Conduit

A RESEARCH AND ALUMNI NEWS MAGAZINE
DEPARTMENT OF COMPUTER SCIENCE
BROWN UNIVERSITY

ALSO INSIDE:
Remembering Boy's Surface
The Matrix in Computer Science

Evolving Computer Science

Notes from the Chair: the Latest News from 115 Waterman

Greetings to all CS alums, supporters and friends!

Spring has finally arrived in Providence and we hope to see many of you at the upcoming Computer Science Reunion and Networking Reception on Saturday, May 23, 2009. We encourage all alums, friends and supporters to stop by the CIT for a visit.

Several of our faculty members received awards in recent months and I'm thrilled to highlight some of them:

- Pascal Van Hentenryck was conferred the title of Doctor Honoris Causa from the Université catholique de Louvain in recognition of his important contributions to constraint programming, his remarkable scientific and technological impact in the optimization field, as well as the industrial applications of his research.
- Andy van Dam was awarded an honorary doctorate from ETH Zurich for his fundamental contributions to research and development of graphics in general and interactive graphical user interfaces in particular.
- David Laidlaw was presented with the IEEE VGTC Visualization Technical Achievement Award in recognition of outstanding technical work in the area of multi-valued data visualization. David is the fifth recipient of this award, which was established in 2004 to recognize seminal technical achievements in visualization.
- Chad Jenkins was awarded a Sloan Research Fellowship, the oldest and one of the most competitive fellowship programs in the United States. Chad's work in human-robot interaction and robot learning, with a specific focus on robot learning from human demonstration, led to his inclusion in this elite group.
- John Savage was presented with the President's Award for Excellence in Faculty Governance. This award recognizes Brown faculty members who have made outstanding contributions to the university through their distinguished service on faculty committees, councils and advisory boards.
- Amy Greenwald received a Career Development Award from Brown's ADVANCE Program, which is funded by an NSF grant. She plans to use the funds to build collaborative relationships with industrial research labs in the area of electronic commerce.

I'd also like to congratulate undergraduate student Theodor Moldovan who was selected for Honorable Mention in the Computing Research Association's Outstanding Undergraduate Award competition for 2009. I am happy to note that this award marks the twelfth consecutive year that Brown CS students have been recognized by this competition.

I am also happy to report that our master's program has experienced notable growth in recent years and now has 55 students enrolled, an all-time high. Master's students are involved not only in the department's research and teaching activities, but also in helping chart its course. If you are interested in learning more about the program, please visit cs.brown.edu/grad/masters. Applications are accepted on a rolling basis and we would love to have you back in the CIT.

As we are concluding the 30th year of the department's history and we look forward to a successful fourth decade, I am delighted to share with you that we have hired a new faculty member, James Hays, who will join us in the fall. James's research is in the emerging area of computational photography. He is currently completing his Ph.D. in Computer Science at Carnegie Mellon University.

Please send along your research and personal stories for inclusion in upcoming issues of Conduit. Your support of and participation in department activities is always appreciated and we are grateful to have such a devoted community.

Finally, it is with heavy hearts that we dedicate this issue of Conduit to Candace Batts '01, who was killed in a car accident last November. She enrolled in the Ph.D. program in environmental science at Iowa State University two years ago after working as a member of the GISLab Team at Los Alamos.

Candace is remembered by many as a very bright, energetic, community-minded young woman who contributed to the department as a student, TA and member of our technical staff. She was also active in the Brown University Chapter of the National Society of Black Engineers where she held executive board positions for three years. Upon graduation, she received the Eva A. Moore Premium, a highly selective award given to a small number of women whose contributions to the college and the community evidence great personal and scholastic growth and compassion for others. Candace will be truly missed by the department and our thoughts are with her family and friends during this difficult time.

Roberto Tamassia
Professor and Chair
Department of Computer Science
Brown University

Volume 18, Number 1

Spring | Summer 2009

Published twice yearly by the Department of Computer Science at Brown University, *Conduit* is distributed free to all computer science alumni, faculty, staff, students and industrial partners.

Queries about this publication can be directed to: conduit@cs.brown.edu or
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Providence, RI 02912

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Department of Computer Science

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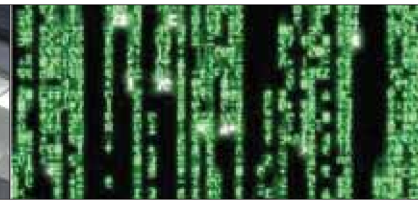

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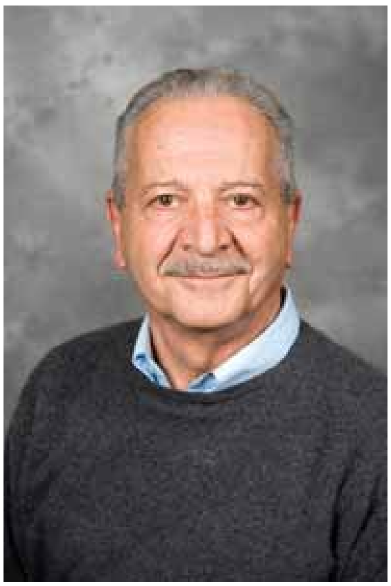
Evolving Computer Science*



By **Franco P. Preparata**,
An Wang Professor of Computer Science

Each scientific discipline has its own characteristic intellectual color. Physics evolved by confronting challenging questions formulated in response to perceived mismatch between current models and experimental evidence; the development of mathematics occurred under a variety of evolving philosophical, aesthetic or utilitarian pressures, and so on. The history of a discipline establishes its epistemological underpinning, in other words, its "intellectual color."

Computer science, a recent affiliate in the family of the analytical/hard sciences, shares several features with traditional members, although a unique dynamism makes not only for an evolving profile but also for a historical diversification of role. Needless to say, my views are inevitably colored by my own personal experiences.

At the advent of the computer era – roughly at the end of WWII – it took some time for the new field to assert its own identity. Its conceptual cornerstones had been in place for some time in the functional conception of Babbage and, much later, in the profound characterization of Turing-Church. However, what made Babbage's conception a pure thought-experiment was the lack of a supporting technology at the epoch. It took over a century for such technology to materialize and to rapidly mature under the pressure of the global cataclysm that was World War II.

Recourse to electronic implementation eliminated the frustrating effects of friction inherent in mechanical realizations and functional stored-program (i.e., modern) computers appeared on the scene. The digital computer, dubbed initially "electronic brain," was regarded as a new "toy" by electronic engineers, while mathematicians were intrigued by the potential formalization of the field of computation.

The mention of electronics and mathematics is not accidental. This dual tutelage characterized the early years and shaped both the history and the cultural mindset of the emerging discipline. Electronics is unchallenged in providing the preferred technology for the processing of information and the imperative to formalize and to prove properties and assertions – a mindset of unmistakable mathematical character – became and remains the "language" of the new field.

This dual nature is the enduring hallmark of our discipline, its strength and at the same time its burden. Indeed for many years it was the root cause of passionate academic "turf" battles, as the two camps – mathematics and engineering – vied for the stewardship of a field with an unmistakably bright future. This antagonism was later softened by the reasonable partition of the domain under the rubrics of "computer science" and "computer engineering," although the choice of the heading "informatics" by the non-anglo community has to a great extent lessened the contention.

It took about two decades for the field to mature and free itself from its original tutelage. However, the inherent dual nature characterized the emerging discipline of computer science. For some time, the admittedly sterile question was asked as to which unique characters distinguished computer science from its sisters in the family of hard-sciences/engineering and equally dubious answers were formulated. More appropriate would have been the acknowledgement of the fact that this new field has inherited the outlook of engineering in the form of the imperative to optimize performance and use of resources, and the structural richness and precision of discrete mathematics as its standard language.

1 Models as means

Any field of science or engineering refers to some mathematical model of the reality that is the focus of its attention, although a conscious critical analysis of this aspect is frequently overlooked.

The same issue appeared in more subtle form in the computer field. Here the original physical reality was a variety of exceedingly complicated and detailed digital machines whose conceptual background was an elegant but operationally very remote model, the universal Turing machine. The extant machines not only had distinct instruction repertories, but also very different execution times for similar instructions as a consequence of the adopted logic and electronics. In other words, performance predictions concerning a specific digital computer in no way could be derived from the abstract model of the Turing machine.

The need was therefore recognized to conceive a model of computation that offered at the same time a simplified and convincingly reflective representation of the computing environment. Achieving such a goal (a delicate compromise between simplicity and reflectivity) would have assured both the ability to formally describe/analyze operational behavior and a sufficient degree of confidence in the predictions derived from such analyses.

Faithful to one line of inheritance, the emerging computer science resorted to the formalism of discrete mathematics (sets and functions) to develop an adequate model, the random access machine (RAM). This development unleashed analytical freedom and creativity, which resulted in extremely fertile research in the analysis and design of algorithms, an area succinctly referred to today as algorithmics.

The fundamental contribution of algorithmics is the awareness that performance gains – in both running time and used memory space – derived from algorithmic redesign are destined to far outpace those derived from technological hardware improvements.

The acceptance of this tenet is now central to the entire field. To measure performance in terms of "order of growth" (the notion of asymptotic notation) is now pervasive, i.e., not restricted to theoretically minded peer communities. Armed with this powerful conceptual arsenal, over the years algorithmics has responded imaginatively and aggressively to a rapidly evolving technological landscape, developing as a result a remarkable body of knowledge and establishing itself as a vibrant area of computing. While algorithmic research was thriving in several application areas, theoretical computer science, through deep investigations of complexity classes and a thorough study of NP-completeness, was laying out rigorous foundations for the entire field, which acquired a level of sophistication comparable to that of the more traditional sister disciplines. In a sense, at the conclusion of an inward-looking process lasting several decades, computer science was coming of age.

A concurrence of exogenous and endogenous pressures determined a state of uneasiness in the early 90s.

The main exogenous event, especially in our scientific community, was the evaporation of the cold war. It became evident that several important research directions in computing (notably, massive parallel computation) were fueled by the comfortable support of the American funding agencies because of a perceived strategic value. The contraction of funding had a depressing influence on the entire field. The job market slumped and took several years to recover.

This external conditioning was accompanied by internal self-criticism, some of which was penned by recognized leaders of the field. A main article of contention was the perceived excesses of theoretical investigations, which seemed to have drifted away from relevance. Additionally, serious dissatisfaction was manifested by practitioners, to whom whole areas of algorithmics were targeted, such as computational geometry and the area-time theory of VLSI. The main reason was the acknowledged inadequacy of adopted computation models. Indeed, striving for simplicity may lead to the suppression of features originally deemed irrelevant, but later found to be quite significant.

More generally, the model-of-all-models, asymptotic analysis (perhaps the most pervasive contribution of algorithmics to the mindset of computer science), originally intended as a conceptual framework for technology-independence, has been used very frequently beyond its original scope. As a consequence, computations were compared on the basis of their asymptotic running times, with total disregard for multiplicative constants and for the plausible range of problem sizes. Thus the qualifier of "optimal" was sometimes bestowed on algorithms that had no chance whatsoever of ever being implemented.

Computation models, which are essential to the development of the field, are sometimes forgotten to be mere "convenient images" and tend to acquire a life of their own: they dangerously become the reality, not an imperfect mirror of it. The lesson learned through this critical reflection is that models, while indispensable means, must undergo constant scrutiny to guarantee that they are not used beyond the confines of their original conception.

2 Models as ends

In summary, algorithmics became the victim of its own success. Next to an impressive volume of acquired knowledge and methodological know-how was the internal criticism of its excesses, mainly due to an improper use of models, with the ensuing drift from the motivating reality to a solipsistic world open only to inner circles.

In that period of uncomfortable reflection and self-examination, two concomitant, and certainly not unrelated, phenomena were maturing and were rapidly perceived as having an enduring impact on society as a whole:

- Technology was continuing its vigorous development resulting in the availability and affordability of unprecedented computing resources (both as hardware and as software) and of exceptional communication facilities;
- Many application domains in the most diverse areas witnessed an explosion of the volumes of data to be handled and recognized the inadequacy of their traditional approaches to face the rapidly changing reality.

Here again, algorithmics manifested its vitality and reasserted its role in computer science. While in the earlier decades theoretical work had focused on establishing and strengthening the foundations of the discipline and the development of methodological know-how, the time was now ripe for transitioning from an inward-looking mindset to an outward-looking attitude.

In my perception, the field was naturally adding to its traditional profile the far-reaching functions of an enabler of applications, in any areas where the growing amount of data called for treatments that only the computing field was capable of providing. In other words, computing was to assume for the information-rich society a role analogous to that earlier assumed by mathematics at the dawn of the scientific revolution. Computing was bound to morph from a "vertical" discipline, building its own theoretical foundations, to a "horizontal" discipline, cutting across all domains of knowledge and societal organization. We could witness the concurrence of complementary supply and demand: a mature computer science ready to export its capabilities and a host of applied areas for which such capabilities appeared indispensable.

In no other field was this need more evident than in molecular biology. After the pivotal elucidation of the structure of nucleic acids – the blueprints of living organisms – molecular biology underwent extraordinary developments once efficient sequencing techniques achieved the potentiality of elucidating the genome of any organism. The accumulated data, crucial to the understanding of biological functions, can only be analyzed computationally, giving rise to the booming field of molecular computational biology.

Although computational biology is perhaps the most complex and vibrant manifestation of this new situation, it is in no way unique. Recourse to computing as an alternative avenue to "doing science" – and, in some cases, the only one feasible – had been established for some time. For example: the physics of quantum chromodynamics; numerical simulation of fluid-dynamics; computer-based proof of theorems in mathematics (e.g., the celebrated four-color theorem). While the adoption of computational approaches in the "hard" sciences is not surprising at all, a vast number of academic specialties or societal systems become open to interaction in order either to radically rationalize their "modus operandi" (banking, communications, medical practice, etc.) or to synthesize and fine-tune sophisticated prediction tools (typically, computational finances). And the list goes on.

The emerging state-of-affairs places demands on professional expertise. It requires professionals suitably equipped to effectively interface with the various applied fields that are mature enough for interaction.

A natural question arises — are current computer science curricula adequate to face this situation? The appropriateness of this question rests on the norm that expertise necessary to society must result from institutional commitments of the educational enterprise, not from the self-teaching efforts of enterprising individuals.

Even a superficial review of the applications mentioned above, most of which deal with large ensembles of items and for which the objective is the formulation of ensemble predictions, exposes the importance of domains of knowledge generally not emphasized by traditional computer science education.

Members of large ensembles are characterized probabilistically, while the study of probability theory and statistics is not always a fundamental part of computer science curricula. The same can be said, for example, for topics such as numerical analysis, discrete-event simulation, design and evaluation of experiments, congestion theory and methodologies for the dynamic analysis of large systems. The latter are grounded in linear algebra, dynamical systems theory, signal-flow theory, combinatorial optimization, etc.

In other words, a large subset of the topics listed above is part of the body of knowledge originally categorized as operations research or systems engineering half a century ago, in a pre-computer era. Today, computing technology adds an entirely new dimension to these powerful techniques.

The argument can therefore be made that the higher-education enterprise must take a proactive role in response to this societal need as a reflection of the evolving profile of computer science. Curricular diversification is presumably the appropriate solution.

This viewpoint in no way implies a diminished role for standard computer science curricula, since technology and practice are in a constant state of robust evolution and the traditional curriculum is the most appropriate vehicle for calibrating instruction to such a mutable environment. Rather, what should be designed and implemented is a sister-curriculum fine-tuned to the effective application of information technology to a complex variety of fields.

Since names have their importance, an appropriate denotation should be found both to characterize its novel role and to underscore its affinity to foundational computer science. The choice is widely open to debate. I'd like to propose here the title of:

Applied Informatics

to underscore the alluded dual character. Additional appeal is provided by the analogy with the established specialty of "applied mathematics," which has acquired high reputation scientifically and educationally.

While fundamental computer-science knowledge remains the underpinning of the new curriculum, the intellectual core of the added dimensions is the notion of "mathematical model." The new professionals should be equipped with know-how targeted to:

- the formulation of mathematical models of systems proposed to their consideration and the analysis of their behavior, either formally or through computer simulation;
- the design of correct and efficient algorithmic solutions for the achievement of the particular goals of the target systems.

Practically, the acquisition of such expanded know-how cannot be achieved without sacrificing some topics in standard computer-science education or recalibrating the emphasis. Certainly, topics such as programming, algorithmics, discrete structures, digital systems and software systems remain central; to make room for the background appropriate for "computer-based modelers," other topics, such as computation theory, operating systems, compilers, etc., should be de-emphasized, while their fundamentals should be appropriately repackaged. Moreover, a substantial portion of this proposed curriculum should be provided by established offerings in electrical engineering, applied mathematics and statistics.

As a concluding remark, the notion of "model," which played such a crucial role as a means in the evolution of computer science, will become the target end in this expanded role of the discipline.

** This note is an abridged version of a more substantial article currently being published in China*

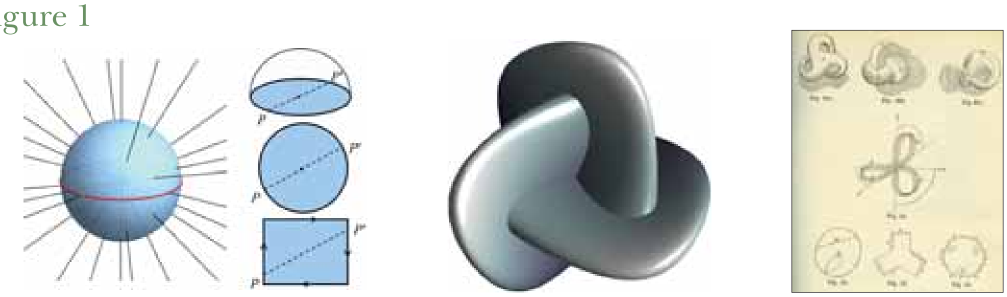
Remembering Boy's Surface After 15 Years

By **John Hughes**, Professor of Computer Science with **Çağatay Demiralp**, Ph.D. Student

We make pictures of all sorts of things in graphics. My career in graphics began with making pictures of Boy's surface (Fig 1b), a self-intersecting shape that *is* the result of "immersing" RP^2 (the real projective plane) into R^3. RP^2 is a space with the odd property that it has one point for each *pair* of antipodal point of the sphere (Fig 1a). So while the sphere has a north and a south pole, RP^2 has a single point that corresponds to this pair. Boy's surface was introduced by the German mathematician, Werner Boy, in his 1901 thesis (David Hilbert was his thesis advisor). What is amazing is that Boy demonstrated his immersion by using hand drawings only (Fig 1c). And, in fact, the first mathematical expression for Boy's surface had to wait until the late 1970s. I was interested in Boy's surface because of a mathematics problem about self-intersections, but I haven't really touched it in the last 15 years.

Çağatay Demiralp, one of David Laidlaw's students, wanted to make pictures of *line fields* – these are like vector fields, where at each point there's a vector (e.g., at each weather station, you draw an arrow indicating the wind speed and direction); in a line-field, however, you have a *line* at each point rather than a vector (Fig 2a-b). An example: you splatter ink onto a piece of rice-paper. Each droplet diffuses, but because of the alignment of fibers in the rice-paper, a drop diffuses into an elliptical shape rather than a disk (Fig 2c). The major axis of the ellipse provides you a three-dimensional *line* rather than a vector. The collection of these is a line field. Diffusion in human tissues is similar, except that at every point in a solid, you have an axis of principal diffusion. This axis intersects a sphere in two points that correspond to a *single* point of RP^2! Çağatay had the idea that if you could assign a different color to each point of RP^2, you could use that coloring as an encoding of the diffusion axis.

figure 1

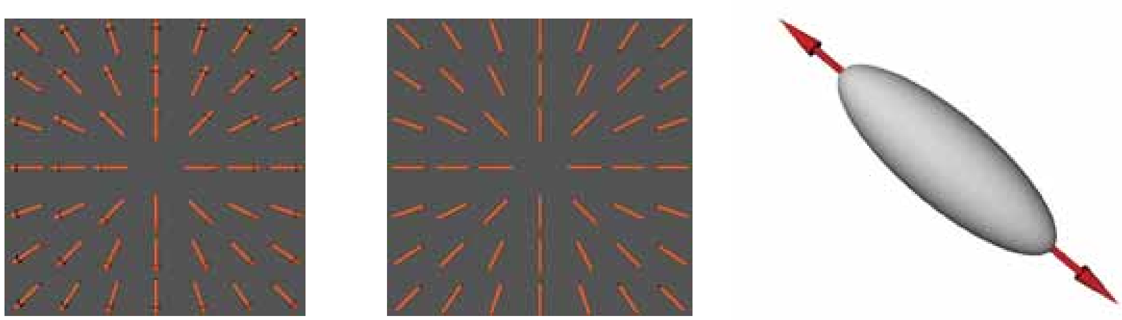


(a) Each pair of antipodal points is *one* point of RP^2. RP^2 can also be thought of as a disk with opposite points glued together.

(b) Boy's immersion of RP^2 into R^3, represented by polynomials I discovered in the mid-1980s.

(c) Boy's original drawings of his surface.

figure 2



(a) A vector field

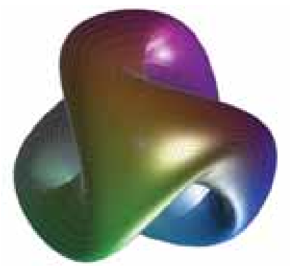
(b) A line field

(c) The principal axis of an ellipse gives a line, which corresponds to a point of RP^2.

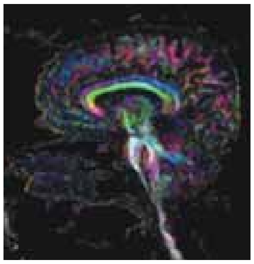
Unfortunately, there's a problem: you cannot assign colors to points of RP^2 uniquely; some pair of points will always have the same colors (indeed, this will happen at infinitely many points). But you can assign them *almost* uniquely. If you treat the space in which Boy's surface lives as having red-green-blue coordinates instead of *xyz*-coordinates (Fig 3a), then Boy's immersion assigns a unique color to every point except along the curve of self-intersection. So, Çağatay decided to use Boy's immersion of RP^2 as a color model. When he shared his idea with me, I pointed him to the parameterization code that I worked out 15 years ago. Çağatay used this to color-code diffusion data.

The result was a system for coloring diffusion data in a way that ensures that different diffusion directions almost always correspond to different colors, so shifts in diffusion detection correspond to color boundaries, making these shifts especially easy for a scientist to recognize (Fig 3b-c).

figure 3



(a) Boy's surface, colored.



(b) Mid-sagittal cross-section of a diffusion-tensor MRI brain data. Principle axes of diffusion at each point, a 3D line field, colored using Boy's surface.

(c) Brain fibers, colored by diffusion directions: it's easy to distinguish different diffusion directions by color differences.

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The Faculty Speak Out

By **Claire Mathieu,**
Professor of Computer Science

Q&A with Claire Mathieu

How did you first become interested in computer science?

As an undergraduate, I was preparing a math major with the intention of continuing graduate studies in number theory or combinatorics. A year-long computer science course was one of the concentration requirements.

The course was cleverly designed with five parts, specifically chosen to attract math students: programming in Pascal with four projects (the stable marriage algorithm, red-black trees, k-d trees and quad trees); design and analysis of algorithms, a la Knuth; automata, languages and grammars; logic and lambda-calculus and Petri nets.

I took the course reluctantly in 1983 and then quickly fell in love with programming, and shortly later, with algorithms. My interest in programming has kind of faded, but to this day, my interest in algorithms has remained more or less unchanged.

"Because I am a problem-solver, my work is interplay between looking for algorithmic ideas to overcome difficult problem instances and looking for challenging instances to destroy potential algorithms."

What motivated you to focus on your current research?

Because I am a problem-solver, my work is interplay between looking for algorithmic ideas to overcome difficult problem instances and looking for challenging instances to destroy potential algorithms. To reduce the world of possible problem instances, it is natural to think about a variety of simplifications and approximations. The design and analysis of approximation algorithms is an area in which I have always felt at home.

The first problem that fascinated me was bin packing and the clever rounding technique of de la Vega and Lueker in their famous 1981 paper. Understanding that paper in depth was really the start of my interest in bin packing and related problems in the mid-90s.

Since then, my motivation has changed somewhat: I am no longer so interested in solving the next problem, but have come to realize that we really have a very limited number of algorithmic tools at our disposal for problem-solving and I am now more interested in exploring the power of those techniques. In that sense, my focus has become more mathematical and it is more and more difficult to convey my enthusiasm to the layman...One of the most popular techniques currently is linear programming relaxations and so my current perspective is to try to better understand the why and how of those relaxations.

What do you consider the most interesting and exciting challenges of your current research?

There is a class of little understood techniques to strengthen linear programs, called "lift-and-project." They're expensive, but powerful. Are they worth it? I am on the fence as to how promising they are, but what I know for sure is that there are many misunderstandings and unwarranted claims about them, even on the part of experts. I have started reviewing them carefully, going back to the basics, and am excited about the clarifications. I think that there will be a few surprises!

Do you have a favorite project that you've worked on?

Probably two projects.

One was strip-packing, a two-dimensional extension of bin-packing algorithms. With Eric Remila, I designed an algorithm to pack rectangles on a strip of fixed width and minimum height: think about cutting cloth to make clothes (from rectangular pieces) while trying to save on the amount of cloth you need to buy. Our algorithm was almost optimal, and as such, attracted the notice of bin packing experts who had been under the impression that such a powerful result might not be achievable. I remember telling David Johnson about it in the elevator at a conference when we had just obtained but not yet written our result. I was all excited about it and quite disappointed by his lack of reaction. When I saw him again six months later, after the paper had come out, he was much more enthusiastic and the reason later dawned on me. Originally, he just had not believed my unsubstantiated claim!

The other project was an algorithm for the Maxcut problem in metric spaces: given *n* items with distances between items, partition them into two sets that are as far as possible from one another, in terms of the sum of distances between points in different parts. In joint work with Fernandez de la Vega, I designed a nearly optimal solution based on biased sampling. It was quite simple and not very deep, with just a single idea, but it happened to be in a "hot" area, so there was a lot of interest. I also have good memories of giving that talk at a conference, making jokes and eliciting good laughs from a large audience.

"I am no longer so interested in solving the next problem, but have come to realize that we really have a very limited number of algorithmic tools at our disposal for problem-solving and I am now more interested in exploring the power of those techniques."

I think that those two projects really shifted my career, changing my image from that of someone unknown working on slightly arcane topics to that of someone whose name and interests were familiar to the mainstream. They both indirectly grew out of my increased interest in combinatorial optimization, following a sabbatical year at UC Berkeley, during which I collaborated with Dick Karp whose taste and methods I admire and who became my role model.

How do you see your field evolving over the course of your career?

It is quite obvious that there is increased mathematical sophistication. When I was a student in the mid-80s, you could put together an elementary problem, a clever observation and a little bit of combinatorics and get a nice paper out of those ingredients. Now we know much more and such shallow research does not attract much attention; the core of our field builds on increasingly advanced techniques. For example, in probabilistic techniques, we have gone from using expectations to Tchebycheff inequalities to Chernoff bounds to martingale arguments. Not only do we borrow more difficult tools from other related fields, but we are also constructing a deeper theory. Since the mid-90s and work on PCP – proving that some problems cannot be solved even approximately in reasonable time – I think that we have gained the right to be respected by other scientific disciplines. Theoretical computer science is, in places, just as deep as theoretical physics or theoretical chemistry!

What's the "next big thing" in approximation algorithms for combinatorial optimization?

I would be careful to make predictions. We have a few classic problems from whose study all novel ideas seem to originate. We have been gradually absorbing knowledge of semi-definite and convex programming and the expertise from the people in mathematical programming is slowly, slowly coming into our field. I think that they are really different from and superior to the kind of tools to which we previously restricted ourselves. As we become more comfortable with these techniques, we may be able to realize their potential. But that is all purely speculative, of course, and it is really just a matter of opinion!

If you had enough extra time to study one additional area, what would it be?

Judging from what I read during my spare time, I suppose that I'd have to say philosophy. I am currently reading, with some difficulty, "Amour et justice" by French philosopher Paul Ricoeur, a specialist of hermeneutic phenomenology. But I must admit that it has virtually nothing to do with algorithms. At least, if there is a connection, it is hidden to me for now!

Michael Black

Michael Black's group filed several provisional patents on new technology to estimate human body shapes from a small number of images.

One of the methods enables the computer to compute body shape even under clothing. This work was presented at the European Conference on Computer Vision in Marseilles. The work, which has applications in video surveillance and the apparel industry, was picked up by news organizations such as the Boston Globe.

Michael's group also received funding from Willow Garage for a startup focused on developing robots for the home environment.

Michael and a former student, Stefan Roth, won the best paper award from INI-Graphics Net for their work on "steerable random fields."

Maurice Herlihy

The National Science Foundation awarded Maurice Herlihy a grant in the expected amount of $250,000 to develop an open-source infrastructure to support Transactional Memory, a synchronization mechanism for multicore architectures.

Maurice gave a talk in the Jon Postel Distinguished Lecture Series at UCLA, was an invited speaker at ICDCN Conference and the IMMM multicoeurs workshop in INRIA, as well as at the Workshop on Directions in Multicore Programming Education.

Sorin Istrail

Sorin participated in a number of conferences including the following: RECOMB Regulatory Genomics 2008 at MIT and the annual meeting of the American Society of Human Genetics in Philadelphia. Sorin also served as a member of the National Science Foundation Data-Intensive Computing Panel for their Cluster Exploratory Program. Sorin made another research visit to the California Institute of Technology in December to continue the ongoing collaboration he and his lab have with Eric Davidson. He also visited Dr. David Altshuler of the Broad Institute of MIT and Harvard to begin work on collaborative research projects. Sorin attended the Brown-Marine Biological Laboratory retreat that was hosted by Brown University Associate Provost Pam O'Neil on September 19, 2008.

Sorin gave two invited talks; one at Boston University on September 18, 2008 and the other at the University of Connecticut, Storrs on November 7, 2008.

Sorin hosted visitors in his lab including, Simon Kasif (Boston University and Children's Hospital, Boston) and Srinath Sridhar (Facebook).

With Ryan Tarpine, his Ph.D. student, Sorin focused research on regulatory genomics. Significant progress was made in the software development of the Cyrene cis-Browser and cis-Lexicon project; one paper was submitted. Ryan presented a very well received poster at the RECOMB Satellite at the Broad Institute. Sorin's small army of students, a team of 11 undergraduate lab members (biologists and computer scientists), reached their next milestone of 150 genes in the cis-Lexicon in preparation for a visit to Eric Davidson's lab at the California Institute of Technology in March 2009.

Sorin was awarded a Brown University Lectureship Funding grant for the establishment of the John von Neumann Distinguished Lecture Series, developed in collaboration with Leon Cooper (Physics Department), Stuart Geman (Applied Mathematics Department) and Roberto Serrano (Economics Department). He was also a collaborator on three other funded grants together with Brown colleagues: an NIH training grant on cardiovascular research; a DOE grant on protein folding and molecular simulations; and a March of Dimes grant on genetic determinants of pre-term labor.

Sorin taught two Independent Study and four Reading and Research courses involving 1 Ph.D. student, 3 master's students and 5 undergraduate students.

Sorin's activities as director for the Center for Computational Molecular Biology include further progressing the computational biology Ph.D. proposal. The Graduate School unanimously approved the proposal and the Academic Priorities Committee approved it on March 31, 2009.

Chad Jenkins

I am pleased to announce that I have been selected as a 2009 Sloan Fellow and won a 2008 AFOSR Young Investigator Award. While my children are happy for me, they are more interested in WordGirl and "Robot Batman" these days.

Shriram Krishnamurthi

Tara Shriram Fisler

Shriram has been virtually immobile these past few months, as Kathi and he hunkered down to await the birth of their first child. Tara Shriram Fisler has been a delight, but has also (to the relief of many) sapped Shriram of the excess time he had for mindless email and blog entries. Search for "Tara Shriram Fisler" to find a webpage with photographs as well as an AFQ (Anticipated Frequent Questions). Shriram also gives a shout-out to Brown alum Curran Nachbar, who became a parent around the same time.

David Laidlaw

David had a busy VisWeek in Columbus, Ohio last October at the IEEE Visualization Conference. During the conference opening session, he was awarded the once-a-year IEEE VGTC Visualization Technical Achievement Award for his work in visualization of multi-valued fields. He also delivered the conference capstone lecture, where he tried to connect the progress of the discipline in the last 10 years with directions it might take in the future. David and about a dozen Brown alumni at the conference had a first reunion of the visualization group, dining together at a local Italian restaurant. We hope it will be the first of many such reunions.

This spring David has organized a new graduate seminar that is exploring cognitive modeling and human-computer interaction in an attempt to create a research vision for software that can help scientists do complex analytical work. If you think that sentence is a mouthful, the class is a real challenge for him, trying to keep up with the students, mostly from CS and CLS.

Claire Mathieu

Claire Mathieu stayed pretty much put during the fall semester. She has growing appreciation for Bela Bollobas, who has never ever missed a lecture in his many years of teaching at Cambridge University (UK). She's not quite there yet but has only moved one lecture in order to attend the grand opening of the Mircosoft New England research lab in Cambridge (MA). The fall semester ended with her customary visit to Seattle and a few days spent working with collaborators at the University of Washington before heading to France for Christmas. The landmark event in her professional life was the Symposium on Discrete Algorithms (SODA), for which Claire served as program committee chair. The event took place in the financial district of Manhattan in early January 2009: three days tightly packed with scientific talks and a high attendance rate. She wishes she could have said that it was the highest ever attendance rate, but with 363 paying registrations, the conference needed just one more participant in order to break the previous record!

Barbara Meier

This year I have undertaken a major overhaul of the animation courses. The most significant change is the addition of our own online tutorials. We found that existing materials are either focused on theoretical background material or on commercial software solutions. We have written a textbook-worth of illustrated tutorials that explain the underlying theory and algorithms within the context of the software workflow necessary to put these ideas into practice. Student projects demonstrate better understanding and students report less flailing. The final screening of the short films produced in the introductory class continues to draw a standing room only crowd even on one of the last days of final exams. Life is good!

We are also pleased to announce that Brown has been accepted into the Sony Imageworks university outreach program, IPAX. Sony provides the twenty or so member schools with scholarship, student internship and faculty fellowship opportunities. Membership is highly competitive and we are pleased to join this elite group of schools, all well known internationally for their strength in computer graphics and animation.

Franco Preparata

Franco returned to Brown from his sabbatical at the end of summer 2008. After a stay in Singapore devoted to collaborative research, he chaired for the second time the "Frontiers in Algorithmics" International Workshop, which was held in Chang-Sha, Hunan, P.R.C.

A significant outcome of Franco's interaction with the Singapore team has been a novel approach to repeat finding in long genomic sequences, which is much more sensitive than any of its competitors. The repeat-finder software, named SAGRI, is now available on the web as a joint Brown-NUS project. In addition, he finalized the details of a concurrent BS-Sc.M. degree in computational biology (in computer science), an initiative that he undertook in the previous year.

In September, an issue of Theoretical Computer Science appeared in "honor of Franco Preparata," containing a collection of papers presented here at Brown on the occasion of the Festschrift for Franco, promoted and organized by his former students Nancy Amato, Der-Tsai Lee, Andrea Pietracaprina and Roberto Tamassia.

John Savage

Having completed a semester-long sabbatical leave, John has resumed his normal faculty duties. While on leave he gave an invited talk at Old Dominion University (ODU) in October and two talks in November at the First International Forum on Next-Generation Multicore/Manycore Technologies in Cairo, Egypt. The first, entitled "A Unified Model for Multicore Architectures," was on a paper that he submitted with Mohammad Zubair of ODU. The second, entitled "Bounds on the Theoretical Efficiency of Multicore Cache Hierarchies," was an invited talk. The trip to Egypt afforded an opportunity to see pyramids, temples and several spectacular necropolises in or near Luxor. In November, John served on the New England Association of Schools and Colleges (NEASC) accreditation team for Northeastern University. This semester he is teaching CS 159, Introduction to Computational Complexity, and serving on three committees. They are the Organization and Governance Subcommittee of Brown's NEASC Steering Committee, which is preparing for Brown's accreditation review in April and for which he is co-chair, and the Graduate Exams and Diversity Committees of the department.

Eli Upfal

Eli was one of the organizers of Random Graals 2008: The 4th Bertinoro Workshop on Randomized Algorithms and Graphs. The meeting was held at the veritable XIIIth century castle in Bertinoro, Italy. The food, wine and particularly the grappa were excellent as usual, as well as the talks by some of the leading researchers in the field.

Eli received a new research gift from Yahoo! Research to support his collaborations with researchers in the company on algorithms for large-scale stochastic data. The collaboration with Yahoo! motivated a new graduate course on Internet and Web Algorithms. Judging by the number of students that are taking the course, the excitement about the web and its technical challenges is still high.

Andy van Dam

Andy poses with his birthday cake made by an exec at Adobe and his wife.

Andy van Dam received an honorary Ph.D. from ETH Zurich in November. His ETH graphics colleague, Markus Gross, the CS department and the university treated him and Debbie royally during their five-day visit. One of their three daughters, Lori, who lived in Switzerland both when Andy was on sabbatical in Geneva in '78 and '79 and more recently as an adult, joined them for some nostalgic fine dining and touring. Collaborator and good friend Henry Fuchs from UNC flew in for the occasion as well.

In December, Andy participated extensively in the multiple celebrations of the 40th anniversary of "the Mother Of All Demos," Doug Engelbart's 1968 landmark demonstration of NLS (oNLine System) at the Fall Joint Computer Conference, one of the two main computer conferences at the time. NLS was designed as a tool to enhance the "collective IQ" of workgroups and organizations. It introduced not only the mouse, but also real-time collaborative work on hypermedia documents (text and line graphics cross-referenced via hyperlinks), the use of video displays for text and graphics that allowed insets of real-time video feeds, outline editing and many other innovations.

Alan Kay and Andy had an hour-and-a-half moderated discussion of what Engelbart's amazing vision and its implementation in NLS accomplished and what still needs to be done. Andy also was the only outsider on a panel of the lead hardware and software engineers on the project, again discussing the history of the demo, the project and its subsequent impact and significance. He was invited because he saw and appreciated the significance of the demo while working on early hypertext systems implemented by Brown students under his direction (HES, the Hypertext Editing System and FRESS, the File Retrieval and Editing SyStem) in the 60s, followed by others in the following decades. He started HES in 1967 with fellow Swarthmorean Ted Nelson, coiner of the term hypertext and originator of many ideas about non-linear documents

In mid-February Andy and Debbie celebrated their 70th birthdays by taking their three daughters, their husbands and their three grandkids to go diving and snorkeling in Roatan. Andy's 70th birthday was marked by a party at home where Debbie and their daughters cooked up his favorite birthday dinner, a tempura orgy. There was a Klezmer band to provide the musical entertainment, followed by a con-brio sing-along with Andy's first Ph.D., Charles Strauss, at the piano.

The following day Andy flew to San Francisco for a conference. He was met by Marc Brown '80, Ph.D. '87 and escorted to a marvelous surprise party in Palo Alto organized by dear friends Marc, Norm Meyrowitz '81 and Paul Strauss '81, Ph.D. '88, and attended by some 70 former students, their "spice" and some of Andy's non-Brown friends from the area.

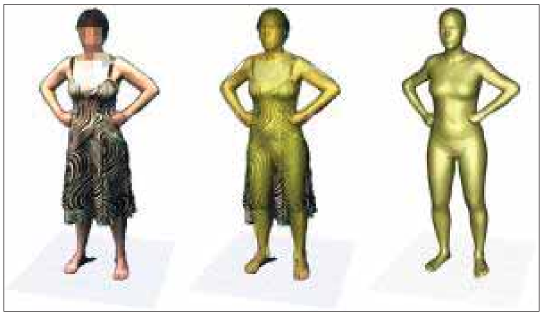
Pascal Van Hentenryck

In the fall, Pascal received an honorary degree from the University of Louvain in Belgium. The other recipients of this honorary doctorate included Japan Prize and Nobel Prize winner Professor Albert Fert, Turing Award winner Professor Ronald L. Rivest and National Academy of Engineering member Professor John N. Tsitsiklis. Pascal also gave invited talks at NIPS in Vancouver and LASH in Leuven.

Department Awards and Honors

Michael Black and Alexandru Balan Create Program to Calculate Body Shape

Imagine you are a police detective trying to identify a suspect wearing a trench coat, baggy pants and a baseball cap pulled low. Or imagine you are a fashion industry executive who wants to market virtual clothing that customers of all shapes and sizes can try online before they purchase. Perhaps you want to create the next generation of "Guitar Hero" in which the user, not some character, is pumping out the licks. The main obstacle to these and other pursuits is creating a realistic, 3-D body shape — especially when the figure is clothed or obscured.



"If you see a person wearing clothing, can the computer figure out what they look like underneath?" asked Michael Black, professor of computer science at Brown.

Black and graduate student Alexandru Balan believe they have figured out how that can be done. The researchers have created a computer program that can accurately map the human body's shape from digital images or video. This is an advance from current body scanning technology, which requires people to stand still without clothing in order to produce a 3-D model of the body.

With the new 3-D body-shape model, the scientists can determine a person's gender and calculate an individual's waist size, chest size, height, weight and other features.

Black and Balan debuted their findings last October at the European Conference on Computer Vision in Marseilles, France. Their paper was one of fewer than five percent of submitted manuscripts chosen for oral presentation at the prestigious international gathering.

A simulation of the new technology can be seen above.

The potential applications are broad. Besides forensics and fashion, Black and Balan's research could benefit the film industry. Currently, actors must wear tight-fitting suits covered with reflective markers to have their motion captured. The new approach could capture both the actors' shape and motion, while doing away with the markers and suits.

In sports medicine, doctors would be able to use accurate, computerized models of athletes' bodies to better identify susceptibility to injury. In the gaming world, it could mean the next generation of interactive technology. Instead of acting through a character, a camera could track the user, create a 3-D representation of that person's body and insert the user into the video game.

Brown University has filed two provisional patents covering the research and its potential commercial applications.

The key insight for Black and Balan was when they learned they could divine clues about a person's shape even with clothing. They created a computerized body model from 2,400 detailed laser range scans of men and women in minimal clothing. They found that by combining information from a person in multiple poses, the computer was able to infer the gender of the person and the 3-D body shape. They further refined the model by incorporating the computer's detection of skin in the images.

"As I move, my clothes become loose or tight on different parts of my body," Black said. "Each pose gives different constraints on the underlying body shape, so while a person's body pose may change, his or her true shape remains the same. By analyzing the body in different poses, we can better guess that person's true shape."

The researchers stress the technique is not invasive; it does not use X-rays, nor does it actually see through clothing. The software makes an intelligent guess about the person's exact body shape.

The Office of Naval Research, the Rhode Island Economic Development Corp. and the Intel Corp. funded the research.

Michael Black's Forensic Video Research Featured in Providence Business News

The Providence Business News recently featured a piece on Michael Black's work on advanced forensic video analysis. Last year, Michael contacted Rhode Island State Police Lt. Dennis Pincince, who leads the Criminal Investigations Unit, about working together. The pair received a collaborative research grant from the R.I.

Science and Technology Advisory Council, which paid for department researcher Alex Weiss and another student to work full time on advanced video forensics at state police headquarters in Scituate last summer.

Pincince said the collaboration was "particularly valuable because law enforcement officials have been using surveillance video more since the Sept. 11 attacks. Although image-enhancement products are available commercially, the price is often prohibitive for police departments." Plus, he said, "the stuff they're working on at Brown is by far the best stuff I've seen out there."

Chad Jenkins Receives Sloan Research Fellowship

In February, Chad Jenkins was awarded the prestigious Sloan Research Fellowship, the oldest and one of the most competitive fellowship programs in the United States. Chad's extraordinary work in human-robot interaction and robot learning, with a specific focus on robot learning from human demonstration, led to his inclusion in this elite group.

"The Sloan Research Fellowships support the work of exceptional young researchers early in their academic careers and often at pivotal stages in their work," says Paul L. Joskow, president of the Alfred P. Sloan Foundation. "I am proud of the foundation's rich history in providing the resources and flexibility necessary for young researchers to enhance their scholarship and I look forward to the future achievements of the 2009 Sloan Research Fellows."

Selection procedures for the Sloan Research Fellowships are designed to identify those who show the most outstanding promise and fundamental contributions to new knowledge. "I am very honored to be selected as a Sloan fellow," said Chad. "It is always great to receive such recognition. I believe it is a sign of the strong and supportive environment cultivated by our department as well as the great collaborations I have had throughout my career. In addition, the intellectual freedom of Sloan awards is an excellent opportunity to pursue bolder exploratory research directions that might be difficult to fund traditionally."

The 118 winners of the award are faculty members at 61 colleges and universities in the United States and Canada who are conducting research at the frontiers of physics, chemistry, computational and evolutionary molecular biology, computer science, economics, mathematics and neuroscience. They receive grants of $50,000 for a two-year period to pursue whatever lines of inquiry are of most interest to them. This money will be used to support the work of Chad and his students in robot learning and human-robot interaction.

Aside from the monetary aspect of the fellowships, less tangible benefits have been cited by former fellows. The early recognition of distinguished performance that the fellowships confer, after years of arduous preparation, was said to be immensely encouraging and a stimulus to personal and career development.

The Sloan Research Fellowships have been awarded since 1955. Since then, 38 Sloan Research Fellows have gone on to win the Nobel Prize in their fields and 14 have received the Fields Medal, the top honor in mathematics.

David Laidlaw Honored with IEEE VGTC Visualization Technical Achievement Award

David Laidlaw was presented with the IEEE VGTC Visualization Technical Achievement Award in recognition of outstanding technical work in the area of multi-valued data visualization. His work, which visually portrays a lot of data simultaneously, has been presented at IEEE Visualization. The award was given by the IEEE Visualization and Graphics Technical Committee on October 22, 2008 at IEEE Visualization 2008, held in Columbus, Ohio.

The IEEE VGTC Visualization Technical Achievement Award was established in 2004 to recognize an individual for a seminal technical achievement. David is the fifth recipient of this award.

"I'm thrilled to be given this amazing honor and thankful to the many people who helped along the road to this award," said David. "I am especially grateful for the tools that my parents provided me with that helped me become an independent researcher as well as the guidance all of my mentors – Tom Banchoff and Andy van Dam at Brown and Al Barr, Scott Fraser and Russ Jacobs at Caltech – offered over the years. The colleagues and advisees I've had the honor of working with at Brown have supplied real problems, a truly collaborative environment, mentoring and co-advising and without them, my research would have been completely different."

John Savage Honored with President's Award for Excellence in Faculty Governance

In February, John Savage was presented with the President's Award for Excellence in Faculty Governance. This award recognizes faculty who have made outstanding contributions to the university through their distinguished service on faculty committees, councils and advisory boards. In addition to John, Professor of Physics Robert Pelcovits and Associate Professor of Sociology Ann Dill were also recognized for their service. Each honoree will receive a research stipend of $2,000.

Since his arrival at Brown in 1967, John has worked tirelessly to serve the university. He has served on numerous committees over the years including the following: Faculty Executive Committee (FEC) (Chair, Vice Chair, Past Chair), Faculty Policy Group, the FEC predecessor (Chair, Vice Chair); Task Force on Faculty Governance (Chair); Academic Priorities Committee; Advisory Committee on University Planning (Vice Chair); Faculty Campaign Committee (Chair); Committee on Nominations; Educational Policy Committee (Vice Chair); Campus Planning Committee; Secretary of the Faculty Forum; the President's Senior Staff; Search Committee for VP for Public Affairs and University Relations (Chair); Subcommittee on Organization and Governance of the NEASC Steering Committee (Co-Chair); Planning Committee for the Inauguration of President Ruth Simmons; Working Group on Global Science and Technology; Chair of the Department of Computer Science; Computer Science Curriculum Committee (Chair); Computer Science Industrial Partners Program (Founder and Director); and Faculty Club Board of Governors (President).

"I've enjoyed my service to the university and the department," said John. "The faculty is a self-managed community that requires the willing and effective participation of large numbers of faculty members to be successful. I've been pleased to participate in this process."

Roberto Tamassia Named IEEE Fellow

The IEEE Board of Directors, at its meeting on November 12, 2008, elevated Roberto Tamassia to IEEE fellow, effective January 1, 2009, "for contributions to graph drawing and computer-science education."

The grade of fellow recognizes unusual distinction in the profession and is conferred upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The IEEE Fellows are an elite group from around the globe. The IEEE looks to the fellows for guidance and leadership as the world of electrical and electronic technology continues to evolve.

"I feel honored to be included in the IEEE fellow class of 2009," said Roberto, "and I would like to take this opportunity to thank all my former and current students, research collaborators and teaching assistants."

Roberto Tamassia is professor and chair of the department of computer science and director of the center for geometric computing at Brown University. Over the years, his research interests have included analysis, design and implementation of algorithms, graph drawing, computational geometry, information security, cryptography and computer science education. He has published six textbooks and numerous research articles in the above areas. His textbook on "Data Structures and Algorithms in Java" (coauthored with Michael Goodrich) has had a major impact on the teaching of data structures worldwide, with translations in multiple languages. He is the recipient of a Technical Achievement Award from the IEEE Computer Society for pioneering the field of graph drawing and he is listed among the most highly cited computer science authors by Thomson Scientific, Institute for Scientific Information. His research has been funded by ARO, DARPA, NATO, NSF and several industrial sponsors. He received the Ph.D. in electrical and computer engineering from the University of Illinois at Urbana-Champaign in 1988 and the "Laurea" (M.S.) in electrical engineering from the University of Rome, "La Sapienza" in 1984.

Roberto joins our other four IEEE fellows: Franco Preparata, John Savage, Eli Upfal and Andy van Dam.

Eli Upfal Receives Substantial Faculty Research Grant from Yahoo!

Eli Upfal was recently awarded a substantial research grant from Yahoo! for his research on algorithms for large-scale stochastic data. He intends to develop a theoretically well-founded framework for the design and analysis of algorithms for a number of large-scale web-related applications. The primary efforts of this work will focus on two areas:

1) Computing global properties of dynamic structures, such as efficiently maintaining a close to minimum spanning tree in a network, when edge weights are dynamically changing according to some stochastic process; and

2) Developing and analyzing tools for decision-making in a stochastically changing environment.

In 2006, Eli and collaborator Michael Mitzenmacher (Harvard) were awarded a $100,000 Yahoo! Research Alliance gift for their research in the same area.

Andy van Dam Receives Honorary Doctorate from ETH Zurich

In December 2008, Andy van Dam was awarded an honorary doctorate from ETH Zurich, his fourth such honor. This degree honors Andy's fundamental contributions to research and development of graphics in general and interactive graphical user interfaces in particular. He is also known for pioneering work on multiple hypertext systems, starting in 1967 with the Hypertext Editing System, co-designed with Ted Nelson and largely implemented by undergraduates, and for the use of hypertext systems in the humanities. Andy also co-founded ACM SICGRAPH, the precursor of today's ACM SIGGRAPH, and is the co-author of field-defining textbooks in computer graphics, "Fundamentals of Interactive Computer Graphics" (with J.D. Foley) and "Computer Graphics: Principles and Practice," with J.D. Foley, S.K. Feiner and J.F. Hughes.

"I am most grateful for this tremendous honor, especially from such a distinguished university as the ETH," Andy said. "I owe a huge debt of gratitude to my students and colleagues who contributed so much to my career over the years."

Andy is the second person to ever receive a Ph.D. in computer science, which he earned at the University of Pennsylvania in 1966. He came to Brown in 1965 and was one of the co-founders of the department of computer science. Andy was also the department's first chairman, from 1979 to 1985. From 1996 to 1998 he was a principal investigator and the director of the NSF science and technology center for graphics and visualization, a research consortium including Brown, Caltech, Cornell, North Carolina (Chapel Hill) and the University of Utah. He also served as Brown's first vice president of research from 2002 to 2006.

Over the years, Andy's research has been focused on computer graphics, hypermedia systems, post-WIMP user interfaces, including pen-centric computing and educational software. For more than four decades, he has been working on systems for creating and reading electronic books with interactive illustrations for use in teaching and research.

Pascal Van Hentenryck Receives Doctor Honoris Causa from the Université catholique de Louvain

In October 2008, Pascal Van Hentenryck was honored with a Doctor Honoris Causa from the Université catholique de Louvain in recognition of his fundamental contributions to constraint programming, his remarkable scientific and technological impact in the optimization field and the industrial applications of his research. Along with Pascal, the other recipients of this honorary doctorate include Japan Prize and Nobel Prize winner Professor Albert Fert, Turing Award winner Professor Ronald L. Rivest and National Academy of Engineering member Professor John N. Tsitsiklis

"It is a wonderful honor," said Pascal. "Louvain is one of the oldest universities in Europe and the largest French-speaking university in Belgium. Its engineering school is world-class and its multi-disciplinary center in econometrics and operations research features amazing scientists. The center has been emulated at various institutions in the United States. In the last two years, we have established a close collaboration between the optimization laboratories in computer science here at Brown and in computing science and engineering at Louvain and it is greatly satisfying to witness how this transatlantic initiative catalyzes a spirit of innovation and nurtures a global sense of community and excitement. Students love it."

Before coming to Brown in 1990, Pascal spent four years at the European Computer-Industry Research Center (ECRC), where he was the main designer and implementer of the CHIP programming system, the foundation of all modern constraint programming systems. During the last 15 years, he developed a number of influential systems, including the Numerica system for global optimization, the optimization programming language OPL and the programming language Comet, which supports both constraint-based local search and constraint programming. These systems are described in books published by the MIT Press and have been licensed to industry.

Pascal was previously a professor at the Université catholique de Louvain and a visiting professor at MIT and the University of Marseilles. He holds a Ph.D. from the University of Namur (Belgium) for his work on the constraint programming language CHIP at ECRC.

Pascal is the recipient of a 1993 NSF National Young Investigator (NYI) Award, the 2002 INFORMS ICS Award for research excellence at the interface between computer science and operations research, the 2006 ACP Award for research excellence in constraint programming, best paper awards at CP'03, CP'04, and IJCAI'07 and an IBM Faculty Award in 2004. He is the author of five books (all published by the MIT Press) and of more than 170 scientific papers. Pascal has an H-number of at least 38 in Google Scholar and his first MIT Press book has more than 1,000 citations.

Department Among Most Influential Institutions in Middleware Technology

The department of computer science at Brown University was mentioned as one of the seven most influential institutions in the area of middleware technology in a recent issue of ACM Transactions on Software Engineering and Methodology. According to authors Wolfgang Emmerich, Mikio Aoyama and Joe Sventek, "without researchers laying the foundations in computer science departments at Brown, CMU, Cambridge, Newcastle, MIT, Vrije and University of Washington, and without industrial researchers at Xerox, PARC, IBM Research, HP Labs, DEC Research, AT&T Research and APM consolidating basic research results, contributing them to standards and informing product development departments, we would not have the $8.5 billion middleware market in the same form as we have today."

The department is thrilled to be recognized for our contribution to the field of middleware. Shriram Krishnamurthi was especially excited and said, "this acknowledgement of the department's work is really a tribute to Steve Reiss's contributions over the years, starting with Field. Congrats, Steve!"

Teodor Moldovan Receives Honorable Mention in 2009 CRA Outstanding Undergraduate Competition

Undergraduate student Teodor Moldovan was recently selected for honorable mention in the Computing Research Association's Outstanding Undergraduate Award competition for 2009. The 2009 awards mark the twelfth consecutive year that Brown CS students have been recognized by this competition.

Teodor will graduate in May with full majors in computer science, physics and mathematics. His research focuses on optimization problems and statistical physics methods, especially those that can be applied to computer vision. As a freshman he wrote a paper, along with Michael Black and Stefan Roth, which was accepted at the International Conference on Image Processing.

Teodor's record of service to the department is exemplary. He has been a TA in Michael Black's introductory vision class three years in a row and possesses a deep understanding of the material.

Teodor is also a co-inventor of a method for computing a "super resolution" image of a 3-D object from many low-resolution images (e.g. a human face in surveillance video). An invention disclosure for this work has been filed with Brown and the university has decided to file a provisional patent application on the method. Brown selects very few inventions for patenting and doing so speaks to the importance and quality of Teodor's work.

Directions: The Matrix in Computer Science

By **Philip Klein**, Professor of Computer Science

"Directions: The Matrix in Computer Science" is a new course on linear algebra and its applications to computer science problems. It is designed around a series of labs in which students carry out programming, data-processing assignments and homeworks in which they derive proofs for the fundamental results in linear algebra.

Here are some of the labs. For each, I mention a related application area.

- Geometric Transformations: explore transformations for moving and rotating shapes (graphics).
- Vector Space Document Model: from a corpus of news articles, select the article that is most relevant to a query, according to the cosine rule (information retrieval).
- Perspective Rectification: given a photo of the CIT taken from an angle, synthesize an image of what one wall would look like if taken head on (computer vision).
- Integer Factorization: use a sophisticated algorithm to factor a large integer (cryptanalysis of RSA).
- Error-Correcting Codes: explore use of a concise representation of bits that is resilient to single-bit errors (storage devices, radio communication).
- Eigenfaces: analyze some photos of faces to obtain a heuristic for distinguishing faces from nonfaces (computer vision).
- Latent Semantic Indexing: analyze a corpus of news stories to obtain categories and the words that characterize them (information retrieval)
- PageRank: analyze a corpus of Wikipedia articles to sort them by importance, using the ranking method originally used by Google (web search).
- Image Restoration: using linear programming, restore a noisy binary image (image processing).

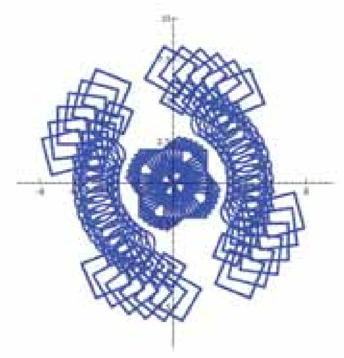
Other applications are discussed in lecture and homework, such as game theory, random walks, graph layout, fitting data to a model (e.g., a line or a quadratic) and a little game called Fiver.

My goal for the course is three-fold:

- to develop in students an appreciation for the variety of ways in which vector and matrix mathematics arise in computer science and related areas;
- to familiarize students with the basic ideas of vectors and matrices(and related concepts such as basis and singular value decomposition) so that they can use these concepts in future work; and
- to ensure that students learn the beautiful mathematical proofs that underlie our understanding of linear algebra, training the students in understanding and coming up with proofs.

The course has no formal prerequisites; it is accessible to any students who are comfortable with mathematics and programming. It satisfies the linear algebra requirement for the Sc.B. in computer science.

I am always on the lookout for more examples of linear algebra. One of our new faculty members, Rodrigo Fonseca, recently provided an example from his work: estimating power draw of individual components in a sensor network node from multiple measurements of total power draw. I welcome ideas from readers of Conduit.



Some rotations of squares in two dimensions

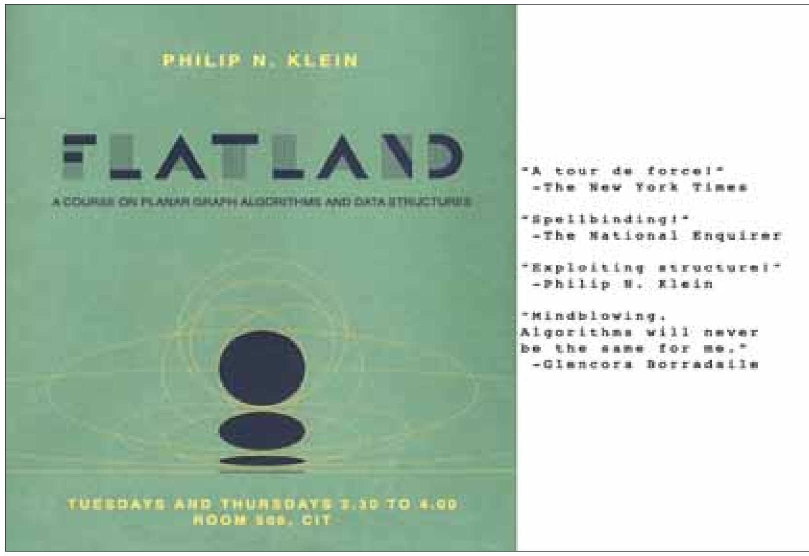
Distinguish faces from non-faces

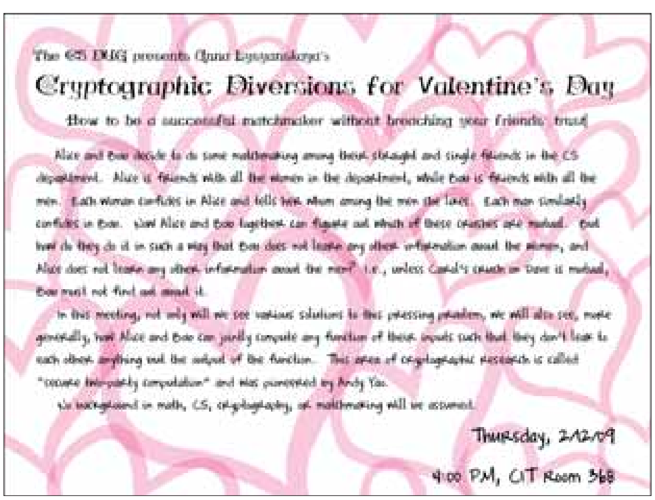
A photo of the CIT and a synthetic image showing one wall head-on

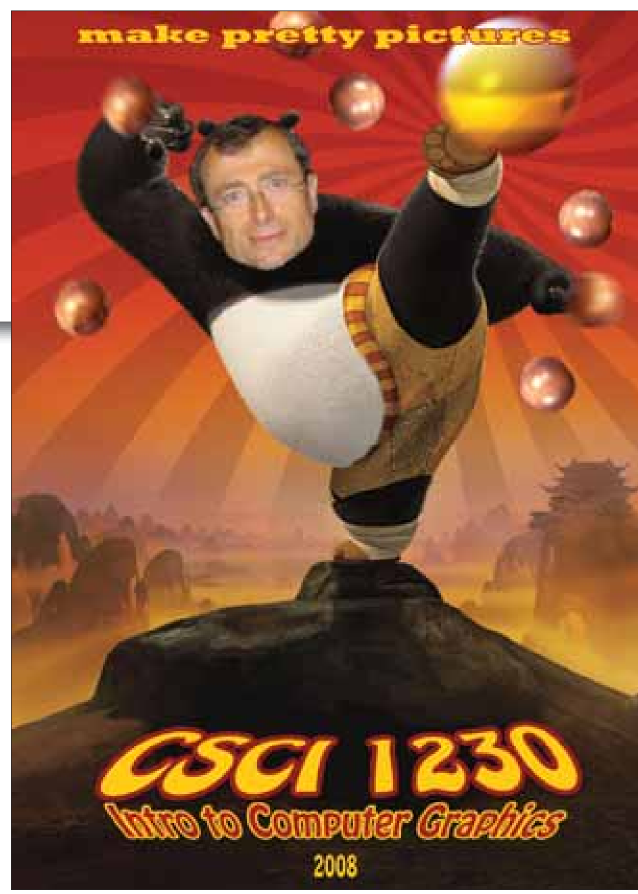
A noisy image and the repaired version

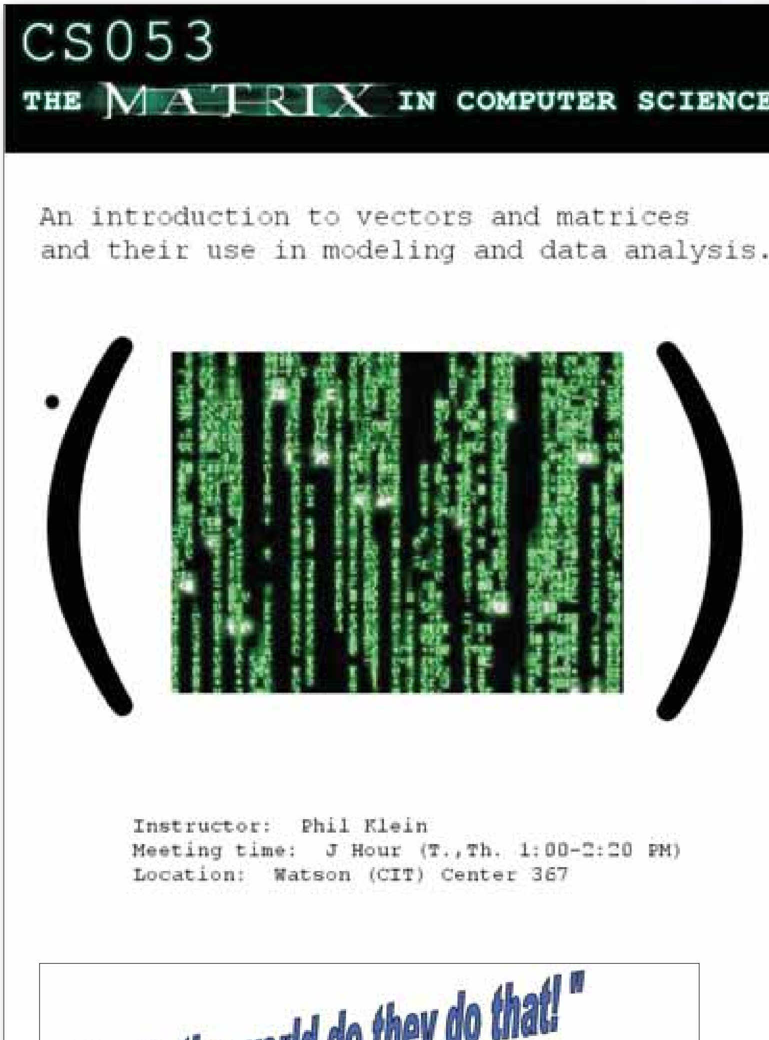
A noisy image and the repaired version

Around the CIT: Course Flyers

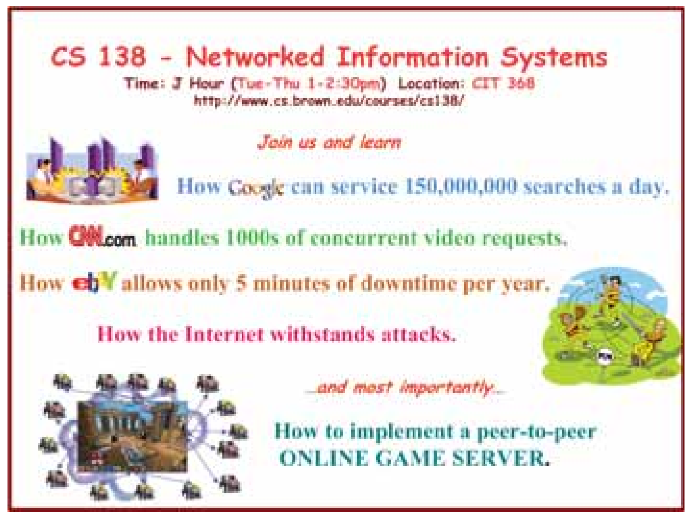


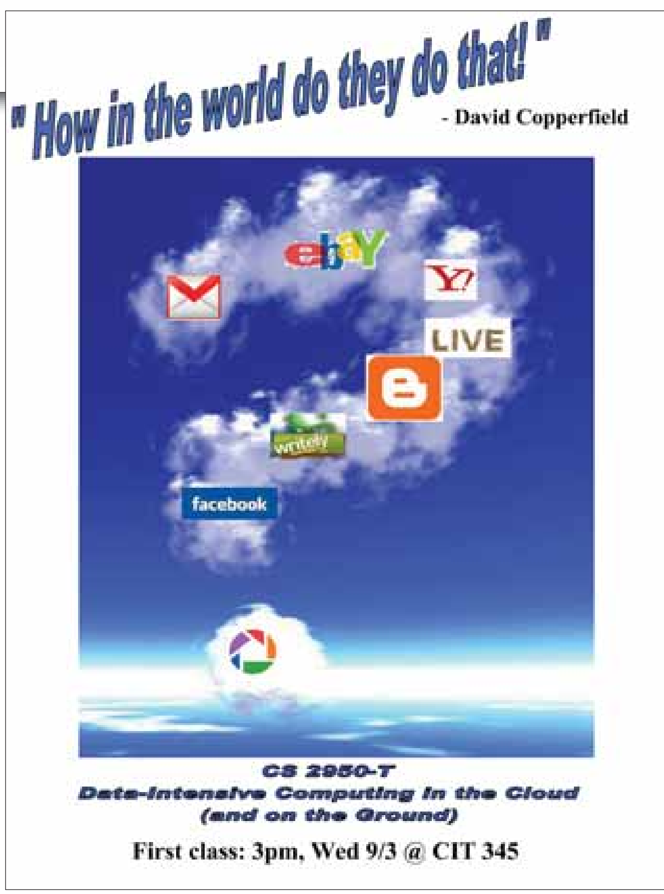





CS053
THE MATRIX IN COMPUTER SCIENCE
An introduction to vectors and matrices
and their use in modeling and data analysis.
Instructor: Phil Klein
Meeting time: J Hour (T.,Th. 1:00-2:20 PM)
Location: Watson (CIT) Center 367


CSCI1250
intro to 3d
computer animation
www.cs.brown.edu/courses/cs125/
Live in the Box...
or Live
Come to first class
Wed 9/3 1:20pm
CIT 367


CS 138 - Networked Information Systems
Time: J Hour (Tue-Thu 1-2:30pm) Location: CIT 368
http://www.cs.brown.edu/courses/cs138/
Join us and learn
How Google can service 150,000,000 searches a day.
How CNN.com handles 1000s of concurrent video requests.
How ebY allows only 5 minutes of downtime per year.
How the Internet withstands attacks.
...and most importantly...
How to implement a peer-to-peer
ONLINE GAME SERVER.


" How in the world do they do that! "
- David Copperfield
ebaY
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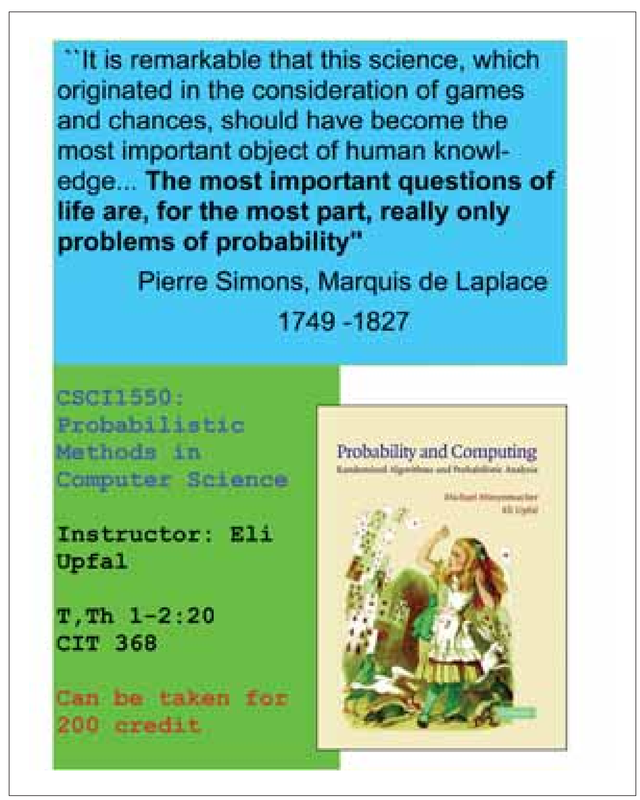
LIVE
writely
facebook
CS 2950-T
Data-Intensive Computing in the Cloud
(and on the Ground)
First class: 3pm, Wed 9/3 @ CIT 345


``It is remarkable that this science, which originated in the consideration of games and chances, should have become the most important object of human knowledge... The most important questions of life are, for the most part, really only problems of probability"
Pierre Simons, Marquis de Laplace
1749 -1827
CSCI1550:
Probabilistic
Methods in
Computer Science
Instructor: Eli
Upfal
T,Th 1-2:20
CIT 368
Can be taken for
200 credit
Probability and Computing

Parenthetically Speaking

By **Shriram Krishnamurthi**, Associate Professor

Taking Down the SciLi

Every campus has a building rumored to be sinking into the ground (usually a library; legend usually has it that the architect forgot to calculate the weight of the books), and at Brown it's said to be the SciLi. If this urban legend were true, it could only improve the appearance of this architectural eyesore.

My concern, however, is not with brick and mortar (and concrete), but rather with the institution. Do we need a science *library*? I can count the number of times I've been to a library at Brown. Most trips have been to borrow from the history stacks in the Rock. I've used the lovely new meeting rooms in the basement of the SciLi as well as the cafe on its ground floor; but I couldn't even tell you what floor the computer science collection is on.

I wasn't always so apathetic. My first Ph.D. advisor was a wonderful scholar named Alejandro Schäffer, who organized a competition based on a sort of treasure hunt through the library collection. My memory tells me that I entered and won the contest, but may have been helped by being the only contestant. Nevertheless, I've clearly fallen far.

How did this come to pass? I think it's because of how we select library books. We still do buy computer science books in the SciLi, and at a fairly liberal clip. These books have been selected, fittingly if somewhat obscurely, by purchasing bots. Our new computer science librarian, Lee Pedersen, has taken the extraordinarily sensible step of halting this.

As an aside, Lee is doing a remarkable job of outreach. She has initiated a program called Librarian in the Lobby (which she's been doing for years with engineering). She spends an hour or two every week in the middle of the third floor atrium, nameplate prominently visible, happy to talk about any library matter. She's smart, knowledgeable and eager to engage in discussion; she's also not afraid to provoke. As a result of her presence, the library feels far less remote as an entity.

One of the things I learned from Lee is that we have a considerable but unspent budget for books, especially now that robots are no longer doing our work for us. What books would we like bought? Would we give her a list?

Spike and I discussed this and realized that having a library order books for us was the wrong solution to the wrong problem.

One problem we have is in getting books we need for active research projects. When we need them, we really do need them *now*, not a month or two weeks or even a week from now. If the library has them, that's great – we walk over and check them out. But much of the time, the library doesn't have them.

Even more compellingly, there's the case of adventitious discovery: going to a bookstore, conference or even tech fair, finding an interesting volume, but not being able to take advantage of that physical proximity. (In fact, I do of course buy such books, which then reside in my private stacks – not the library's.) We therefore proposed the following, which we know will help *us* in such situations and hopefully others and the library itself.

We proposed that the library consider letting professors more proactively participate in purchasing. The scheme is utterly straightforward: if we find a book that we believe is useful, we purchase it directly. If we believe the book is of use to the library, we offer the book in return for reimbursement of its cost.

This proposal is simplicity itself. That hides its true nature, which is that it's a remarkably daring suggestion. Libraries are not in the business of accepting books from third parties (except as gifts, which are carefully managed). The idea that I would just walk over and hand them a book and be reimbursed for it must sound daft. But is it really so bad?

Is content control a problem? Presumably, there are few books that I would ask the librarian to buy that she would actively refuse to purchase. The handful that might be rejected – like the complete works of Robert Ludlum – the library can reject anyway.

Is book quality a problem? It's true that I might walk over with a book that is stained with delicious Indian pickle. But actually, I can just as well stain a book the library has purchased and it is rarely the wiser for it. And anyway, the library can refuse to take a book that features my paw prints.

Is money laundering or theft a problem? It certainly would be if I bought a book on the cheap but asked for the list price. The simple solution to that is to only reimburse what the receipt says. Monetary incentive small enough makes it not worthwhile to actually perpetrate fraud. (And anyway, professors are trusted with much bigger receipts when it comes to spending off grants.)

Is runaway cost a problem? Easy: limit each faculty member to some fixed amount of such books per year. A limit of $200 or so still enables the purchase of several technical books. (The current budget would support even doubling that amount per faculty member.) It's even possible to reward good buying by increasing the limit.

Are frivolous purchases a problem? Yes. But the library can simply reimburse a little shy of the full cost: take off either 10 percent, or a flat rate ($5?) or, very simply, the cost of shipping. This last option is particularly appealing: if a book is important enough to me I can pay for overnight shipping, which gives me immediate access to it, but there's no reason to pass that cost along to the library.

There is some cost to the library if the books are delivered by hand – they have to key in the book's electronic record. This amount, which cannot be much (the cost of a little of a work-study's time), can be deducted from the book's reimbursement per the proposal above.

The most important benefit is that this gets books in the hands of people who need them – fast. There is no point to a book lingering in transit or waiting in the library to be catalogued while the person who wants to read it twiddles her thumbs. Similarly, for many books there is no real advantage that traditional purchasing channels offer; indeed, some of the books I care about are designed specifically for quick procurement online, not through academic purchasing channels.

Again, it sounds extraordinary to have professors buying books for the library, but I contend it's actually an awfully boring suggestion: professors already *do* buy books for the library. We just happen to do it through a process that ends up adding weeks that offer no tangible immediate value to the one person on campus who actually wants the book. This proposal (a) trusts that most professors will do the right thing and (b) limits the damage of the few that aren't worthy of that trust.

What's not to like? Not much, other than that it's likely to be far too radical for Brown. What does the library think of it? I don't know, but I expect we'll find out, because we sent them this proposal last month. Watch this space...or better still, watch the SciLi. If this plan works, I might just order books by weight.

Distinguished Lecture Series

The department launched a Distinguished Lecture Series this academic year on topics of broad interest given by prominent computer scientists from academia and industry. The 2008-2009 Series included five lectures that were well attended by faculty, graduate students and undergraduate students. Included in this series was the annual "Kanellakis Lecture," which honors Paris Kanellakis, a former faculty member who died in an airplane accident in 1995. We believe that the Distinguished Lecture Series will enrich Brown's academic environment and enhance its stature as a leader in computer science.

Thursday, September 25, 2008

Martin Rinard
Department of Electrical Engineering and Computer Science, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology
Title: Simple Techniques for Eliminating Fatal Errors in Software Systems

Thursday, October 16, 2008

John Maeda
President, Rhode Island School of Design
Title: Simplicity is Complex

Thursday, December 4, 2008 – Kanellakis Lecture

Anna Karlin
Department of Computer Science and Engineering
University of Washington
Title: A Survey of Some Recent Research at the Border of Game Theory and Theoretical Computer Science

Thursday, February 26, 2009

Michel Goemans
Department of Mathematics
Massachusetts Institute of Technology
Title: Approximation Algorithms

Wednesday, April 29, 2009

Daphne Koller
Computer Science Department
Stanford University
Title: Probabilistic Models for Complex Systems: From Cells to Bodies

Recent Ph.D.s

Recent Ph.D. Thesis Defenses included Yanif Ahmad and Olga Papaemmanouil

Olga Papaemmanouil

Yanif Ahmad

Alumni Update

Haley Allen '06 (now Haley Samale)

50 Washington St. Apt. 33
Santa Clara, CA 95050
haley.samale@gmail.com

Haley and Marcus Samale's wedding

Marcus Samale '05 and I were married this past summer in San Diego, my hometown. The wedding was held on a pristine day by the bay, with both sailboats and the city as the backdrop. We were pleased so many CS Brown alumni could join us in celebrating, including bridesmaid and old roommate Lucia Ballard '06 and groomsman Dan Heller '07. A month later, we honeymooned for a week in gorgeous Nuevo Vallarta, Mexico. Hurricanes nearby didn't prevent us from enjoying the beaches and great food, and we even managed to get a pretty great tan (the first for me since I went into computer science). In addition to planning our wedding, since I graduated, I've been working at Apple in a small group on the calendaring application, iCal.

Oran Bodner

Hello again! My last letter to Conduit was in the spring 1994 issue – maybe it's time for another update. Let's see. I left you when I was working at Intel, I think. I moved from there to Microsoft, which seemed to be the natural move at the time. It was a good time to be there - lots of perks for employees (e.g., weeklong trips to Club Med with the whole family), real cooperation and research among the employees and yes, the stock options were worth something too. I spent 8 years there during which time my options grew (and then shrunk) but towards the end it became like any other large company, with few perks and more competition, even among the staff.

The past few years I've spent at home, traveling and spending time with my family (I have 5 kids). I've been writing a book on and off too. It's about life, travel and science but I can't decide whether or not it should be fiction. Watch this space – should be published any decade now!

I also still do a bit of coding here and there – can't get away from it. About a year ago I installed a (relatively) new compiler at home and have been doing some web programming, producing a new website every 2 or 3 months, working solo, which I like, but sometimes I miss the exchange-of-ideas-water-fountain.

Here are some of my sites from the past year that may be of interest to some of you:

- http://relayswim.com is a tool for swim teams (2 of my kids are swimmers)
- http://whenholiday.com (lets you mark multiple country holidays and then add your own dates)
- http://orgthat.com is an exercise in tree-structures (for company org-charts, family trees, stamp-collection, software classes, etc.)
- http://hop2home.com (a different kind of customizable home page)
- And, my latest (still is progress) – http://villagedir.com (yet another people-finder, where you can look up anybody and leave them a message; it was inspired by the Mrs., who observed that while one can look up the phone number and address of anybody, there is no general directory for getting somebody's e-mail address; we thought about that a bit and decided nobody would really want to give the world their e-mail address (we get too much spam already), but a message center where we can view our messages when we want to is pretty harmless; so I put it together using SQL, which is nice because it lets you search and sort on any field: birthdays, schools, etc.)

I believe I encountered SQL for the first time under Steve Reiss's guidance when I did my master's at Brown back in 1981. Steve had a database he called 'eris' (is it still around?) and I added a GUI. I house-sat Steve's house for a week – almost killed his violets.

So there it is – a message center directory for the whole global village (hence the name villagedir). The only catch, of course, is that now we have to convince the whole global village to register. So if each of you can get, like, a billion of your friends to sign up, we'll be in business...

Michael Frederickson '08, now a Technical Director at Pixar Animation Studios, poses with the Oscar Wall-E won for Best Animated Feature. Andrew Stanton, the writer/director of Wall-E and Oscar recipient, is on the right.

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Brown University
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Providence, RI 02912
USA

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Organization
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Ping!

First Name

Last Name

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Where are you and what are you doing?

Let us know what's happening in your life! New job? Received an award?
Recently engaged or married? Use this form to submit your news or e-mail conduit@cs.brown.edu.

My news:

Mail to: Conduit, Department of Computer Science, Brown University, Box 1910, Providence, RI 02912