SIGCSE '98 Workshops

The following workshops were available to attendees of the SIGCSE '98 Symposium at a nominal fee.

- **Introduction to Object-Oriented Design**
  Rick Mercer, Penn State Berks & Michael Clancy, University of California at Berkeley

- **Introduction to Java**
  Edward C. Epp, The University of Portland

- **Using Macromedia Director for Multimedia Design**
  Domenick Pinto & Sandra Honda Adams, Sacred Heart University

- **Java as a Concurrent Programming Language for Operating Systems and Related Courses**
  Stephen J. Hartley, Drexel University

- **Pedagogical Uses of Adaptive Hypermedia**
  MAJ Curtis A. Carver Jr. & CPT Joseph Adams, United States Military Academy

- **Parallel Computing for Undergraduates: Curricula Issues and Software Tools**
  Helmar Burkhart, University of Basel & Ignatios Vakalis, Capital University

- **Cooperative Learning in the Non-Laboratory Classes of CS Courses**
  Dorothy Deremer, Montclair State University

- **Intermediate Java**
  Edward C. Epp, The University of Portland

- **Network Programming With Java**
  Rodney S. Tosten, Gettysburg College & Paul T. Tymann, Rochester Institute of Technology

- **Object-Oriented Programming in Ada 95**
  Mordechai Ben-Ari, Weizmann Institute of Science

- **www.development.multimedia.issues.edu**
  Karl J. Klee, Jamestown Community College

- **Systematic User Interface Construction with the Java AWT Toolkit.**
  Fintan Culwin, South Bank University

- **Teaching CS1 and CS2 with the Standard Template Library**
  Joseph Bergin, Pace University

- **Using Case Studies in AP CS/CS 1/CS 2**
  Michael Clancy, University of California at Berkeley

- **Active and Group Learning Techniques for Computer Science Education**
  Jeffrey J. McConnell, Canisius College

- **Visual Programming in Java with Borland JBuilder**
  Barry Burd, Drew University

- **Research in Computer Science Education: Focus on Quantitative Methods**
  Vicki L. Almstrum, University of Texas at Austin

- **Visual Modeling Technique Using VisualAge for C++**
  Roger Y. Lee, Central Michigan University
  Dale Jarman, Central Michigan University

SIGCSE '98 Poster Presentations

GRADUATE DIVISION

Hardware/Software Codesign
D'Sunte Wilson, Brown University, http://www.lems.brown.edu/~dlw

Embedded systems are becoming a growing area for the field of computer design. Embedded system CAD(Computer-Aided Design) tools are not fully prepared to answer to the needs of the users, especially in the field of power consumption. Currently, embedded system CAD tools evaluate systems based on hardware and software separately. Hardware/software codesign can be a viable solution to address the need to lower energy dissipation within embedded systems. Arguably, the most important aspect of codesign is hardware/software partitioning. Hardware/software partitioning evaluates the units of software and hardware, and obtains an optimal solution. This research proposes to use this same hardware/software approach to find a lower power consumption within an embedded device. The goal in this poster presentation is to look upon a non-biased approach towards hardware/software partitioning, which will lead to a better overall solution. This will be achieved by using COSH-CDFG, standing for Codesign of Software and Hardware-Control Data Flow Graphs.

Scalable IP Router Architecture and Parallel Routing Table Computation
Vibhavasu Vuppala and Xipeng Xiao, Michigan State University, {vuppala,xiaoxipe}@cps.msu.edu

Conventional routers are not able to scale to the growth in the Internet traffic. The design and implementation of a high- performance gateway-architecture that is scalable and cost-effective is described. The proposed architecture consists of a set of processing nodes interconnected by one or more high-speed SANs like ServerNet. The processing nodes can act as line-cards, forwarding engines, routing protocol processors or any combination of them. An efficient distributed approach for routing table computation that can achieve up to super-linear speedup is also proposed. A prototype with four Pentium processors and a four-port Myrinet switch is developed.

Implementing Resonant Consonants in Speech Driven Lip-Sync Animation
Andrew S. Freeman , North Carolina State University, asfreem2@eos.ncsu.edu

The goal of speech driven lip-sync animation is to determine mouth position without the availability of text, mechanical devices or video to track the mouth. It should be independent of speaker, or the language being spoken, and should be possible without resorting to speech recognition. Furthermore, it should be accomplished with minimal or no training. The obvious application for this system is commercial animation, but it has other significant uses. Perfected, this technique could be used as an aid to the deaf or hearing impaired. It could also visually enhance virtual conferencing, or the graphical display of computer agents.

From Algorithm Animations to Animation-embedded Hypermedia Visualizations
Steven R.Hansen, Daniel Schrimpsher, Auburn University, {hansensr,schridj}@eng.auburn.edu

Intuition suggests that animations are powerful vehicles for effectively conveying the dynamic behaviors of algorithms, yet accumulated empirical evidence to substantiate this hypothesis is disappointing. However, we report on a research project based on this hypothesis and the premise that rethinking algorithm animation design is required in order to harness its power to enhance learning. The key insight is that for algorithm animations to be effective, they have to be "chunked" and embedded within a context and knowledge providing hypermedia information presentation system. Furthermore, we provide empirical evidence from two experiments using over 50 students to support our findings.

An Interactive Surface Design Tool
Yan Zhou and Yuan Zhao, Michigan Technological University, yzhou@mtu.edu

Teaching surface design in computer graphics, visualization and computer-aided design courses usually requires involved mathematics that students feel very difficult to grasp. This poster discusses a system that can illustrate the fundamentals of surface design with an interactive environment in which students can design, modify and manipulate surfaces. In this way, students would interactively learn the fundamentals of surface design rather than through understanding and memorizing mathematical formulae .

An Architectural Framework for Domain-Oriented Software Generators
Marcelo Sant'Anna, PUC-RJ - Brazil, draco@inf.puc-rio.br

Software generators are important tools in the deployment of a software product-line but, most of the time they are built without an architectural framework that can help on planning and evaluating their design. Also, an architectural framework can help automate the task of building software generators using generators themselves, further helping evolution and maintenance of software product lines. Motivated by these ideas, we present an architectural framework for the construction of software generators where components are focused on manipulating domain-specific languages. We bring together compositional and transformational technologies in an attempt to put forward the ideas of generative reuse. By taking this approach, we build upon Draco paradigm seminal idea of language-based domain networks. In terms of tools that give support to the presented architectural framework, we are continuously improving a development environment based on Java Beans and Corba component models called Draco-PUC. Keywords: Component-based software development, Software Architecture, Generative Reuse, Domain-Specific Languages, Transformation Systems, Draco Paradigm.

You too can have an interactive class website!
Henri Naccach, Arizona State University, henri@asu.edu

The MDLI server was developed in response to a lack of flexible interactive web site design systems. It enables the web site developer to incorporate into an existing web site interactive elements including file upload, grade retrieval, and an interactive roster. This server provides password protection and, additionally, allows users to change their own passwords, email addresses and other personal information. The MDLI server allows a designer to use his or her own web page format, HTML development tools and even proprietary databases for student information. At the same time, it provides a set of useful interactive tools which can be used even by developers with minimal HTML skills.

Sharing and Interoperability of Information in the Medical Services Management
João Eduardo Ferreira1, Tarcísio de Souza Lima2, Caetano Traina Junior3, UESP -Rio Claro and UFMG, Brazil
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The conception and creation of a distributed system not only imply new concepts and technologies, but also the adequacy of the existing legacy information. There are serious conversion, load and data reuse problems. One strategy is to not only change technologies, but also adequate existing ones. Through practical examples, such as a medical application, we show how our architectural model subsidizes the migration to or the creation of a truly distributed system, being an approach for a dynamic strategy of systems enhancement.

Improving tutoring activities using a Multi-Agents system Architecture
Lucia Maria Martins Giraffa , CBLU/Leeds University - II/PUCRS - CPGCC/UFRGS, lucia@cbl.leeds.ac.uk

The MCOE- Multi-agent Co-Operative Environment, is a pedagogical game modeled through agent's techniques. We use a DAI architecture - Distributed Artificial Intelligence, composed by a society of agents who work to achieve a common goal: to fight against the pollution resulting from pollutants and to maintain the equilibrium. The system has two kinds of agents: reactive (designed and implemented using the object-oriented approach) and cognitive (designed with mental state approach based on Situation Theory). The interactions are performed in a game-like fashion, using multimedia resources. The Ecologist, that represents the tutor, uses multiple teaching strategies to give advice for the students.

Segmentation of Boron Carbide Microscopic Images which Present Twins
Wanessa Nascimento Matta, UFMG/CDTN - Brazil and Groupe ESIEE - Paris
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Boron carbide microscopic images present grains crossed by twins (or macles) viewed as straight lines in the inner part of each grain. The twins preclude the segmentation because they are very similar to the grain borders. To eliminate the twins a pre-processing step, which relies on mathematical morphology tools, is applied to the image keeping the grain borders undisturbed. After this step the image is ready to be segmented. A modified watershed algorithm, CBMA, is then used to segment the image.

Audible User Interface for the Visually Handicapped
Balaji Santhanam, Govind Bangarbale, Justin VonHagen, Villanova University

This work focuses on an Audible User Interface (AUI), which will enable the visually handicapped to navigate through the modern information world. The AUI system is based on the standard mouse-monitor configuration. It contains different sonic objects/icons, which are arranged based on the sonic architecture. Each sonic object has a unique sound assignment. A sonic object could be an application, a directory, a file or a system attribute. By navigating through the system the user can find the specific object he is searching for with the help of audio feedback from each object.

UNDERGRADUATE DIVISION

SynCon Team B: Reasoning With Environmental Data Sets
Jason Tedor and Patrick Race, University of Alaska at Fairbaks, fsjet1@uaf.edu

The collection and dissemination of data has been at the heart of scientific pursuits since the dawn of civilization. The challenge of organizing heterogeneous environmental data sets is currently being addressed by the SynCon Project Team at the University of Alaska Fairbanks. The SynCon Project is an ambitious heterogeneous data set organization effort originally funded by the Office of Naval Research. SynCon Team B is responsible for developing decision support tools using mathematical models utilizing point thresholding and polygonal thresholding techniques developed specifically for the SynCon Project by Team B to predict the prospective impact of remediation of particular sites.

Improving the Aliasing Artifacts Associated with Ray Tracing
Robert Schutt, Colgate University, rschutt@cs.colgate.edu

Research conducted at Colgate involves developing parallel computing models for the ray tracing algorithm based on anti-aliasing techniques. Improving the image quality involves "supersampling" the image. There are well defined algorithms for improving the aliasing artifacts associated with ray tracing. Research develops parallel models for supersampling, adaptive supersampling, and "monte carlo" ray tracing. Case studies of each model are analyzed for efficiency and speed-up

Systemic Control of Computer Peripherals: Human vs. Computer
Joe P. Said, D. Hamilton Radcliffe, & Richard L. Pettys Jr. Purdue University, jsaid@cs.purdue.edu

Our goal is to solve the Atari 2600 game Pitfall. Our approach involves an ideology in which computers can control many nontraditional peripherals. Traditionally, one would solve this problem using real-time human input honed through hard practice. Our approach is unique because it uses a computer to play the game; indeed, interfacing the Atari with the parallel port of a computer is more methodological. The computer not only bypasses the need for practice but also eliminates human error. This research should demonstrate that computers can be used to perform many tasks, not just those for which they are typically used.

Using Constructivist Software to Teach Linear and Differential Equations
Eliut Hernandez and John Saenz , Texas A&M University - Corpus Christi, e0h30575@kestrel.tamucc.edu, jms34007@kestrel.tamucc.edu

Most of the software available on the market that focus on teaching high-school students mathematics (algebra, geometry, etc.) tend to rely on the students' ability to memorize equations; students are not required to understand the concepts behind the mathematics. Through the Alliance for Minority Participation program (AMP) of the National Science Foundation (NSF), we were given the opportunity to build open-ended, constructivist software capable of enhancing the teaching of linear and differential equations. The students can manipulate and observe how mathematical concepts are applied in real-world situations and not have to worry about the mathematical equations used in these concepts.

Finding Accurate Input Features for Knowledge Based Neural Networks
Brendan Burns , Williams College, 98bdb@cs.williams.edu

Classification systems rely heavily upon having the best set of input data from which to make decisions. However, many domains have a variety of potential input features. Therefore, choosing the appropriate set of inputs is critical to the performance of any expert system. INDiGENT, the system described below, is designed to refine knowledge based neural networks by genetically searching for the set of input features which most accurately classifies the given data.

Footsteps into the Future: Revising the Introduction to Computer Science Course Using Web Pages to Teach Programming Concepts
Kevin Arnold and Andrew Seidl, Kalamazoo College, k94ka01@kzoo.edu

In the Summer of 1997, a research group of faculty and students formed to revise the Introduction to Computer Science course at Kalamazoo College. Our goal was to increase the use of the World Wide Web and interactive, hands-on lab exercises to teach computer science concepts. We modified and developed five closed labs and six "mini-labs" to introduce students to basic programming concepts using JavaScript. Students were highly motivated to learn JavaScript to develop and customize personal home pages.

FLAVE, the Functional Visual Language
Renata Rubinsztajn, Ryerson Polytechnical University, rrubinsz@scs.ryerson.ca

FLAVE (Functional Language Applying Visual Expressions) is a statically typed functional programming language. FLAVE is geared towards allowing students at an introductory computer science level to learn computer science concepts without worrying about complex code syntax. Inside FLAVE'S programming environment icons represent all primitive functions and data types. Functions will be represented as icons with gaps waiting to be filled by either other function icons or data type icons. Users will build their own functions by filling these holes with the appropriate icons for the action they wish to perform.

"Server-Side Includes" and Web Server Security
Jared Karro, UNC Greensboro, jqkarro@uncg.edu

I investigate security loopholes concerning the use of Server-Side Includes (SSI) in some of the most used World Wide Web servers. SSI is a powerful tool that allows users to easily include dynamic information in their Web pages. I show that, by exploiting SSI, one could seriously compromise the security of a Web server. I demonstrate several attacks including, crashing a Web server computer. Such attacks can be made without leaving a trace. All the attacks described were executed on servers I set up for testing purposes. Finally, I suggest several cures to prevent a Web server from such attacks.

The Ups and Downs of Formal Methods
Michael R. Clarkson, Toni E. Lehmkuhl, Stephanie R. Taylor, Bryce D. Williams ,Miami University at Ohio

Elevator scheduling is an interesting and complex problem that has pertinent implications in computer science. The specification, design, and implementation of the solution to this problem will be presented using a formal method that is a new and unique design methodology based on first-order logic. A major contribution of formal methods to software engineering is a reduction in development cost, along with the creation of complete and correct systems. This research demonstrates the feasibility of utilizing formal methods to solve non-trivial problems that have practical applications.

MIDN 1/c M
Damon Eason , United States Naval Academy, m981860@nadn.navy.mil

This research project is the development of a physics knowledge base for circular motion for an intelligent tutoring system named ANDES. ANDES is an ONR-funded collaboration between the US Naval Academy and the University of Pittsburgh. The development of this knowledge base involves representing the physics concepts and the givens of homework problems as CLIPS facts and templates, and the creation of rules that model physics experts' cognitive processes in obtaining solutions to the problems. The knowledge base generates equations which solve the problems and solution graphs indicating the cognitive steps. The presentation will demonstrate ANDES using the circular motion knowledge base to solve physics problems.

Quality and Speed in Linear-scan Register Allocation
Omri Traub, Harvard University, otraub@eecs.harvard.edu

A linear-scan algorithm directs the global allocation of registers to register candidates based on a simple linear sweep over the program being compiled. This approach to register allocation makes sense for systems, such as those for dynamic compilation, where compilation speed is important. In contrast, most commercial and research optimizing compilers rely on a graph-coloring approach to global register allocation. We implement both register allocators within the Machine SUIF extension of the Stanford SUIF compiler system. Experimental results show that linear scan is much faster than coloring on benchmarks with large numbers of register candidates. The linear-scan approach produces code near in quality to that produced by graph coloring.

Secure Data Storage and Transfer Over Public and Private Networks
James M. Blum, Alma College, jblum@mcs.alma.edu,

Public networks have made the electronic transfer of data simple. However, there are many security risks, including those from rogue system managers. Secure data transmission standards exist, but these solutions do not address the possibility of a super-user disclosing secure information. By establishing what is effectively an encrypted, distributed, file system, the data will be secure even if the file is obtained by an unauthorized user. We have implemented a prototype system which uses existing server technologies augmented by a new technique called protocol spoofing. This provides secure data storage and transmission utilizing existing protocols, servers, and clients.

Intelligent Abstract Data Types
Ivy Carter, Hampton College, cscarter@cs.hampton.edu

The focus of this research is to explore the nature and applications of Intelligent Abstract Data Types (IADT's). An IADT is an Abstract Data Type (ADT) that runs correctly with the clients. An IADT allows many "client" tasks to share a resource in real time, or it can perform internal functions when its clients do not require its services. To research the usage of IADT's, emphasis is placed on testing and correcting current IADT list programs and implementing new features to the current IADT.

Authoring a multi-user graphic virtual world
Chaim Gingold, West Virginia University, gingold@cs.wvu.edu

Currently, no software enables users to simultaneously build and explore a wide variety of graphical virtual worlds. The software described here enables users to simultaneously build and explore graphical virtual worlds by utilizing a client/server architecture, authoring tools, and a distributed simulation architecture. This work represents a significant advancement beyond current work in text based MUDs and graphical virtual worlds.

Shared Resource Protection and Deadlock Detection in Java
Anita Van Engen, Nathan Oostendorp, Michael Bradshaw, Hope College and Centre College, vanengen@cs.hope.edu

Java threads enable programmers to write parallel programs very easily and conveniently. However, the current Java specification does not adequately provide for the protection of shared resources or for deadlock detection, two of the most common problems arising from parallel programs. The ability to solve these problems is crucial for real Java concurrent programming. We introduce and implement a model that provides various levels of protection for shared resources and the ability to detect deadlock. This model can be used to write parallel programs which protect shared resources and are able to detect when deadlock occurs.

A formal implementation of delegation using objects and messages
Natalia Romero, Maria Jose Presso, Veronica Arganaraz, Universidad Nacional de La Plata. Republica Argentina.
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Most Object-Oriented languages and models provide some means of sharing behavior as a primitive feature -class-based inheritance or delegation between prototypes-. We aim to construct a formal model of Object-Orientation based on a minimal definition consisting in just objects and messages, where other concepts relevant to the paradigm -such as classes and prototypes- are built with the basic elements. We define an extension of Abadi and Cardelli's object calculus, and use it as a kernel to construct an implementation of delegation. Our construction allows to define formal semantics for prototype-based languages and rigorous reasoning about them.

Lock-Free Distributed Objects: A Shared Spreadsheet
Christopher R. Palmer, University of Waterloo, crpalmer@uwaterloo.ca

Groupware applications have long seen the need for lock-free distributed objects. Distributed systems typically rely on a central authority and are subject to failure. Using Cormack's Calculus for concurrent update (University of Waterloo TR CS-95-06), lock-free algorithms are considered in a larger scale than previous work. An abstract model of a spreadsheet is used to develop the required model of the concurrent semantics. The model is implemented in the free-ware spreadsheet sc. This spreadsheet provides a distributed shared object in which local updates may be immediately applied. That is, the system may function when there are failures in any number of distributed nodes.

Evaluating Register Assignment Strategies on Out-of-order Issue Superscalar Processors
Brian Auton, Appalachian State University, ba21379@cs.appstate.edu

Register allocation impacts the performance of programs on fine-grain parallel architectures. The allocator can introduce dependencies that did not exist among the original code sequence, preventing instructions from being executed in parallel. What is not well-understood is the impact of the allocation on code targeted for an out-of-order issue, superscalar architecture. The dynamic scheduling performed may be able to find independent instructions in spite of the dependencies added by the register allocator. Our experimental studies indicate that the assignment strategy is not significant on processors with low latencies, but is quite significant on processors with high-latencies.

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