Spatial Technology Talks

This is a semi-regular series, hosted by spatial@ucsb, which aims to promote discussion and interaction within the university's spatial technology community and also share tools and techniques for mapping and spatial analysis.

Monitoring Ocean Acidification on Your Mobile Device

Aaron Bagnell

October 20, 2017

Aaron Bagnell, student in the Interdepartmental Graduate Program in Marine Science and Department of Geography, discussed how ocean acidification can be monitored through a smartphone application. He built this application through the combination of high-resolution satellite observations with an artificial neural network, which addresses the scarcity of historical data on ocean acidification.

Abstract: A large percentage of the anthropogenic carbon emitted each year finds its way into the world's oceans. Following the current trajectory, it is anticipated that the resulting ocean acidification will dramatically alter ocean chemistry later this century. But the effects of this change are expected to be non-uniform in time and space, and certain ecosystems and human communities will likely be more susceptible. This poses a challenge for those monitoring the situation when determining where to utilize finite resources, as data on ocean acidification has been historically sparse. Combining high resolution satellite observations with an artificial neural network allows for a generalized method to address the scarcity of this data by providing global estimates of ocean parameters that are of scientific and public value. With this approach, a database has been assembled that provides daily updates to users via a smartphone app, giving them direct access to ocean acidification parameters at tens of thousands of coastal locations.

Spatio-temporal Data Integration for an Integrated Approach in the Modeling of the City-wide Energy Chain

Alexandru Nichersu

November 7, 2017

Alexandru Nichersu joined us from the European Institute for Energy Research (EIFER) to discuss their proposed approach to integrating energy simulations of different complexity levels, including both spatial and temporal variation, with semantical city models. This allows for the quantification of environmental influences by using different spatial algorithms.

Abstract: With energy simulations of different complexity levels for smart cities and the concurrent IoT revolution we have observed an increase in the demand of spatial awareness for

data coming from the energy sector. The measured or simulated data requires interoperability with semantical city models, which allows for the quantification of environmental influences by using different spatial algorithms. In the presentation we describe our proposed approach to the integration of this data with both spatial and temporal variation.

Evaluating Vegetation-Type Effects on Land Surface Temperature at the City Scale

Erin Wetherley

December 5, 2017

Geography Ph.D. student **Erin Wetherley** shared how we can better understand the effects of different plant functional types and urban materials on surface temperatures, and how this has significant consequences for climate modeling, water management, and human health in cities.

Abstract: The growing concentration of the global human population into cities has coincided with the rise of increasingly rich remote sensing data. Near-future hyperspectral/thermal satellites could revolutionize our understanding of urban environments by allowing us to discriminate urban materials and examine their thermal properties. With this wealth of information, we will be able to disentangle the links between land cover, management, and climate at the city scale for the very first time, with significant consequences for improved modeling of urban climate, energy, and water use, as well as targeted urban planning and public health initiatives.

I will present new results in which we sampled the material and thermal heterogeneity of the Los Angeles, CA, metropolitan area (4,283 km2) to quantify, analyze, and model surface drivers of urban heat. We used airborne hyperspectral imagery (AVIRIS: 36 m resolution, 224 bands, 0.35–2.5 µm) to produce robust estimates of fine-scale (sub-pixel) urban patches, defined as mixtures of key urban surface classes. We then used airborne MASTER thermal imagery to quantify and model surface temperature changes as patch mixtures transitioned from low to high proportions of vegetation. Significant differences were observed between tree, turfgrass, senesced vegetation, and impervious mixtures. Finally, we used our modeled and measured temperatures to observe and quantify additional urban microclimate drivers beyond urban patch type, including income levels, building fraction, and irrigation.

Experimental VR Research on Spatial Cognition in Chinese Traditional Villages

Sinan Yuan

April 30, 2018

Visiting scholar **Sinan Yuan** (Tianjin University) presented his work using experimental VR technology to do spatial cognition research in Chinese traditional villages.

Abstract: By using VR technology, the researcher establishes an experiment platform to analyze the spatial cognition process of people when they are wandering in the traditional Chinese villages. Xiamei and Chengcun, two traditional villages in northern Fujian province, were chosen as the samples in the experiment. The data of movements, head directions of the subjects in the experiment were collected as well as the corresponding subjective feedbacks during the experiment. Through data visualization and analysis, the research reveals the characteristics of the cognition and behavior of the participants when experiencing a complex space such as the traditional villages.

How well can a $750 DIY LiDAR scanner scan?

Jorge Chen

May 22, 2018

UCSB Geography postdoc **Jorge Chen** assessed the use of the Scanse 3D panoramic LiDAR scanner, one of the first panoramic scanners designed for consumer use, in his research.

Abstract: Laser scanners provide a fast, convenient, and accurate way to take distance measurements of the surrounding environment. They operate by calculating the time it takes for a light beam to travel to a distant object and back using a process called light detection and ranging, or LiDAR, that, when repeated numerous times, forms a “point cloud” of (x,y,z) coordinates. Until very recently, only large enterprise users with big budgets could afford this type of technology, with the cost of most LiDAR scanners running well over $100K. However, the trickling down of LiDAR to consumer products has resulted in a new class of relatively cheap sensors that can now be found in robotic vacuum cleaners, drones, autonomous vehicles, and maybe even in upcoming smartphones.

This presentation looks at the performance of the Scanse 3D panoramic LiDAR scanner, one of the first panoramic scanners designed for consumer use. At an incredible price of $750, this camera-sized do-it-yourself scanner uses a $150 LiDAR sensor attached to two orthogonally rotating servos that are controlled by open source software on a Raspberry Pi—all powered by an off-the-shelf cell phone charger. Performance assessment involved comparing measurements of a conference room taken with the Scanse 3D and a professional Trimble scanner. Results showed the Scanse consistently overestimated room dimensions by 15 cm, although at the local level of a flat surface it showed sub-centimeter accuracy, with high

standard deviation and sub-centimeter precision. This latter result indicated systematic drift, which can be seen in a plot of the point cloud. Perhaps more interesting than the results, though, were the challenges faced in aligning the noisy and wavy Scanse data with the highly accurate and precise Trimble data. These were addressed using extended Gaussian image analysis, histogram analysis, and the iterative closest point process, all of which will be covered during the presentation.

Integrating heterogeneous, dynamic adaptation behavior in drought risk modeling

Marthe Wens

May 30, 2018

Visiting Ph.D. student **Marthe Wens** discussed extending the traditional drought-risk framework to better include the bilateral relationship between human and physical systems. The use of agent-based modeling technique to simulate the co-evolution of future drought hazard, exposure, vulnerability and heterogeneous, individual adaptation decisions, is showcased using a case study in Kitui, rural East Kenya.

Abstract: Droughts are a prevalent and costly hazard impacting urban, agricultural, and natural systems. Increasing climate variability is expected to exacerbate drought conditions in many parts of the world while evolving socio-economic conditions and adaptation strategies influence both short and long-term risk to ecosystems, economies, and human health. Since adaptation strategies evolve over time, explicitly modeling these dynamics is important for understanding future risk.

In this talk, I will advocate extending the traditional drought-risk framework to better include the bilateral relationship between human and physical systems. The use of agent-based modeling technique to simulate the co-evolution of future drought hazard, exposure, vulnerability and heterogeneous, individual adaptation decisions, is showcased using a case study in Kitui, rural East Kenya.