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NSF AT WORK

Terrorists groups and their followers have created a vast presence on the Internet. A recent report estimates that there are more than 5,000 Web sites created and maintained by known international terrorist groups, including Al-Qaeda. Credit: Jupiter Images.

Analyzing the Web's "Dark Side"

Terrorists and extremists have set up shop on the Internet, using it to recruit new members, spread propaganda and plan attacks across the world. The size and scope of these dark corners of the Web are vast and disturbing.

In a non-descript building in Tucson, a team of computational scientists is using cutting-edge technology and novel new approaches to track extremists' moves on line, providing an invaluable tool in the global war on terror. Funded by the National Science Foundation (NSF) and other federal agencies, Hsinchun Chen and his Artificial Intelligence Lab at the University of Arizona have created the Dark Web project, that aims to systematically collect and analyze all terrorist-generated content on the Web.

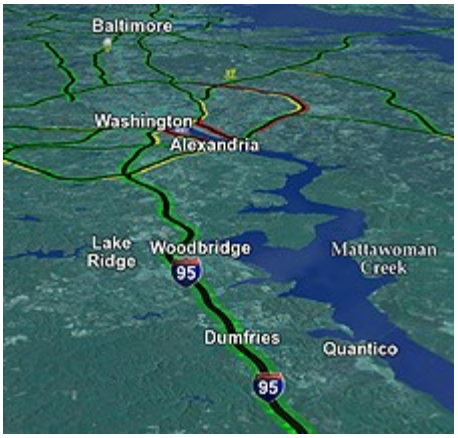
Using advanced techniques such as Web spidering, link analysis, content analysis, authorship analysis, sentiment analysis and multimedia analysis, Chen and his team can find, catalogue and analyze extremist activities on line. For more information on what's hiding on line, see NSF's "Scientists Use the 'Dark Web' to Snag Extremists and Terrorists Online."

Powerful Tool Crunches Commutes

Web sites for travelers are nothing new, but researchers in Sunnyvale, Calif., have developed an advanced system with a twist. In addition to tracking traffic congestion, the program crunches data from 14,000 sensors, in some cases every 30 seconds, to decipher evolving rush-hour patterns. The end result is www.BeatTheTraffic.com, a tool that tells commuters how long they can expect to sit in their cars, which shortcuts will get them home faster that day, and even the best time to leave the home or office.

The tool is now available to commuters in 45 U.S. cities, with the heavily-congested Washington, D.C., metropolitan area just now coming online. Tied to a statistical database that tracks how traffic conditions develop--over the course of a "rush hour," for example--the software suggests a commute based on congestion that may arise, not traffic status at the time of departure. Based on such statistics, the researchers have found that many commuters can save more time by altering their departure time than they would using mass transit.

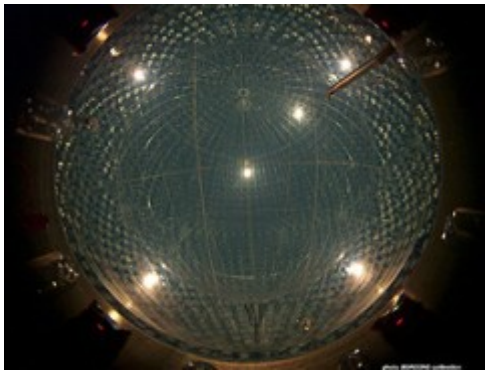
Developed by Triangle Software with the support of NSF's Small Business Innovation Research (SBIR) program, the tool is currently serving about 35,000 commuters, with the potential to help millions through coordination with local news media. For more on the traffic tool, see NSF's press release.



BeatTheTraffic.com, a tool providing real-time traffic data, is now available to commuters in 45 U.S. cities. The tool crafts alternate routes for troubled commuters and predicts the best times to travel. Credit: Triangle Software.

See a video of the real-time animation this tool generates for local news broadcasts.

Catching Some Rays



The pattern made by the flux of neutrinos passing through the Borexino detector that lies more than a kilometer (almost a mile) underground in one of the planet's deepest laboratories. Credit: INFN.

An international team of researchers has detected low-energy solar neutrinos--subatomic particles produced in the core of the sun--and measured in real-time the rate the particles hit our planet. The researchers also obtained fresh evidence that neutrinos oscillate (transform from one state to another) before arriving at Earth, adding weight to present theories about the nature of neutrinos and the inner workings of the sun and other stars.

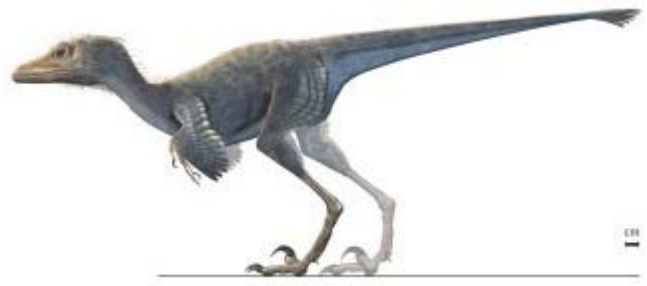
In recent years, physicists have theorized that neutrinos produced in the sun oscillate into different "flavors" of neutrinos. Earlier measurements of higher-energy neutrinos have shown that the solar models appear to be correct, but due to oscillations, only a fraction of the neutrinos with the original flavor is detected. Now, the Borexino measurement of low-energy neutrinos confirms this picture, including the expected neutrino deficit.

A team of more than 100 researchers, including NSF-supported investigators at Princeton University and Virginia Tech, have operated the Borexino experiment in one of the deepest laboratories in the world, the Gran Sasso Laboratory of the Istituto Nazionale di Fisica, near the town of L'Aquila, Italy. These are the first results from the Borexino facility that has been under construction since the late 1990s. Learn more about the new findings in NSF's press release.

I Just Want to Fly...

An 80-million-year-old dinosaur fossil unearthed in the Gobi Desert of Mongolia demonstrates that miniaturization, long thought to be a hallmark of bird origins and a necessary precursor of flight, occurred progressively in primitive dinosaurs.

Because most dinosaurs were too massive to fly, miniaturization has been considered crucial to the origin of flight. Although paleontologists have shown that birds evolved from bipedal carnivorous dinosaurs known as theropods, fossil evidence of miniaturization and other characteristics leading to flight has been sparse.



A dinosaur fossil unearthed in the Gobi Desert of Mongolia shows that miniaturization, a hallmark of bird origins and a necessary precursor of flight, occurred progressively in primitive dinosaurs. Credit: F. Ippolito, American Museum of Natural History.

The new find is providing the first signs of these early evolutionary steps. While other dinosaurs of the Cretaceous Period were evolving in favor of increased body size, this dinosaur, named Mahakala, represented a progressive step towards the miniaturization of body forms necessary for feathered dinosaurs to take flight. For more on this NSF-supported find, see NSF's "Dinosaur Fossil Shows Signs of Early Flight Mechanism."

Did You Know?

Credit: Art Explosion.

More than one-third of immigrant scientists and engineers report that the most important factor in their decision to come to the United States was family-related reasons. Of the 3.3 million immigrant scientists and engineers in the United States, 37 percent came to America for family-related reasons, according to the latest statistics from NSF. Other reasons cited include educational opportunities (30 percent), and job or economic opportunities (21 percent).

NSF's InfoBrief, "Why Did They Come to the United States? A Profile of Immigrant Scientists and Engineers," offers more information on the immigration of scientists and engineers.

Faces of NSF Research

Robots Entice Students to Study Science and Engineering

Can a robot get high school students interested in studying science and engineering in college? A team from the University of Pennsylvania has found the answer is 'yes,' if the students design, build and operate the robot themselves. This approach is a departure from traditional science and engineering education methods, and it suggests a new way of getting students attracted to scientific and engineering fields early in their academic careers.

Over the past three summers, Penn.'s School of Engineering and Applied Science has taught a three-week robotics course as part of the Summer Academy of Applied Science and Technology (SAAST). The robotics camp, which was developed with funding from NSF, attracted more than 20 students, some from as far away as Turkey, China and the United Kingdom. This top-down approach to science and engineering education is the reverse of how these fields are usually introduced to students. The researchers note that typically students must go through years of learning theoretical concepts in mathematics, physics, and other fields before they are allowed to think about putting these concepts into practice. Many students, the researchers believe, lose interest in these fields because they must wait so long before experiencing the excitement and creativity that comes from finding solutions to intriguing challenges.

Hence, the researchers sought to create an approach to teaching science and engineering where "students are introduced first to the applications and systems concepts which then leads to the teaching of fundamentals." Through the development of robots, students had the opportunity to put what they learned into action, and the final team competition taught them how to work as a group to solve complicated challenges with many possible solutions.

Some of the participants from the first camp are now studying engineering in college, including three former participants who are enrolled at Penn. See the NSF press release for more on this "hands-on" educational approach.

Credit for photos: David J. Cappelleri, Department of Mechanical Engineering and Applied Mechanics, University of Penn.

For three weeks, SAAST combined intensive lectures, lab work, field trips, and building time to give students a more complete idea of how robots are designed and built. Students worked on their robots and presented them during the final competition.

NSF in the News

Oceanographers May Bring Undersea World to Masses -- *Columbus Dispatch (9/18/07)* -- Under a program financed by NSF, John Delaney and a team of scientists from several institutions are leading the new Ocean Observatories Initiative, a multifaceted effort to study the ocean through a combination of Internet-linked cables, buoys atop submerged data-collection devices, robots and high-definition cameras.

Physicists Pin Down Atomic Spin For Spintronics -- *Environmental News Network (9/13/07)* -- Scientists who dream of shrinking computers to the nanoscale look to atomic spin as one possible building block. University of California, Berkeley, physicists have succeeded in measuring the spin of a single atom, moving one step closer to quantum computers and "spintronic" devices built from nanoscale transistors based on atomic spin. This work was supported in part by the NSF.

"What we know and what we need to know about structurally deficient U.S. bridges"

Presentations and Panel Discussion
September 20, 2007 @ NSF Headquarters

NSF and the American Society of Civil Engineers along with honorary cosponsor, Congresswoman Eddie Bernice Johnson, hosted a luncheon briefing on Capitol Hill on what engineers know about the state of the nation's bridges and what they are hoping to learn from the recent collapse of the I-35W bridge in Minneapolis, Minn. Congresswoman Johnson's introductory remarks emphasized the importance of bridge safety throughout the country and in her own Texas district.

Professor Richard Sause of Lehigh University's Advanced Technology for Large Structural Systems Center (founded in 1986 under NSF's Engineering Research Center program) presented an overview of the current condition of U.S. bridges. According to Sause, while most of the country's bridges are in acceptable condition, engineers have found more than 25% of bridges either 'structurally deficient' or 'functionally obsolete.' Given the vital economic role bridges play in transporting people and goods, the nation's grade of "C-minus" in bridges leaves plenty of room for improvement. Sause points out that investment in research on more durable design and materials will pay off in bridges that are resistant to fatigue, corrosion and extreme events.

Professor Taichiro Okazaki from the University of Minnesota, who recently received an NSF Small Grant for Exploratory Research (SGER), illustrated the importance of continued research in bridge design and inspection with his presentation on the tragic I-35W bridge collapse that claimed the lives of 12 people and injured over 100. Okazaki detailed the design features and flaws of the I-35W bridge and reviewed fatigue and corrosion findings from a 2001 University of Minnesota study of the bridge. He underscored the importance of academic involvement in the current investigation to ensure that the lessons learned are widely distributed.

The briefing was concluded by Professor Antonio Nanni, Director of the Repair of Buildings and Bridges with Composites, a NSF research center at the University of Miami. Nanni explained that increasing funding for research is an important first step, but it is not enough--breakthroughs in the laboratory must find their way into new bridge design and construction. In current practice, building codes are "both a blessing and a curse" because, while they ensure proven designs and materials are used in construction, they also restrict the use of new techniques. Nanni called for support of prototype-based research, in which engineers can test innovative designs and materials on a small scale with the aim of applying proven results to the safer, more durable, and ultimately more cost-effective bridges of the future.