

To Petra and Beyond

CISA3 Associate Director Tom Levy returned in late November from Jordan, where he and many of the IGERT-TEECH Trainees and Associates participated in the dig -- collecting artifacts for their research and deploying and testing new technologies and methodologies developed over the past year. Grad students participating in this year's Cyber-Archaeology Field School in Faynan, Jordan, included Matt Vincent, Ashley Richter, Aaron Gidding, Ian Jones, Matt Howland, David Vanoni, Vid Petrovic and Kathleen Bennallack.

As part of a collaborative project to create a working field methodology to capture and enhance diagnostic data digitally from cultural heritage and archaeological sites, three CISA3 graduate students used terrestrial laser scanning (LiDAR), high-resolution photography, augmented reality, structure from motion, and other tools.

IGERT-TEECH Trainees Vid Petrovic and David Vanoni, Ph.D. students in the Computer Science and Engineering Department, joined IGERT Trainee Ashley M. Richter, a Ph.D. student in Archaeology, on the Edom Lowlands Regional Archaeological Project (ELRAP) in southern Jordan.

"The series of captured point clouds represent the archaeological sites under excavation by ELRAP in Jordan (including Khirbat Faynan, the ancient Biblical city of Punon (Roman Phaino), as well as a Roman-Nabataean aqueduct system, and two of the most exciting monuments at the UNESCO World Heritage site of Petra: the Petra Mosaic Church, and the Temple of the Winged Lion (in conjunction with the American Center for Oriental Research's Temple of the Winged Lion Project).

The students' collaboration provided a field test for their ongoing work, including Vid's point-cloud software and Ashley's Rescue LiDAR strategies. Of special note is David's testing of ARtifact, his augmented-reality Android application, which recognizes its real or virtual surroundings and allows users to view the real or digital space with layers of annotated information overlaid upon it. The team is currently working to consolidate the data collected from the field and to refine the methodologies of combining their data sets to make them available not just for cultural heritage diagnostics and virtual tourism beyond the field, but for archaeologists to use in the field as investigative tools. The fall expedition to Jordan has also added new aspects to their work, including a new investigation by Vid and Ashley into further data capture methodologies, which can be combined with LiDAR data to provide higher resolution towards detailed areas within landscape point clouds, such as mosaics and sections of stratigraphy.



Pictured top: Ashley Richter (foreground) does LiDAR scan, while Vid Petrovic photographs. Immediately above: Richter inside the Mosaic Church at Petra.



CAPTURING PETRA



NSF IGERT Updates

Trainee Flies IGERT-TEECH Flag at Two Conferences in Japan



IGERT-TEECH Trainee Andrew Huynh presented his work at two meetings in Japan recently: In September, he spoke on the limitations of using crowdsourcing for damage assessment at the **10th International Workshop on Remote Sensing for Disaster Response**, held in Tohoku. After the workshop, researchers went on a two-day field trip visiting sites that were damaged by the 2011 tsunami disaster (pictured above). The workshop resulted in a call for better metrics of damage assessment in remote sensing.

Then in mid-November, Andrew was back in Japan to present his work on the application of triadic clustering to map dirt roads in northern Mongolia. The venue was the **21st International Conference on Pattern Recognition**, in Tsukuba. Andrew's oral presentation went over the difficulties of working with noisy, crowd-sourced data, capturing human perception, and the use of methods such as triadic clustering to make more sense of the data.

Euromed

Two other IGERT-TEECH Trainees, Ricky Wood and Christine Wittich, represented CISA3 at the 2012 International Conference on Cultural Heritage (EuroMed), which took place in Lemesos,



Cyprus. Christine presented her work "Methodology For An Integrative Documentation and Characterization of Culturally Important Statues." Separately, Ricky recounted his research on "Characterizing Cracks in the Frescoes of Sala degli Elementi within Florence's Palazzo Vecchio."

X-Ray Analysis

In early August, IGERT-affiliated grad students Samantha Stout, Tom Wypych and Kathleen Bennalack presented three papers at the Denver X-Ray Conference section on applications for cultural heritage research, which has been offered since 2006.

The conference provides details about state-of-the-art techniques and future developments in X-ray analysis. All presenters were invited to submit manuscripts for publication in *Advances in X-ray Analysis (AXA)*, the journal of the conference proceedings.

Tom presented a paper on "Progressive Structural Decomposition Analysis Using In-Situ Digital Radiography," and Kathleen's talk was about "Applications of PXRf for Cultural Heritage Diagnostics: Rapid In-Field Analysis at Khirbat Faynan, Jordan."

Samantha talked about X-ray Fluorescence (XRF) Assisted, Multispectral Imaging of Historic Drawings. Her talk presented the complementary techniques of multispectral imaging and XRF in the context of a case-study of the original preparatory drawing for *The Adoration of the Magi*, by Leonardo da Vinci. Through a critical examination of the method demonstrated by Prof. Maurizio Seracini in 2002 and 2006, Samantha showed how imaging diagnostics may inform and direct the use of XRF when examining historic drawings and other artifacts of cultural heritage.

Events

EVENTS

Underwater Archaeology

On September 20, archaeologist Dr Dominique Rissolo (*at right, in Calit2 Theater, Atkinson Hall*), Executive Director of the Waitt Institute and CISA3 to present his work on "Ice Age Discoveries: Deep Beneath the Yucatan, Mexico, The Hoyo Negro Project." His talk was part of the IGERT-TEECH Cultural Heritage Diagnostics & Engineering Seminar Series. The talk was well received and prompted lots of discussion about technologies that could be developed to aid in this kind of research.



Grad student David Vanoni demonstrates the ARifact augmented reality app

New CISA3 Labs Open in SME Building

CISA3 participated in the dedication of the new Structural and Materials Engineering (SME) building on Sept. 14 at UC San Diego. CISA3 director Falko Kuester and IGERT students presented their research as part of the Augmented Reality and Visualization showcase, which became a magnet for visitors. Highlights included a new free-space interface allowing users to explore virtual environments by simply pointing and gesturing with their hands. CISA3 projects were also showcased on the double-decker TourCAVE virtual-reality environment (*bottom near right*), and there was a sketch-based interface allowing intuitive sketch-centric modeling, simulation and visualization of structural systems. The visualization lab included posters (*below*) and demonstrations of the latest UAVs for aerial videography (*below far left*).



Events

EVENTS

TED Talks

TED Talks have become one of the most popular, if high-brow, ways of conveying academic research to a large audience in person and over the Internet. Several CISA3 researchers have been invited to talk about their work in the TED format. Here we focus on two of the most recent TED talks, including one to the highest-level international TED conference of all, TEDGLOBAL.



Calit2's Maurizio Seracini delivered a talk on "The Secret Lives of Paintings" at TEDGLOBAL in Edinburgh, Scotland. His presentation was a hit, and the video is now streaming under the title: "That unicorn is really a lap dog." In addition to explaining how he believes a mural (*The Battle of Anghiari*) three times the width of *The Last Supper* could get lost, Seracini also talks about secrets he discovered after doing multispectral imaging of four other masterpieces: da Vinci's *The Annunciation*, and the *Adoration of the Magi*; Botticelli's *Allegory of Spring*; and Raphael's *Lady with the Unicorn*. The latter is pictured at left alongside a closeup of the X-ray scan showing that the unicorn was originally painted as a lap dog, and was probably changed by an artist long after Raphael finished the painting. Watch Seracini's TED talk at <http://bit.ly/TGVqW3>.

Cyber-Archaeology in a Holy Land

CISA3 associate director Tom Levy spoke at the TEDx Sonoma County event in June. Levy is a Distinguished Professor at UC San Diego and holds the Norma Kershaw Chair in the Archaeology of Ancient Israel and Neighboring Lands. He is a member of the Department of Anthropology and Judaic Studies Program, and leads the Cyber-Archaeology research group in Calit2. His TEDx talk, "Cyber-Archaeology in a Holy Land," is now streaming online at <http://bit.ly/LocX0p>.



A Royal Visit

Calit2's Maurizio Seracini played host to a brief private visit in October from Queen Beatrix of the Netherlands. They toured the Palazzo Vecchio in Florence, where CISA3 has been searching for the lost da Vinci mural, *The Battle of Anghiari*. The project is currently on hold, but the sovereign was game to climb a narrow staircase with Seracini and IGERT Ph.D. student Samantha Stout to a location just under the towering, ornate painted ceiling.



In the News

News magazine Profiles Albert Lin's Search for the Burial Site of Genghis Khan

It is historic for more reasons than one. Based on the work of CISA3 and Calit2 research scientist Albert Yu-Min Lin after several high-tech expeditions to Mongolia in search of Genghis Khan's lost tomb, *Newsweek* magazine was so taken with the story of history, exploration and conservation that the magazine decided to put it on the December 10 issue. The decision was also notable because the print issue is one of the last ever -- because Newsweek will stop printing the magazine at the end of 2012 (opting to carry on as an all-digital publication like its web-based sibling, *The Daily Beast*).

According to writer Oliver Steeds, "A multi-disciplinary research project uniting scientists in America with Mongolian scholars and archaeologists has the first compelling evidence of the location of Khan's burial site and the necropolis of the Mongol imperial family on a mountain range in a remote area in northwestern Mongolia." He goes on to note that "in an exclusive interview with *Newsweek*," Albert Lin argues that all the evidence "lines up in a very compelling way."

Lin is referenced as a National Geographic explorer and a UC San Diego research scientist in the California Institute for Telecommunications and information technology. "I was lucky. I'm a scientist and engineer who stumbled across this extraordinary 800-year-old mystery," Lin is quoted as saying, adding: "I felt that perhaps the rapid advancement of technologies might [open] up a new scientific chapter in a lost piece of world history."

Newsweek went on to note that Lin partnered with the International Association of Mongol Studies and the Mongolian Academy of Sciences. "Three years ago the expedition, supported by the University



of California, San Diego, as well as the National Geographic Society, was granted permission to explore the [Khentii] mountain range, and the Valley of the Khans Project was born," wrote Steeds.

"Among the discoveries by the team are the foundations of what appears to be a large structure from the 13th or 14th century, in an area that has historically been associated with this grave. Scientists have also found a wide range of artifacts that include arrowheads, porcelain, and a variety of building materials."

Lin says he plans to reserve full details on the team's discoveries in Mongolia for a peer-reviewed academic publication. But until then, avid readers will have to pick up copies of the newsmagazine fast -- before *Newsweek* as a print publication is relegated to history.

Scientific Methods for Cultural Heritage Research

IGERT-TEECH Trainee Samantha Stout retreated to Mount Snow Resort in Vermont in late July to participate in the first-ever Gordon Research Conference on Scientific Methods for Cultural Heritage Research. Samantha received a scholarship to attend, and she presented a joint research poster detailing "a comprehensive methodology for the analysis of a 16th century fresco mural." The poster was co-authored by fellow Trainee Vid Petrovic, and professors Falko Kuester and Maurizio Seracini.

Mark Your Calendar

Wednesday, February 6, 2013

CISA3 Open Lab Night

Time: 5:50pm - 7:30pm

Location: Atkinson Hall, UC San Diego

RSVP: Allyson Hearst, ahearst@eng.ucsd.edu

Publications

Following are some of the latest journal articles, conference papers or chapters authored or co-authored by CISA3-affiliated faculty and students:

November 3, 2012

"A Methodology for Integrative Documentation and Characterization of Culturally Important Statues to Support Seismic Analysis," C.E. Wittich, T.C. Hutchinson, R.L. Wood and F. Kuester, *4th International Conference on Cultural Heritage Preservation*

November 3, 2012

"Characterizing Cracks in the Frescoes of Sala degli Elementi within Florence's Palazzo Vecchio," R.L. Wood, T.C. Hutchinson, C.E. Wittich and F. Kuester, *4th International Conference on Cultural Heritage Preservation*

September 5, 2012

"Virtual and Immersive Experience Presentation of Cultural Heritage Sites," S. Smith, S. Cutchin, A. Rockwood, A. Saad, N. Smith and T.E. Levy, *18th International Conference on Virtual Systems and Multimedia*

September 5, 2012

"Terrestrial Laser Scanning (LiDAR) as a Means of Digital Documentation in Rescue Archaeology: Two Examples from Faynan, Jordan," A. Richter, F. Kuester, T.E. Levy and M. Najjar, *18th International Conference on Virtual Systems and Multimedia*

August 1, 2012

"Geophysical Surveys at Khirbat Faynan, An Ancient Mound Site in Southern Jordan," A. Novo, M.L. Vincent, and T.E. Levy, *International Journal of Geophysics* 2012:8

August 17, 2012

"Portable Data Management Cloud for Field Science," Y. Matsui, A. Gidding, T. Levy, F. Kuester, and T. DeFanti, *5th IEEE International Conference on Cloud Computing*

July 1, 2012

"ArchaeoSTOR Map: Publishing Archaeological Geodata on the Web," Y. Matsui, A. Gidding, T.E. Levy, F. Kuester, and T.A. DeFanti, *3rd International Conference on Computing for Geospatial Research and Applications*



Invest in CISA3!

Research universities are critical to the growth of our economy. Your investment in innovative centers like CISA3 helps new methods of discovery and in this case, preservation of our cultural heritage for future generations. With your gift, you become part of the World Cultural Heritage Society, and enjoy special benefits and exclusive access to world-renowned explorers, emerging innovators, and bright young minds. Your gift at any level is meaningful, please consider the following opportunities to invest in CISA3:

- Support students through graduate and exploration fellowships.
- Create opportunities for field work and hands-on experience with travel grants.
- Provide flexible funding to meet the greatest needs for innovation and discovery.



Give Online:

To contribute via the Web, click on this link:

<http://culturalheritage.calit2.net/cisa3/patrons.php>

and click on "Give Now" to be directed to the UC San Diego Giving site.

For more information about ways to support the World Cultural Heritage Society and CISA3, please contact Sarah Beckman, Director of Development, at sbeckman@ucsd.edu or call (858) 534-7320.

World Cultural Heritage Society

To provide the vital support necessary for innovative research, international expeditions, and unique global partnerships, the World Cultural Heritage Society (WCHS) for CISA3 was formed. With ever increasing competition for public funding, private support from individuals, foundations, and corporations is critical to the growth and sustainability of CISA3. We are grateful for the passionate donors and volunteers who have invested their time and resources to support exploration and discovery, and helped position CISA3 as a global leader in the field of cyber-archaeology and cultural heritage preservation.

Pictured (l-r) Patrons Norma Kershaw, Thad and Arelene Wolinski, being briefed by IGERT Trainee Aaron Giddings on his research in Jordan.



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