The Newest Face on the CS Faculty

The Computer Science Department welcomes Dr. Anastasia Kurdia, who will join the department in the Fall 2012 semester as a Visiting Assistant Professor. In her own words, she describes her path to computer science and teaching in a liberal arts institution like Bucknell.

Steve Jobs once said, “You can’t connect the dots looking forward; you can only connect them looking backwards.” This is definitely true for my journey in CS.

I obtained my undergraduate degree from Belarusian State University in Minsk, Belarus. As a high-school graduate, I had a very vague idea of what career I would like to pursue; two occupations I considered were cell biologist and dance teacher. My parents, both engineers, insisted that I major in applied mathematics and computer science – subjects that I found really difficult to like. I could barely see the connection between the abstract mathematical notions and ancient computer languages that we studied, and the rest of life, in which few people would care (or afford) to have a computer at home, where email was rare, and you could eat your breakfast in the time it took to connect to the Internet. I did well in my courses grade-wise, but for most of my undergraduate life, I was a much better cheerleader than I was a coder. That changed in my last year when I started working as a database developer for IBM’s subsidiary in Belarus. Suddenly I could see how knowing archaic languages and technologies enables me to learn modern ones very quickly and how my experience in analyzing abstract problems allows me to develop an analytical approach to a problem from any subject area. It felt amazing to realize the power of the education I had received and of the tools that I possessed in my hands. The moment of enlightenment came when I got to work with a brute-force solution implemented in a legacy system that took several hours to process seven million database entries, and I would design and implement a simple intelligent solution that worked in an eye blink. I’ve been passionate about computers and computing science ever since.

Continued on page 10

Alumni Column

“How I’ve applied my Bucknell education”
Jonathan Cabelly CSE ’89, Principle at Capgemini

Okay, okay! I must admit, I’ve never actually been challenged with a new problem for which I’ve had that “Aha” moment and could use that Freshman CSCI 204 algorithm I wrote to solve “The Tower of Hanoi” problem. And, if you are at all like me, there are probably many situations over the course of your career that have caused you to look back and ask “Do I apply what I learned during my four years of college in situations today? Did I (or really my parents I should say) get the value of my Bucknell education?”

Although some of the concepts may have appeared too abstract or theoretical at the time (and at times a bit pedantic), the fundamentals that I learned in my core courses – mathematics, computer science, sciences, and engineering – coupled with my homework and lab assignments all provided me with a foundation in basic, structured problem decomposition and analysis. Bucknell helped marry these skills with written and oral communications often times working collectively in small groups. These further helped to prepare us for new situations.

My Bucknell engineering education has given me the raw materials and tools that I have been able to apply a variety of factors to challenging situations I have faced over the years – preparing me well to adapt to new situations and solve new problems along the way. Let me share with you some valuable things I’ve learned and observed on how I apply my Bucknell education on every new situation that I have faced:

• “You can’t boil the ocean!” – Perform problem analysis and decomposition - Decomposing big problems into manageable “chunks” (in an organized manner) is crucial – You will find the most successful engineers have the innate ability to consistently do this (almost to a fault, but we’ll save that for another day).
  • “I can’t be the first one to have worked on this issue.” – Often, many people have worked to try to solve your very same problem before you have. Leave your ego at the door and Google to see if others have traveled the unchartered waters before you.
I then wanted to learn more computing, and graduate school emerged naturally as the next waypoint. I joined the Computer Science program at the University of Texas at Dallas to work in computational geometry. Computer applications often use primitive geometric shapes - points, lines, spheres, convex hulls, and so on - to represent the objects that they are manipulating. Turns out that through utilizing the information about the geometry of the objects involved, one can design more efficient algorithms and data structures for storing and manipulating those objects. For example, a classical Dijkstra’s algorithm of finding the shortest path between two points fails when we try to use it for a moving vehicle that cannot make arbitrarily sharp turns. I fixed this problem by using computational geometry methods to design an efficient algorithm. Interestingly, biological and medical computer models can also greatly benefit from employing geometric tools, and here my love for molecular and cell biology came in handy. I could utilize my geometric tools in the domain area that I liked: I worked on analyzing the networks of protein interactions with methods that were originally developed to study interactions on Facebook. Also, I was developing a geometric model of individual protein molecules. The latter topic became the focus of my postdoctoral work at Smith College.

It was at Smith where I discovered and fell in love with the liberal arts system of teaching and learning. I found joy in connecting with intelligent, balanced and curious individuals that my students were, and realized that I truly wanted to concentrate on teaching. So my next step was clear: I went on to teach introductory and upper-level courses Keith Buffinton (Dean of Engineering), Margot Vigeant (Associate Dean of Engineering), and Xiannong Meng (Computer Science) led a group of 21 engineering students of different majors to China in May for a three-week session of the course ENGR 290 Engineering in a Global and Societal Context. The class visited four types of sites: (1) industrial sites such as GE and IBM; (2) universities including Southeast University and The Science and Technology of Electronics University of Chengdu; (3) cultural sites such as the Great Wall and the Terracotta Warriors; and (4) engineering sites such as the National Stadium (Bird Nest) and Three Gorges Dam. The entire trip encompassed seven cities and covered more than 4,000 miles of travel.

The class visited a number of companies from different technical fields. The list includes DuPont, Air Products, IBM, Lenovo, HP, GE, and AECON. As a consequence of visiting the companies, we learned how international business operates in China. For example, GE expends a lot of effort in converting very sophisticated technology into something that is less expensive that can be used by people living in China’s rural and less developed areas. The personal experiences presented by mechanical engineering alumnus, Ryan Sheinbein of HP in Tianjin, were particularly enlightening in terms of how an American graduate can move to China and work for an international company such as HP.

Our exchanges with Chinese college students were very informative and eye-opening. At Southeast University, we visited their classrooms, cafeteria, labs, libraries, and dormitory. Bucknell students and SEU students were paired up to have open discussions on all aspects of student life including what they study, how they spend time outside the classroom, and much more. In the end,
Continued from Page 10 **ENGR 290 Trip to China**

Both groups of students understand more the similarities and differences between the two cultures, especially those in higher education.

Seeing first hand such great historic sites as the Great Wall and the Terracotta Warriors was breath-taking! Many students remarked that they had dreamed of visiting the Great Wall starting when they were little, and now they were actually standing on top of the wall! If the Forbidden City, the Great Wall, and the Terracotta Warriors represented some of the Chinese historic engineering marvels, the National Stadium (Bird Nest), the National Aquatic Center (Water Cube), the Grand National Theatre of China, and Three Gorges Dams on the Yangtze River that we saw represent examples of great accomplishments of modern Chinese engineering.

We enjoyed experiencing Chinese culture. Students learned to buy items from street vendors using haggling techniques learned during the trip; they interacted with locals in the street and in the restaurants by a mixture of limited Chinese vocabulary and hand gestures; they tasted Chinese cuisines of many varieties from Peking duck to hot-pots. On our travels through the country, we had a variety of experiences: the excitement of riding on high speed trains traveling at 300 kilometers per hour (180 mph); the different and sometimes very strange foods served on airplane flights; the frustrations of sitting on buses in very crowded city traffic; the fun of spending one day and two nights on a Yangtze River cruise ship while traveling to the Three Gorges Dam.

This summer’s ENGR 290 course was a huge success and a great learning experience. We all learned so much from the course. We now better understand Chinese culture and Chinese engineering and appreciate the similarities and differences between ours and their culture.

**Semester Teaching in China**

Professor Steve Guattery

I spent nine weeks of my sabbatical this past semester teaching undergraduates at Southeast University in Nanjing, China. It was an interesting, challenging, and rewarding experience.

In April 2011 a delegation from Southeast University (SEU) visited Bucknell and gave a presentation about plans for changing engineering education in China. They were interested in having Bucknell faculty members teach at SEU. I had a sabbatical coming up, so I expressed an interest. With the help of department member Xiannong Meng I was able to arrange to spend eight weeks at SEU to teach two courses, Computers in Society and Advanced Algorithms.

Southeast University is much larger than Bucknell. It has 20,000 undergraduates who live and learn on a new campus about eight miles from downtown Nanjing. Many of the students study technical fields. The campus is very large and spread out, and new buildings are continually being added.

Teaching at SEU presented many challenges to an American professor. My Computers in Society class was twice the size of the section I taught at Bucknell. Chinese students were not used to the interactive way in which I taught the class. Getting students to participate in classroom discussions was further complicated by language problems. I taught in English. My students all spoke English; some were nearly fluent, but others had considerable difficulty. I also had limited background in the legal and social issues related to computers in China, though I had made an effort to read up on those topics before I went. The Algorithms course was a little easier in that the course material was more mathematical, and there was a Chinese edition of the textbook. Still, it also presented challenges.

SEU classroom facilities were good, though the technology tended to be a generation or two behind our Bucknell facilities. My classroom had a computer and projection screens so I could put up slides of my course materials. That was especially important because I was teaching in the students’ second language.

My academic experience at SEU was valuable, especially in putting me outside my usual environment. In spite of the difficulties I was able to find ways to make the courses work. In Computers in Society I came up with a number of group exercises and assignments that encouraged class participation. In the end my classroom experience was strongly positive.

Continued on page 100
I also enjoyed learning about China outside of the classroom. Language was a particular problem because few people outside of the university spoke much English. I was lucky to have taken the first semester of Chinese at Bucknell. While my language facilities were limited, I was able to communicate some basic things, and I could read and recognize characters enough to find my way and order meals (always important!).

I found that, while the culture is strongly and distinctively Chinese, there is a growing Western influence. It is easy to see American movie trailers and find fast food restaurants like KFC and Pizza Hut. Several students told me their favorite TV show is “The Big Bang Theory”. And many of my students were working hard for the chance to study in the U.S. – GRE review books were everywhere.

Overall I had a great experience, and would happily do it again.

Bucknell Hosts Programming Contest

Professor Lea Wittie

Bucknell’s Student Chapter of the Association for Computing Machinery (ACM) hosted the sixth annual Bucknell Spring Programming Contest on Saturday April 14th, 2012. Three area schools participated: Bucknell University, Susquehanna University, and Bloomsburg University. There were four teams in the expert division and four in the novice division (students not yet in their third year).

Students win items for each problem correctly solved. This year’s theme was Spies so teams sported fake teeth, glue-on mustaches, and other spy gear.

In the novice division, the winning team of Stephen Prescott ’15 and Jesse Rittner ’15 from Bucknell solved all 7 problems.

In the expert division, Bucknell team Awesome (Sean Cheetham ’13, Michael Ragusa ’13, and Andrew Rahimi ’13) took first place with 2 problems solved and Bucknell team Gateway Pharmaceuticals (Conrad Buck ’12, Adam Tran ’12, and Martin Tsvetkov ’13) took second place also with 2 problems solved in a slightly longer time. Other Bucknell students receiving honorable mentions were Andre Shields ’12, William Stratton ’15, and Anthony Carno ’15.

Lewisburg PA App Developed by Class

Professor Rick Zaccone

The Lewisburg Downtown Partnership (LDP) is a non-profit organization whose mission is to promote downtown Lewisburg. Linda Sterling, director of the LDP, approached me in the summer of 2011 about writing an iPhone app for downtown Lewisburg. I was about to teach Computer Science 479 (capstone) in the Fall and decided this would make a good class project.

Linda wanted an app that would take information from the Lewisburg web page (lewisburgpa.com), and display it in an easy-to-use fashion on the phone. Using an agile development process, the students began by creating mock-ups for the program until we found a design that Linda found aesthetically pleasing.

Identifying the information the app should display was not difficult, but deciding how to keep the information current was a challenge. The students decided to create a client/server architecture. The server consists of several PHP scripts that run every night gathering information from the Lewisburg PA website. These scripts turn the information into XML files which the app can read quickly when it starts up. Thus, the application updates itself every time you use it.

There were just eight students in the class. Two worked on the server software, and the remainder of the class worked in pairs on the app software, each pair focusing on a different feature of the app. We would meet with Linda weekly and show her what we had done. We
Continued from Page 100  Lewisburg PA App

would note the changes she wanted and then decide what new features we would implement in the upcoming week. This agile process worked beautifully. We were always able to respond to any changes in how the app should work.

The six students working on the app used Xcode, Objective-C and other tools provided by Apple to develop their software. Apple also makes manuals and lots of sample code available.

The students tested the software with iPod Touch loaners that they borrowed from Library & IT. Some had family members do additional testing for them.

The end product was a robust app that automatically synchronizes with Lewisburg PA website. In the six months that it has been on the App Store (it’s free), there have been no crashes and just one bug reported which we have fixed.

If you would like to try the app, download Lewisburg PA from the App Store.

New Changes to CS Core Curriculum

Professor Dan Hyde

Over the last two years, the department has investigated and developed several significant revisions to the core sequence taken by all computer science majors. One significant change implemented last Fall was a major revision to the first course in the core CSCI 203 “Introduction to Computer Science I.” This new version was first taught by Professors Dan Hyde and Rick Zaccone.

CSCI 203 is no longer a traditional programming course in Java but a broader introduction to computer science in which the students explore computer science’s “Big Questions.” These Big Questions include the following: What is computer science? Why is computer science not equal to programming? How to represent data? How to structure data? What’s under the hood of my laptop? Are there well-defined computational problems that we can't compute? What are ‘hard’ computational problems and why are they important? What are the minimum features I need to program? Does the programming model I use influence the solution?

To answer the last question, the students learn and practice three programming models (functional, imperative, and object-oriented programming) using the programming language Python. By the end of the course, students can answer the last question in the previous paragraph with a resounding “Yes, the functional model usually produces more elegant and easier to understand solutions!”

For the “What’s under the hood of my laptop?” question, students explore machine organization for several weeks in the middle of the course. They are introduced to digital logic circuits and a simple register-level model of a computer (HMMM). Students program in HMMM’s very basic assembly language to understand the fetch and execute cycle, loads and stores, branching, activation stack, and calling a function. Students learn that characteristics of the imperative programming model are historically based on assembly language, e.g., imperative's loops are based on branching; and imperative's updating a variable in place is based on updating a register.

A two-week section on computer science theory ends the course. The CS Faculty and students are excited with the new version of CSCI 203. The students find the course demanding but a good introduction to computer science as the course title suggests.

In Spring 2012, Professor Lea Wittie taught a revised version of the second core course CSCI 204 “Introduction to Computer Science II.” Students continue to use the programming language Python they learned in CSCI 203 and the study of computational solutions with an emphasis on how to structure the data of the problem. For many problems, the essence of a good solution is using the proper data structure. The course studies and uses programs the standard data structures of lists, stacks, queues, and trees. These data structures give useful abstractions on which to build applications.

Another significant change in the core curriculum is the introduction of a new course CSCI 205 “Software Engineering and Design” taken in the sophomore year. Professor Brian King will teach CSCI 205 for the first time in the Fall 2012. This course introduces the student to the discipline required to build mission critical, large-scale software. Students will gain a solid understanding of the differences between small and large projects. They will learn about popular software engineering models that are used in industry today that take a software system from concept through completion. Software design models will be emphasized, with a large focus placed on object-oriented design models. They will experience the software engineering process through the development of a large, team-based project in Java. Throughout their project the students will use software development tools used in industry today for development and testing.

Also, we plan a revision of the systems sequence CSCI 206 “Computer Organization and Programming” and CSCI 315 “Operating Systems.” The two courses will be reorganized to reduce redundancies, to provide a better sequence for the introduction of concepts (e.g., we now discuss a full-blown virtual memory scheme before the process model has been studied), and to focus these courses more on how these topics affect software developers. The bulk of the concepts from these courses will be retained, though some technical topics more suitable for hardware developers will be reduced or dropped from CSCI 206. This material will be covered in CSCI 320 “Computer Architecture” instead. In addition, CSCI 206 and CSCI 315 will use a systems programming language such as C. These changes will give graduates a better understanding of the practical application of systems concepts and will support our goal of making our students better programmers.

The faculty of the department is enthusiastic about the changes to our programs, and we look forward to putting more pieces of the new curricula into place.
**Computer Science Open House**

In order to increase the yield of computer science majors in the admissions process, the department initiated a “CS Open House” on Friday April 20, 2012, for students who were admitted to Bucknell but who had not decided where to attend college. To make it convenient for the admitted students and their parents, we chose the afternoon before Bucknell’s campus-wide “Open House for Admitted Students.” The potential CS majors in the class of 2016 were able to attend several CS classes, eat lunch with CS faculty and students, participate in a hands-on lab on wireless networking, attend several faculty and undergraduate research talks, and chat over an ice cream sundae.

The department and the potential CS majors all thought the Open House was worth while.

**Matt Segar Wins Miller Prize**

Matthew Segar ’12 won The Harold W. Miller Prize for his Honors Thesis entitled “Utilization of Probabilistic Models in Short Read Assembly from Second-Generation Sequencing.”

Matt’s thesis advisor was computer science professor Brian King. Matt plans to attend graduate school in Bioinformatics at Indiana University-Indianapolis.

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**Class of 2012**

Back Row (Left to Right): Adam Tran, Mary Elizabeth Matthews, Conrad Buck, Billy Reed, Marc Burian, Rick Engelberg

Front Row (Left to Right): Emily Ehrenberger, Susanne Winkelman, Charles Frederick, Matt Herman, Aurimas Liutikas, Matt Segar

Not Pictured: Brandon Besant, Kat Folger, Alysha Hooper, Zach Mady, Andre Shields, Sarah Stork, Nick Urban