A-Star algorithm to provide flexibility between security and efficiency. We investigated the effects of the heuristic component with various random factors, and compared the performance of our solution with the well-known Dijkstra's algorithm through computer simulations. Our study confirmed that the proposed solution achieves a higher level of security.

P36: Evaluating Whether the Internet Topology is Flattening

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The Internet topology is a hierarchical system of interconnected networks. These networks are sorted into three tiers based largely on the role they play in routing Internet traffic, however tier-1 networks are usually the largest, and tier-3 networks are typically the smallest. Many of these networks are Internet Service Providers (ISPs) such as Comcast, AT&T, and RCN. This Internet topology includes consumers of the Internet, such as students, businesses, and households, as well as content providers such as Google, Facebook, and others. Consumers as well as content providers have traditionally accessed the Internet via tier-2 or tier-3 ISPs, but recent studies have shown that means of access have been changing. Furthermore, with the emergence of applications such as Netflix and Hulu, large content providers may be deploying their own Wide Area Networks (WANs). This could enable consumers to access their content more directly instead of relying on tier-2 or tier-1 ISPs. In a 2008 paper written by Gill et. al., it was concluded that there was an increase in WAN deployment of large content providers. We investigated whether this trend has proven to be enduring and continuing. Our contributions are: 1) Providing a set of automated tools to collect and analyze the data, which allow experiments and results to be replicated at a later time. 2) Studying additional metrics and data for analysis, primarily in the form of geographic information 3) Updating both data for the deployment of WANs by large content providers studied in 2008 as a means of validating the trend previously found, as well as updating the content providers studied, to those more relevant to current Internet traffic. 4) Analyzing the trend of deployment of WANs with regard to net neutrality, as well as future Internet topology and security.

Ontologies, Semantic Web and Services

P37: Towards a Semantic-Based Integration of Water Models

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Water availability is a key societal challenge. It is important to obtain valid forecasts of scenarios of water resource change. Hydrologists use a variety of water modeling systems to simulate environmental change impacts on water systems and associated food systems, e.g. economic valuation of crops or agricultural yield. This paper describes our

current progress towards integrating disparate water modeling tools to better understand the complex issues of water availability. Our approach includes a web-enabled platform that relies on semantic descriptions and a service oriented architecture. We present an evaluation of the USGS-MODFLOW modeling engine by giving a high level description of the model and its capabilities, and represent the technical components of the model in the form of ontologies. We make available an implementation of this model on the web by “wrapping” the modeling software within a Semantic Web service for future model interoperability and data transformation. Additionally, we discuss the challenges of integrating additional water modeling systems in a way that is transparent to the user.

P38: Towards Semantically Integrating Data to Enhance a Field Trip Experience.

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Field-based disciplines, such as geology, may benefit from employing technology to have updated information about the visited location. This paper presents our initial work towards integrating disparate data related to a specific location. We created an ontology to describe data and information that may be useful during a geology field trip, namely the GeoField ontology. GeoField was populated with openly-available data, and evaluated by answering competency questions. We expect to further evaluate the ontology in the field, and to extend it to other domains which may also require real-time access to data.

P39: Semantic-based Data Integration and Exchange for a Research Group

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Disseminating products resulting from research efforts for validation, reproducibility, and reuse is an important task of a research group. Sharing resources using natural languages, like English, are good for humans but hard for computers to process. Sharing resources using machine languages, like JSON, are great for machines but hard for humans to understand. Having a one-stop place where resources of research groups can be dynamically populated from other source and share information for both, humans and machines, would save time and also increase reusability of their resources. In this paper, we describe our approach to disseminate the products of the iLink group through a web-based application designed for both humans and machines.

P40: Towards an Ontology Development Methodology for Interdisciplinary Research Group Collaborations

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Interdisciplinary research (IDR) collaboration can be defined as the process of integrating experts' knowledge, perspectives, and resources to advance scientific discovery. The flourishing of more complex research problems, together with the growth of scientific and technical knowledge has provoked the need for researchers from diverse fields to provide different expertise and points of view to tackle these problems. These collaborations, however, introduce a new set of “culture” barriers as participating experts are trained to communicate in discipline-specific languages, theories and research practices. We propose that building a common knowledge base using ontologies can provide a starting point for interdisciplinary knowledge exchange, negotiation, and integration. This paper introduces a methodology that extends previous work in collaborative ontology development, and integrates learning strategies, such as concept maps, to enhance interdisciplinary research practices.

Human-Computer Interaction

P41: Coding Multilingual Capabilities on a Multimodal Platform: The Challenges and Experiences

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Prime III is a secure accessible, multimodal electronic voting system that emerged from an initiative to create an innovative voting system that could be accessible to everyone. Using touch screens, voice, typing, and switch devices, Prime III allows a wide range of citizens to participate in the voting process. Missing, however, are multilingual capabilities. Without this feature, voters with limited English proficiency may be disenfranchised, unable to understand complex statements of importance while casting their vote. The goal of this research is to analyze, document, design, and implement a strategy to transform Prime III into a multilingual-multimodal platform. Given that Spanish is spoken in more than 36 million homes, we chose this to demonstrate our extensions. As a proof of concept this implementation was developed without an API that uses online libraries, since Prime III works offline. The Prime III software is hardware independent and is coded mainly in JavaScript; it uses an HTML, CSS, and PHP programming languages. The complexity of the Prime III structure presented several challenges. Ranging from translating the main parts of the frontend and backend that will facilitate the voter interaction, to exploring and analyzing the limited resources available that allow creating a translation package/function without using online libraries, like Google API, and that can work with a multimodal platform. In an effort to understand and document the usability and functionality of parts of the Prime III algorithm we created a series of test functions. The template developed from the proof of concept will be used to include additional languages, to extend the accessibility benefits of Prime III to a broader range of voters. In this poster, we will present some of the challenges encountered and lessons learned while extending Prime III to include multilingual features and options.

P42: Drowsy Detection via EEG - Sensor

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Monotonous driving conditions cause drowsiness in the vehicle drivers. Many road fatalities are attributed to drowsiness. In this project we propose to detect the driver's drowsiness via physiological-based sensors. The EEG Data then supplied to feature extraction algorithms for the extraction of meaningful features. The feature vector is supplied to a set of pattern classifiers to categorize the driver's mental state into either normal state or drowsy state. The outputs from the proposed system are validated against the ground-truth data which we have derived from the manual coding of experiment videos. A total of 14 subjects participated in the experiment. During one hour long driving trial, the subjects were asked to use a driving simulation kit.

P43: Controlling an UAVS using Augmented Reality and HCI (Google Glass)

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There is a solution is proposed for controlling the UAV from the distance, which follows the principles of Augmented Reality. Dr. Ahmed Mahdy's laboratory, the Innovation in Computing Research (iCORE), has developed an Android application for Google Glass (a wearable computer created by Google, Inc.). This application was created using concepts

of Augmented Reality in which it superimposes a computer-generated image on a user's view of the real world, thus providing a composite view for augmenting the reality around the user. The Android application for Google Glass, can be controlled by voice, using head movements, and provides real time data about the Unmanned Aerial Vehicle, which is in line with Human Computer Interaction (HCI) principles. A major component of the Android application for Google Glass is its ability to provide a live video feed from the mounted video camera on the Unmanned Aerial Vehicle which displays the video feed to the user with Google Glass. This application will likely impact the way Unmanned Aerial Vehicle systems are used for agriculture, mapping, and surveying.

P44: Influence of Groupthink on Children's Social Networks

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Cyberbullying can be greatly affected by groupthink. To study the conformity effects in young children, we asked users to complete details of a story via sketching in a children's social network. By varying exposure, we found that access to their peer's responses and identity indicated conformity factors influenced by social relationships. This work's analysis of children's patterns of online conformity will inform and inspire the development of algorithms to identify cyberbullying activity and make the Internet safer for children.

P45: Alternative Method to Unstable Structure Searching

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The motivation for this project is to provide an alternative method to sending people into unstable structures with a PhantomX Hexapod. The PhantomX Hexapod will have an Asus Xtion Live Pro connected to the system. The Asus Xtion Live Pro is a RGB depth camera which will provide video feed to the user's controlling it to a computer or a laptop. By providing this alternative, using the PhantomX Hexapod has a chance to lower the risk of injury when inspecting unstable structures. Utilizing the functionality of the Raspberry Pi and the PuTTY SSH, the Asus camera can send a wireless feed from the spider to the user's laptop. The Raspberry Pi will have OpenCV and OpenNI2 installed on it so they can get the feed from the camera, and PuTTY SSH will allow the user to run the program on the Raspberry Pi wirelessly. OpenCV allows the programs to use functions aimed to realtime computer vision, and OpenNI2 allows the program to get the video feed from the Asus camera. When OpenCV and OpenNI2 are used together they will allow the program to use other views that the camera has such as RGB and a Depth Mask. Using the RGB the user can calculate a distance the Hexapod is to an object. The Asus camera also has an infrared sensor. One of the uses of this camera is to detect abnormalities in structures. For example, if there were a gas leak in the unstable structure, the user could spot the gas leak with the camera and make the necessary precautions to ensure that whoever is sent inside the structure will be safe; as well as ensure the leak isn't harmful for anyone that may be stuck inside. We hope that in the future this can be used with smaller UGVs so that this method can be adapted in the uses as an alternative to reduce injury while searching unstable structures.

P46: Adaptation of Affective Brain-Computer Interfaces Towards Card Sorting Activity

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The new generation of brain imaging technologies allow non-medical researchers to detect different forms of brain activity. Therefore, the use of Brain-Computer Interfaces (BCI) have expanded beyond clinical trials. The goal of this paper is to describe how the use of BCI affects user experience studies. This paper infers that the use of BCI can help

UX researchers understand the user mental load and engagement when performing card sorting activities for an interface's content architecture.

P47: Personalized Learned Model to Predict Being Under the Influence

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This project focuses on the personalization of a mobile application called RU Influenced. This personalization will allow us to measure whether the user is under the influence of alcohol or other drugs like marijuana. The Android platform provides a set of sensor technologies that we can use to estimate a blood- alcohol concentration equivalent influence factor. The structure of this application includes two mobile-based cognitive tests called the Digital Symbol Substitution Test (DSST) and STROOP Test and a reaction time test called the Stop Light Test. This application will provide a set of tools for self- monitoring where users can self-quantify their state and avoid being charged with Driving Under the Influence (DUI).

Imaging Processing and Computer Vision

P48: Point Cloud Generation and Stitching for a 3D Machine Vision Reference Design

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The numerous challenges faced by users when scanning an object and digitally visualizing it include: scanning the object requires scans from multiple angles, the extracted data must be stitched accurately, and the object's surroundings could cause pattern reflections. This prompts improvements to the 3D scanning systems currently used, particularly in their robustness and portability. Our proposed solution builds upon Texas Instruments' TIDA-00254 3D Scanning TI Reference Design, which uses a DLP® 4500 LightCrafter™ evaluation module interfaced with a digital camera and a computer, by adding a rotating stage to scan the object from 360° and developing software in C and C++ to stitch the scanned point clouds. The expected outcome of the research project is a replicable system prototype with a library that includes the algorithms for structured light optimization, point cloud reconstruction, and 3D stitching.

P49: Change Detection Method Applied to LANDSAT 8 and Hyperspectral Images of Guanica Dry Forest

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Change detection land cover on the Earth's surface can be detecting from remote sensing satellite images. This research uses change detection methods like Euclidean Distance and Differentiation and applies it to recent images of Landsat 8 in order to verify if those methods are useful in detecting changes in images from new satellite sensors. The other method

used is the Tasseled Cap Transformation with a threshold value applied to both multispectral and hyperspectral images. The images are from the Guanica Dry Forest provided by Landsat 8 and AISA hyperspectral sensor collected by.

P50: Implementing 3D Anaglyph Video with Beagleboard XM System

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In this project we present a 3D anaglyph video system using the GStreamer framework and two embedded low-power, open-source hardware single-board BeagleBoard XM computers with camera boards in each one. The goal is to provide a simple and effective way to stream 3D videos or images, both wireless and wired, to other computer devices that have GStreamer. Benefits from this research include advantages associated with depth perception when streaming stereoscopic 3D videos to fields like medicine. This could positively affect results and methods, like the spatial manipulation of objects. It is ideal to use the GStreamer framework for this project because it allows us to create streaming media applications through its pipeline design. This design is based on plug-ins that will provide synchronization on various codecs that add functionality, like customization of the stream's audio and video components. Previous work on this project consists of a similar video system, where the GStreamer framework was implemented through USB connections. In this project we used two BeagleBoard XMs connected through a network in order to process the videos from the camera boards on a PC. This system generates a stereoscopic 3D video, achieved by encoding each eye's image using chromatically opposite color filters such as red and cyan and superimposing two images as a way to make the human brain combine them to visualize a single three dimensional image. Our implementation was proven using static left and right images achieving the desired results. The implementation mixes the video correctly, but the desired offset was not achieved because the BeagleBoard XM with the camera needs to be fixed on a very precise position. This problem can be fixed with the installation of a firm base for the BeagleBoard XMs.

P51: 3D Modeling From a Single Camera in Unmanned Vehicles

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In this project the goal is to use a single camera to model an environment. We decided to use visualSFM and Meshlab to create these 3D models. First we must get our images by either pulling them from a video or taking many different images. Overlap between images is needed and it helps to have different angles. The higher the resolution and the higher the number of images help to create a better model. To process the images using visualSFM you first try to match the images to each other to see where they overlap. Then run it through a sparse reconstruction and a dense reconstruction. This will yield a point cloud that you can mesh together for a full 3D model. As time goes on we would like to automate this process and get it working in real time. Which could open up our uses for it tremendously.

P52: A Book Reader Using Time of Flight Imaging

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This paper proposes an approach to improve the results of an Optical Character Recognition engine by utilizing depth map information from a time of flight sensor in order to correct the warping in a book spread's image. This approach does not assume a uniform distribution of the pages of the book spread, but rather that there are varying levels of deformation due to changes in the curvature within each page. The corrections are achieved by modifying the lens equation to take into account different height points on the book spread. In addition, the current resolution limitation from the time of flight device is overcome by scaling and matching the pixel depth data to an image taken by a camera with higher resolution, to be able to read the text once the curvature correction is performed. The Implementation results support the assertion of improved reading accuracy, which in turn highlights the merits of using this approach based on depth maps in order to correct for the book curvature. Applications of such a system design are in its use as a book reader for persons with visual impairment or as means to digitize books and other bound documents.

P53: Uniform vs Full Height Depth Map Extraction for Dewarping Book Spread Images

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This study delves deeper on our previous approaches for correcting warping of book spread images to improve character recognition rates and accuracy as a book reader for persons with visual impairment. The initial approach performed the correction with a single curvature with assumed uniformity throughout the book spread. Whereas, the second approach does not assume uniformity, but rather relies on a full height map to perform the corrections. Both of these approaches were tested by running their resulting dewarped images through an Optical Character Recognition Engine. Furthermore, recognition of misalignment book spreads was explored for testing the resilience of these approaches.

Signal Processing

P54: On the Cross-Correlation of Symmetries of Three-dimensional Periodic Welch Costas Arrays

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A 3D Costas array is a three-dimensional grid of blank spaces and dots that has auto-correlation 1. One type of such arrays, a 3D Welch Costas, can be used to obtain more arrays by applying the row (or column) shear transformation to it. We found an upper bound for the cross-correlation of a family of Costas arrays obtained by applying one of the shear symmetries to a 3D Welch Costas array. In addition, we conjecture a method for constructing a family with the same upper bound but by selecting some of the arrays obtained by applying a composition of the shear symmetries to a 3D Welch Costas. These results are relevant to the application of 3D Costas arrays to digital watermarking.

P55: Classification Performance of a Hyperspectral Data Processing Algorithm Using a Block-Compressive Sensing Approach

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Compressive Sensing is an area of great recent interest for signal acquisition, manipulation and reconstruction tasks. Approaches based on this technology can improve the efficiency of acquisition, manipulation, analysis and storage processes already established for hyperspectral imagery, with little discernible loss in data performance. The current work presents the results of a comparative analysis on classification performance between a hyperspectral data cube acquired by traditional means, and one obtained through reconstruction from compressively sampled data points. To obtain a broad measure of the classification performance of both data cubes, we use a set of five classifiers commonly used in hyperspectral image classification. General accuracy statistics are presented and discussed, as well as class-specific statistical properties of the evaluated data set.

P56: Computational Framework for Cyclic Code Formulation Using Polynomial Algebra

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This work presents a mathematical framework to serve as an aid for the formulation of cyclic codes, based on polynomial algebra concepts. We present a series of mathematical isomorphisms between the representation of code elements as polynomials, vectors and circulant matrix-vector products, as well as isomorphisms between operations between these elements in each of their respective native forms. The possibility of seamlessly representing an element in any of these three forms represents a considerable potential increase in the computational efficiency and/or ease of deployment of cyclic code applications in a variety of computer architectures with no sacrifice in either performance or design effort. Important considerations for the evaluation and discovery of new, more robust cyclic codes are also discussed.

P57: VIRSYM: A Virtual Instrumentation Signal Processing Environment for Automated System Monitoring

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VIRSYM (Virtual Instrumentation for Real-Time SYstem Monitoring) is a computational environment for the analysis and design of numerical algorithms, developed under Linux for automated acquisition (raw data), measurement (signal metrics), treatment (signal transformations), analysis (time-frequency spectra), and classification (signal statistics) of state signals from a system under permanent condition monitoring.

P58: Hyperspectral Image-Based Methods for Spectral Diversity

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Hyperspectral images are an important tool to assess ecosystem biodiversity. To obtain more accuracy biodiversity indicators that agree with indicators obtained using field data, analysis of spectral diversity calculated from images have to be validated with field based diversity estimates. The plant species richness is one of the most important indicators of biodiversity. This indicator can be measured in hyperspectral images considering the Spectral Variation Hypothesis (SVH) which states that the spectral heterogeneity is related to spatial heterogeneity and thus to species richness. The goal of this research is to capture spectral heterogeneity from hyperspectral images for a terrestrial neo tropical forest site using Vector Quantization (VQ) method and then use the result for prediction of plant species richness. The results are compared with that of Hierarchical Agglomerative Clustering (HAC). The validation of the process index is done calculating the Pearson correlation coefficient between the Shannon entropy from actual field data and the Shannon entropy computed in the images. One of the advantages of developing more accurate analysis tools would be the extension of the analysis to larger zones.

P59: Analysis and Design of FFT Algorithms Using Group Theory and Kronecker Products

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The current work describes a method to factorization the matrix-vector product representation of fast Fourier transform (FFT) algorithms, this method is known as the Kronecker product formulations. Moreover, we used the group theoretic techniques for the input/output indexing sets of the matrix-vector product. The Cooley-Tukey decimation in time (DIT) and Gentleman-Sande decimation in frequency (DIF) algorithms for a single radix (radix two) and mixed radices (radices two or four) are derived and presented in matrix-vector product representation. Availability of a variety of simplified mathematical representations of an algorithm obtain by this method is crucial for its optimal deployment on a variety of computer architectures.

P60: Estimation of Acoustic Doubly Dispersive Randomly Time-Variant MIMO Communication Channels

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This work presents a computational framework for the analysis and design of large scale algorithms utilized in the estimation of acoustic doubly dispersive, randomly time-variant, underwater communication channels. Channel estimation results are, in turn, used in the proposed framework for the development of efficient high performance algorithms, based on fast Fourier transformations, for the search, detection, estimation, and tracking (SDET) of underwater moving objects through acoustic wavefront signal analysis techniques associated with real-time environmental surveillance and acoustic monitoring (eSAM) operations. Particular importance is given in this work to the estimation of the range and speed of underwater moving objects modeled as point targets. The work demonstrates how to use Kronecker products signal algebra (KSA), a branch of finite-dimensional tensor signal algebra, as a mathematical language for the formulation of novel variants of parallel orthogonal matching pursuit (POMP) algorithms as well as a programming aid for mapping these algorithms to large scale computational structures, using a modified Kuck's paradigm of parallel computation.

P61: Mel Frequency Cepstrum Feature Extraction Using Graphical Processing Units

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A system used by MIT Lincoln Labs for Speaker Recognition is being optimized using parallel programming techniques. The 'front end' consists of various speech signal processing algorithms that extract features, while the 'back end' analyzes these features in order to identify a possible speaker in the speech signal. Among the many algorithms in the 'front-end', our task is to improve the execution time of the Mel Frequency Cepstrum Coefficients (MFCC) Feature Extraction algorithm. The experiment is based on comparing our C implementation where feature extraction of the frames execute sequentially to our CUDAC implementation where execution is concurrent. Early results show that many steps of algorithm can execute multiple times faster in CUDAC: framing & windowing of a speech signal executes 40 times faster, the FFT step executes 60.49 times faster, while computing the DCT can execute as much as 64.35 times faster.

P62: Subsurface Object Recognition: Development of a Testbed to Validate Hyperspectral Pattern Recognition Algorithms and Models

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This research is inspired in an environmental problem, which is the health of the coral reefs. The main goal of the research is the detection and identification of coral reefs and the development of benthic habitat maps of coastal shallow waters. At the Laboratory of Applied Remote Sensing and Image Processing (LARSIP) at UPRM, researchers have been developing a MATLAB toolbox named Hyperspectral Coastal Image Analysis Toolbox (HyCIAT). The current phase of this research is the development of a testbed with real controlled data to validate the toolbox's algorithms

P63: A Web Application for SVM Classification of Alzheimer's Disease and its Prodromal Stages

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This paper proposes the implementation of a web interface for Alzheimer's disease (AD) classification based on anatomical features. Our web interface combines MRI with demographic and optionally neuropsychological data in order to classify AD. The classification algorithm combines all anatomical features by region with other parameters, creating a multidimensional array, and then runs a two-fold cross validated Support Vector machine (SVM). Freesurfer was used to process the MRIs and extract all anatomical features. Currently the database constructed using Alzheimer's Disease Neuroimaging Initiative (ADNI) data contains 544 subjects: 140 controls, 220 (non-amnesic MCI) naMCI, 108 (amnesic MCI) aMCI, and 76 AD. The user can select between a linear and radial basis function kernel (RBF). The data can be normalized or standardized at the pre-processing stage, as well as corrected for (intra-cranial volume) ICV. There are 5 distinct anatomical areas which can be selected, each containing a set of features. This data is combined with age, gender, education (represented as years of study), and the Mini-mental state examination (MMSE), which can be added when needed. Two random multidimensional vectors (one for training), are fed to the SVM algorithm. Each run of the algorithm reports the sensitivity, specificity, and accuracy of the classification.

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