Surveillance networks

Seth Hutchison (EECS) and Steven Liddle (Computer Science). Hutchison’s expertise is in aerospace systems, autonomous systems, and robotics, including control of robots and high performance aerospace vehicles and formation-flying UAVs/MAVs and spacecraft. Hutchison's interests are in robotics, vision and artificial intelligence, while Liddle is interested in the design of planning algorithms, mainly on problems involving continuous spaces, complicated geometric constraints, differential constraints, and/or sensor uncertainties.

Magnus Egerstedt, professor of Systems and Controls in the Georgia Tech School of Electrical and Computer Engineering, will work with the Illinois group. His interests include hybrid and networked control, with applications in motion planning, control, and coordination of mobile robots.

In a related project, Voulgaris and Associate Professor Julian Stipanović recently received a 3-year grant from the Qatar National Research Fund to develop methods for safely coordinating networked vehicles. The overall grant is $950,000, with $530,000 committed to CSL research.

Researchers will work on developing algorithms that will guarantee safety in the presence of physical, collision avoidance and information limits, and they will make the technology robust to communication uncertainty.

Safe and reliable multiple vehicle systems can be applied in numerous ways to benefit the oil and gas industry, making this technology important to Qatar’s growth in that industry. This technology could be used in patrolling robots that sense dangerous leaks, such as methane gas, or in fire extinguishing, coordinated oil spill clearing and field coordinated surveillance.

This project, titled, “Smart Systems for Field Monitoring and Surveillance,” will be done in collaboration with Professor Hamoud Karboul at Texas A&M University in Qatar. CSL researchers will focus on the methodologies and techniques, while Texas A&M Qatar will design and run the experiments.

Voulgaris said that the project is a “collaboration in a field that’s new to us and can lead to further collaborations in bigger projects.”

The proposal presents a complex problem of using a large network of decentralized autonomous agents with various sensing capabilities to work together to provide a massive amount of data. The scientists must also take into consideration uncertainties, including potential sensor and communication link errors.

“We consider multi-autonomous systems tasks with minimal information so that the complexity is reduced and we can deal with the massive amounts of data. The present amount of data is too much to accomplish the coordination task,” Voulgaris said.

Voulgaris’ research interests include robust and optimal control and estimation, structured and distributed control, networks and control, and applications of advanced control and estimation methods to engineering practice.

Voulgaris will be working on the project with fellow CSL researchers Soon-Jo Chung (Aerospace Engineering), Peter Van Valkenburg (Electrical & Computer Engineering), and Mike Helenthal, U of I News Bureau; Elise King, CSL; and Susan Mumm, Aerospace Engineering.

Comments and suggestions are welcome. Please visit the new CSL website.

www.cs.illinois.edu/itii
When most people watched the London Olympic Games this summer, they focused on the unfolding competitions, or on the country’s team. Information Technology Institute researcher Raymon Fouché focused on something else: the role technology is playing in the field, and the extent to which technology is determining the outcome of the game—even reshaping the very nature of sports.

Fouché, who is an associate professor in the Department of History at Illinois, has been studying the impact of technology on sports culture. He has considered everything from the practical problems faced by governing bodies that must rule on which equipment is permissible, to the deeper questions raised by technologies that influence outcomes to the point that they threaten sports’ inherent appeal. If sports are competing not just against one another, but against technology, what are the consequences? In a new era that requires boards to be sophisticated about technology, athletics was seen as a laboratory, and having a coach often was seen as problematic; even training itself was seen as unsettling. You were supposed to win, but not try too hard to win. Times have certainly changed, especially over the last thirty years, which have seen the transformation of sports into a high-stakes, large-scale corporate enterprise.

It is impossible to compete in contemporary sport without the support of modern advances in science and technology. Technologies now exist that are powerful enough to dramatically influence the outcomes of sporting events. For example, where does the sports world draw the fine between performance-enhancing substances and legitimate medications that athletes might need in order to treat medical conditions? What does it mean for a competition if a new technology is available only to a subset of the competitors? The problem is far from hypothetical. Fouché notes the example of the polyeuthane Speedo LZR swimsuits, which marked the culmination of over 10 years of research on “fastskin” suits. Eventually, they hit a technology that made a preposterous leap at a crucial historical moment; he observes—and that moment happened to be just before the 2008 Summer Olympics in Beijing. Those three records were broken in the same suit without a week of its launch, and the Olympic results spoke volumes: summer swimming LZR suits won over 98% of the medals at Beijing. The problem? Most of the Olympic competitions didn’t have the suits, which were only given to swimmers sponsored by Speedo. Companies had contractual obligations, so their suits had to come from other manufacturers. Fouché explains, “Some athletes were actually borrowing swimsuits from their competitors to compare.”

Fouché is writing a book that will explore the impact of technology on sports culture, projected for publication in the summer of 2013.
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“Seventy-five years ago, a small group of dedicated scientists or even the competitors themselves designed and constructed athletic equipment,” Fouche observes. “In the early 20th century, athletics was seen as a linear activity, and having a coach often was seen as problematic; even training itself was seen as ungentlemanly. You were supposed to run, but not try too hard to run!” Times have certainly changed, especially over the last thirty years, which have seen the transformation of sports into a high stakes, large-scale corporate enterprise. “It is impossible to compete in contemporary sport without the support of modern advances in science and technology.”

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Fouche and his co-workers, including CSL researchers Soon-Jo Chung (Aerospace Engineering), Seth Hutchinson (ECE) and Steven LaValle (Computer Science), have been making the leap between learning and the real world for more than six decades. Former UIUC President Joseph Nevins said of Van Valkenburg: “One of his greatest gifts was to be able to tap into and set free the innate desires of every individual to learn and to lead.”

Our hope is that our readers will see that literature as a place that can be a forum that fosters a similar passion for learning in their lives. We are grateful to Van Valkenburg for being such an outstanding role model and will work to uphold his timeless legacy.

William H. Sunder
Microscope Probe-sharpening technique improves resolution, durability

A new technique for sharpening microscope probes that researchers can use to improve the quality of the images they capture is earning Congratulations for CSL’s Professor Joseph Lyding, a professor of electrical and computer engineering, who led a group that developed this new technique. The technique is described in a recent paper published in the journal Nature Communications.

Scanning probe microscopes are used to analyze the surface structures of a wide variety of materials, from biological cells to computer parts. To create good images, the tips of the probes must be as sharp and flat as possible.

Professor Lyding’s group came up with a new approach that would reduce the risk of damaging the tip during the sharpening process. They also found that using a radio frequency voltage to the tip to deface the incoming ions when a voltage is applied to the tip helps to sharpen it.

“Both efforts were very valuable to us,” Professor Lyding said. “The new technique is more robust than previous ones and it also improves the quality of the tip. These are important advancements for researchers working with probe-based techniques.”

The technique has already been used to sharpen tips for use in computer chips, allowing researchers to create more accurate images of the circuitry inside.

Nahrtshew wins IEEE Computer Society Technical Achievement Award for 2012

CSL Professor Kris Nahrtshew has been named the winner of a prestigious IEEE Computer Society Technical Achievement Award for 2012. The Technical Achievement Award honors “outstanding and innovative contributions to the fields of computer and information science and engineering on computing technology.” According to the citation for the award, Nahrtshew is being honored “for pioneering contributions to end-to-end quality of service and resource management in wired and wireless networks.”

Nahrtshew has a long history of research on wireless access technologies and on the control of quality of experience (QoE) in mobile networks. Within wired networks, research efforts are focused on efficient and effective quality enforcement, and on QoE-aware network adaptation techniques.

In addition, Langbort and graduate student Qiaomin Xie recently acquired a CAREER Award from the National Science Foundation to address the QoE problems of mobile telephones and mobile computing through a new QoE-aware network adaptation technique.

Nahrtshew, who joined the Illinois faculty in 1995, is a professor of electrical and computer engineering and director of the Center for Communications Research at the University of Illinois. He has received numerous awards for his contributions to the field of computer science, including the 2007 Fred W. Ellersick Prize from the IEEE Communication Society. He is a Fellow of the IEEE and has served as a member of the National Academy of Engineering’s Computer and Information Science and Engineering Committee.

Mitra earns AFSOR Young Investigator award

CSL Professor Sanj Iyer has been awarded an AFOSR Young Investigator award. This award allows early-career scientists and engineers to pursue research that is relevant to national defense and security. It is typically awarded to researchers who have received their PhD within the past five years. Iyer is a professor of electrical and computer engineering and director of the Center for Communications Research at the University of Illinois. He was appointed as CSL professor in 2005. Before joining the University of Illinois, Iyer was a Postdoctoral Research Associate in Electrical Engineering at Stanford University. He received his PhD in Electrical Engineering from the University of Southern California in 2003. Iyer has been a member of several professional societies, including the IEEE, the ACM, and the Optical Society of America. He is a Fellow of the IEEE and the SPIE.

Lu receives CAREER Award

CSL Assistant Professor Yiu Yu has received a CAREER Award from the National Science Foundation for her work on dynamic scalability problems. The CAREER Award provides an early-career scientist with $400,000 over five years to pursue an independent research project that addresses a significant scientific problem. The CAREER Award also provides support for the development of a new educational activity at the graduate or undergraduate level.

Loui named editor of Journal of Engineering Education

IEEE Professor Michael Loui has been named the new editor of the Journal of Engineering Education (JEE) by the American Society for Engineering Education (ASEE). He will take over the editorial duties of the journal this summer. Loui is the director of Innovation Celebration, an event sponsored by the Champaign County Economic Development Corp. Nuvixa, headquartered in UI's Research Park, was started by CSL Professors Ahuja and Mitra.

IEEE Best Manipulation paper goes to Brett McCarthy

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Rural girls using social media to overcome obstacles

A group of rural girls, people often see them in one of two ways: either as people who are at risk and would benefit from the protective factors of social support and social media, or as people who are not at risk and who are successfully managing their social media use.

“Their You're doing some really meaningful thing that will help them make the world a better place,” said Lyding. “We’re really excited about this work.”

Their research is supported by a grant from the National Science Foundation.

CSL Professor Cedric Langbort recently received a CAREER Award for a project that studies the distribution of the information access and delivery of defense against potential cyber attacks. The project, “A Dynamic Game Theoretical Approach to Cyber-security of Controlled Systems,” involves designing control algorithms that manage the flow of information available to a potential hacker.

The CAREER Award provides Langbort with $400,000 over five years to pursue his research on dynamically scalable web services. "I'm excited by the opportunity to serve as the editor of JEE, which is recognized globally as the premier journal for research on engineering education,” said Loui, who is a senior research engineer at the Coordinated Science Lab. "As the editor of JEE, my primary goal is to ensure the best possible publication experience for authors, and to engage the broader community of users and contributors.

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CSL Dr. Brett McCarthy was named the best paper award at the 2005 IEEE International Conference on Robotics and Automation. His paper was based on a submission to the 2003 IEEE Conference on Robotics and Automation. McCarthy’s research focuses on the development of new algorithms for the control of robots and the design of new robotic devices. McCarthy has received numerous awards for his work, including the IEEE Robotics and Automation Society's Distinguished Service Award and the IEEE Robotics and Automation Society's Outstanding Contribution Award.

For more information, please visit nuvixa.com.

Ahuja to design automated systems for categorizing visual data

Continued to grow, automated systems for categorizing visual data are becoming increasingly important. This is due to the rapid growth in the volume of visual data, which has led to an increase in the number of applications that require automated categorization.

Visual information technology is an area that is rapidly growing. It is used in a variety of applications, including surveillance, security, and medical imaging. The need for automated categorization is especially important in these applications, as it allows for the rapid and accurate analysis of visual data.

Nuvixa founders nab New Venture Award at Innovation Celebration

Nuvixa Inc., a startup company founded by Nuvixa founders in 2010, was named the winner of the New Venture Award at the 2012 Innovation Celebration, an event sponsored by the Champaign County Economic Development Corp. Nuvixa’s mission is to develop innovative computer vision technologies that can be used in a variety of applications, including surveillance, security, and medical imaging.

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Alums create new verification software with start-up ZeroSoft

As graduate students in CSL Prof. Ravi Iyer’s DEPEND group, Claudia Basile and Keith Whitmer worked together to solve fundamental problems in software fault tolerance and reliability. So after they graduated, both with PhDs in electrical and computer engineering, it made sense to continue collaborating, this time in developing logic validation techniques for hardware.

The collaboration turned into ZeroSoft, a startup specializing in software tools that validate complex digital circuits. The team set up shop in Urbana and began working on a project called “Pineapple” to implement several valuable techniques for software validation that, for example, could be used to test complex medical devices.

They began with simple projects, but gradually evolved into software that could verify large parts of a circuit. Their approach was to find a clear, simple way to express the requirements of the circuit and then to check if the software satisfied them. They used a state-of-the-art technique called predicate logic, which is particularly good at expressing complex requirements.

“Doing this in software is a bit different from doing it in hardware,” said Basile. “In hardware, you have the advantage of being able to use hardware-specific languages like VHDL or Verilog. In software, you have to express the requirements in a general-purpose language like English and then translate them into a language that can be understood by a software checker.”

This means that ZeroSoft’s software tools can be applied to a wide range of problems, from verifying the functionality of a complex circuit to ensuring that a software system meets its requirements. The team has already won several contracts for projects in this area and plans to continue expanding their offerings.

“While this may seem like a niche market, there is a huge demand for software validation tools,” said Basile. “We are excited to be part of this growing field and to develop tools that will help engineers create safer, more reliable systems.”

Rural girls using social media to overcome obstacles

Rickman, who earned her PhD from Illinois in 2003, “ZeroSoft took key concepts for accelerating fault simulations from the reliability community and applied those concepts to logic simulation.”

The trend proving fruitful: with the explosion of new computer devices from smartphones to high-performance supercomputers, the increasingly complex digital designs were beginning to overtax traditional logic simulators on the market. Verification demands were outpacing the performance of traditional simulators, which were optimized to run one test at a time.

In order to push through more verification tests in the same amount of time, customers had to grow their data centers. They had to buy more computing power, hire additional people to manage the data centers, increase the amount of money on software licenses and energy costs. Without those investments, companies couldn’t keep up, in some cases, the opportunity to be the first to market with a product.

Microscope probe-sharpening technique improves resolution, durability

CSL Professor Joseph Lyding, a professor of electrical and computer engineering, led a group that developed a new microscope probe-sharpening technique. The technique is described in a paper published in the journal Nature Communications.

Scanning probe microscopes provide images of tiny structures with high resolution, at the atomic scale. The tip of the probe skims the surface of a sample to measure mechanical, electrical or chemical properties. Such microscopes are widely used by researchers who work with tiny structures in fields like nanotechnology or cellular biology. However, probes can degrade rapidly with use, wearing down and losing resolution.

A simple new improvement to an essential microscope component could greatly improve imaging for researchers who study the very small, from cells to computer chips.

To shape tips, researchers shoot a stream of ions at the tip. Lyding had the simple, novel idea of adding electricity to the stream of ions. The voltage to the tip to deflect the incoming ions. When a voltage is applied to a sharp object, the electrical fields repel the atoms or electron in the point region. Therefore, ions approaching the sharpest part of the electrical tip are deflected the most.

He teamed up with CSL colleagues John Abelson, Matt Furhrman and professor Gregory Grimmer to make the tips durable. The group had the high-voltage tip technique patented and further refined it. The researchers then approached researchers who are more familiar to commercialize their tough, sharp probe. They received a patent and started a company called TIP (Tip Innovation Projects). The company is also expanding its sharpening technique to include APM probes as well as STM, and is developing batch-processing techniques for higher throughput.

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The project, “A Dynamic Game Theoretic Approach to Cyber-security of Wired and Wireless Networks,” honors wireless networks that enjoy a physically protected environment in which strong guarantees are relatively easy to provide, wireless networks are subject to highly unpredictable conditions and interference. The third and most recent major phase of this work, has studied how to provide QoS guarantees in the even more challenging context of inter-vehicle communication.

Today, she is pursuing QoS management research on multiple fronts. The inter-vehicle work, which has been supported by the National Science Foundation, has been ongoing since 2004. Other work – funded by Qualcomm, Telcordia, and the Boeing Software Center in ITI – she has been working to address the QoS problems of mobile telephones and mobile computing through grouping strategies. She is developing approaches that would allow phones to share other vehicles’ networks. She is also looking at how controlling QoS and security demands can both be addressed in the context of critical cyber-physical systems, such as the power grid.

Lu receives CAREER Award

CSL Assistant Professor Yu Yu has received a CAREER Award from the National Science Foundation for her work on dynamic scalability problems. The prestigious award recognizes junior faculty who “demonstrate the role of teacher-scholars,” according to NSF.

In addition, Lu and graduate student Quanmei Xie recently won the Best Paper Award at the 2012 Innovation Conference for their paper, titled, “A Novel Loading Balancing Algorithm for Dynamically Scalable Web Services.”

Loul named editor of Journal of Engineering Education

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IEE Best Manipulation paper goes to Brett, McCarthy

CSL Professor Anthony Burrus and former CSL student Brett McCarthy have won the Best Manipulation Paper Award at the IEEE International Conference on Robotics and Automation. Their paper was chosen from a total of 1,032 submissions.

The paper, “Mechanics and Manipulation of Planar Elastic Robots,” provides a mathematical model for solving the problem that has mystified researchers for years: how to enable robots to manipulate deformable, or flexible, objects.

Nahuhts wins IEEE Computer Society Technical Achievement Award for 2012

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Nahuhts has a long history of working with contributors to quality of service (QoS) routing. In the earliest phase of that work, running from 1997 to 2005, she addressed the problem in the context of wired networks, eventually producing a suite of leading QoS routing algorithms.

In the next phase of her work, Nahuhts turned her attention to the much more complex problem of QoS routing in wireless networks. Within wireless networks enjoy a physically protected environment in which strong guarantees are relatively easy to provide, wireless networks are subject to highly unpredictable conditions and interference. The third and most recent major phase of this work, has studied how to provide QoS guarantees in the even more challenging context of inter-vehicle communication.

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“The industry needed a new way of doing the verification problem,” said co-founder Baule, who graduated from Illinois in 2005. “ZeroSoFT took key concepts for accelerating fault simulations from the reliability space and then applied those concepts to logic simulation.”

The team proved furious—enough with the explosion of new computer devices from smartphones to high-performance supercomputers, the increasing complexity of digital designs was beginning to overwhelm traditional logic simulators on the market. Verification demands were outpacing the performance of traditional simulators, which were optimized to run one test at a time.

In order to push through more verification tests in the same amount of time, customers had to grow their data centers. They had to buy more computing power, hire additional people, to manage the increased complexity of verification systems and spend more on manpower, licenses and energy costs. Without those investments, companies lose money, and in some cases, the opportunity to be the first to market with a product.

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CSL Professor Joseph Japinga, a professor of electrical and computer engineering, led a group that developed a new microscope probe-sharpening technique. The technique is described in research published in the journal Nanotechnology Communications.

Scanning probe microscopes provide images of tiny structures with high resolution at the atomic scale. The tip of the probe skims the surface of a sample to measure mechanical, electrical or chemical properties. Such microscopes are widely used by researchers who work with tiny structures in fields of nanotechnology to cellular biology. However, probes can degrade rapidly with use, wear down and lose resolution.

“At the present volume of digital information, continuous and growing automated systems for categorizing visual data are becoming increasingly important,” said Ahuja, who earned a NSF CAREER grant to research the problem of categorizing visual data.

Through this grant, Ahuja, a Donald B. Wyckoff Williams Professor in electrical and computer engineering, hopes to develop an image matching framework that can be used to program computers to learn and recognize whether and where objects appear in images.

Ahuja previously received an NSF CAREER grant to research the problem of categorizing visual data. Through this NSF grant, Ahuja and other researchers will build off of the strengths of existing approaches used in previous research to design an open-source software application. Using the traffic patterns of the database, apps can provide information for recognizing objects.

Ahuja said the system can be expanded to use region as features and can therefore detect things such as the layout of an object in order to recognize the object. The computer vision system will use this framework to be able to learn objects by being shown a series of images, and then be able to recognize those objects in new images without human supervision. This kind of technology can be used for many purposes such as video surveillance and medical purposes.

Ahuja said that, for example, a computer program to categorize visual data can be driven by a series of images that contain brain tumors so that it learns what a brain tumor looks like. Then it can be told to look at a new patient’s brain scans and tell computer to locate and identify brain tumors on its own.

Similarly, Ahuja said, if it is against the rules for someone to enter your room and talk to others, the computer can be taught to recognize the difference between people or multiple people, and can then either video surveillance to see if one person is entering the room and the other person is in the room in the same time a warning will sound.

Researchers want to also make this technology as accurate, robust and fast.

“A few more high-resolution cameras with different lenses and different models could be installed in the corners of the room,” said Ahuja. The computer should be able to tell that a bright red apple and a dark red apple are still both apples, but an apple and an orange are different.

“Don’t go by what you may think you’re seeing,” Ahuja said.
Microscope probe-sharpening technique improves resolution, durability

A simple new improvement to an essential microscope component could greatly improve imaging for researchers who study the very small, from cells to computer chips.

CSL Professor Joseph Lytton, a professor of electrical and computer engineering, led a group that developed a new microscope probe-sharpening technique. The technique is described in research published in the journal Nature Communications.

Scanning probe microscopes provide images of tiny structures with high resolution at the atomic scale. The tip of the probe skims the surface of a sample to measure mechanical, electrical or chemical properties. Such microscopes are widely used by researchers who work with tiny structures in fields from nanotechnology to cellular biology. However, probes can degrade rapidly with use, wearing down and losing resolution.

"We're doing some really meaningful things in health and the way we talk to each other and see the world," said Richman. "But we still have a lot of work to do in understanding the social impact that our work has." A community gathering in the main lounge of the CSL building will be held this fall to discuss these issues, Richman said.

Richman has been a professor at CSL for 12 years, and has been working with collaborators in various disciplines to develop new technologies for cancer detection and treatment.

"We've had a lot of success in terms of developing new technologies, but there's still a lot of work to be done," Richman said.

"The problems we're working on are interdisciplinary, and we need to work with people from different backgrounds to address them," Richman said. "That's what makes this work so exciting."
Surveillance networks

Seth Harrison (ECE) and Steven LaValle (Computer Science). Harrison’s expertise is in aerospace systems, autonomous systems, and robotics, including control of robots and high performance aerospace vehicles and formation-flying UAVs/USVs and spacecraft. Harrison’s interests are in robotics, vision and artificial intelligence, whereas LaValle is interested in the design of planning algorithms, mainly on problems involving continuous spaces, complicated geometric constraints, differential constraints, and/or sensing uncertainties.

Magnus Egerstedt, professor of Systems and Controls in the Georgia Tech School of Electrical and Computer Engineering, will work with the Illinois group. His interests include hybrid and networked control, with applications in motion planning, control, and coordination of mobile robots.

In a related project, Voulgaris and Associate Professor Dusan Stipanovic recently received a 3-year grant from the Qatar National Research Fund to develop methods for safely coordinating networked vehicles. The overall grant is $950,000, with $320,000 committed to CSL research.

Researchers will work on developing algorithms that will guarantee safety in the presence of physical, collision avoidance and information constraints, and they will make the technology robust to communication uncertainty.

Safe and reliable multiple vehicle systems can be applied in numerous ways to benefit the oil and gas industry, making this technology important to Qatar’s growth in that industry. This technology could be used in piloting robots that sense dangerous leaks, such as H2S, coordinated fire extinguishing, coordinated oil spill cleaning and field coordinated surveillance.

This project, “Smart Systems for Field Monitoring and Surveillance,” will be done in collaboration with Professor Hamouda Karboul at Texas A&M University in Qatar. CSL researchers will focus on the methodologies and techniques, while Texas A&M Qatar will design and run the experiments.

Voulgaris said that the project is “a collaboration in a field that’s new to us and can lead to further collaborations in bigger projects.”

If the surveillance network research underway at Illinois had existed in the 1940s, Pearl Harbor may have been better prepared to counter an intrusion.

CSL Professor Petros Voulgaris (Aerospace Engineering) is leading a multi-university group in an approximately $1 million grant over three years from the Air Force Office of Scientific Research (AFOSR) to determine how sophisticated, unmanned surveillance vehicles can provide navy antiterrorism and force protection measures in harbors.

The researchers envision a heterogeneous group of ground, underwater, surface, and aerial unmanned vehicles monitoring the Navy fleet and ports. They believe that aerial autonomous surveillance of vessel traffic, current and wave patterns, and ocean weather conditions can enhance the military’s ability to coordinate autonomous surveillance agents positioned underwater and on the surface.

The proposal presents a complex problem of using a large network of decentralized autonomous agents with various sensing capabilities to work together to provide a massive amount of data. The scientists must also take into consideration uncertainties, including potential sensor and communication link errors.

“We consider multi-autonomous systems tasks with minimal information so that the complexity is reduced and we can deal with the massive amounts of data. The present amount of data is too much to accomplish the coordination task,” Voulgaris said.

Voulgaris’ research interests include robust and optimal control and estimation, structured and distributed control, networks and control, and applications of advanced control and estimation methods to engineering practice.

Voulgaris will be working on the project with fellow CSL researchers Soon-Jo Chung (Aerospace Engineering), Tom Mooney (Electrical & Computer Engineering), Craig Zilles (Mathematics), and Steve Wright (Civil and Environmental Engineering).