Notes from Geospatial/GIS Meetup
May 9, 2024

Rivera Library, Room 140 and Zoom

Attendees: Janet Reyes, facilitator;

In person:, Mike Cohen
Via Zoom: Asaf Evan-Paz, Bolu Daodu, Eddie Helderop, Kavin Phabiani, Luis Barrios, Lynn Sweet, Siddarth Kishore, Steve Ries, Tony Grubesic

Announcements

This meeting was recorded; video is available here. The passcode to view is 5!F!slU%

The **GIS @ UCR** student club is not official yet but welcomes students from all disciplines to check them out! Activities so far this year have included carpooling to the Los Angeles Geospatial Summit, helping gather information for the UCR campus map, and at least one guest speaker. Contact club president Kavin Phabiani at kphab001@ucr.edu if you are interested in learning more.

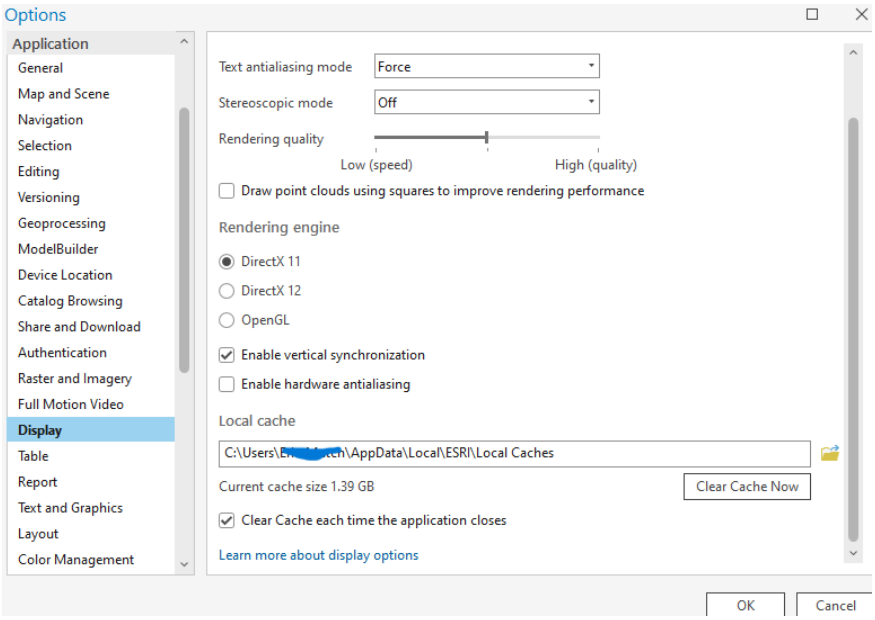
The **Esri Imagery and Remote Sensing Educators Summit** is a free virtual event occurring from 8:00 a.m. to 1:30 p.m. on Wednesday, May 22.

Esri is also providing a webinar on Thursday, June 6 on **Leveraging AI in ArcGIS** from 10-11 a.m.

UCR's **complimentary passes** for the Esri User Conference (July 15-19) have all been claimed. However, students can attend one day of the User Conference for free, and would only pay $150 for attending the entire conference.

Janet asked if any UCR affiliates had feedback on using ArcGIS Pro in the **itopia** virtual machines; there were no responses. Please reach out if you have something to share in the future.

Janet also shared a recently-learned tip regarding displays in ArcGIS Pro. If you find your session is starting to feature black boxes on top of a portion of your map or other unwanted characteristics, try **clearing the display cache**. To do so: from the Home page, click on Settings at left, then choose Options > Display.



Presentation

Eddie Helderop, Associate Director of the Center for Geospatial Sciences within the School of Public Policy, presented on **Higher elevation and higher prices: A model predicting climate gentrification in coastal Florida.**

Gentrification involves the displacement of lower-income residents from their neighborhoods, along with redevelopment of the buildings and a change in neighborhood culture or character. An example is people who lived in the suburbs moving to city centers that had been experiencing underinvestment. Gentrification is a complex phenomenon that involves positives and negatives. The changes can bring long-lasting improvements to quality of life in the neighborhood, but rising property values may force renters to move elsewhere, and cultural or social networks break apart. Causes of gentrification can include profit for developers, public funding to improve neglected neighborhoods, and changes in where individuals prefer to live.

Climate gentrification is a situation in which climate change serves as a catalyst for gentrification. For instance, if there's been public investment to improve an area's ability to withstand flooding incidents, that area becomes more desirable to live in. Areas not as prone to flooding (higher ground or inland) have lower insurance costs which makes them attractive.

Climate gentrification became a popular area of study around Miami after Hurricane Irma in 2017. The hurricane caused more damage to higher-end Miami neighborhoods compared to lower-income inland areas. In the aftermath, the latter areas became more attractive to residents and developers. Climate gentrification forces can operate at various scales, from within a city to within a state to across state lines.

The goal of the current study is to derive a comprehensive modeling framework for southeast Florida to predict future climate gentrification. They are looking at: where the higher-income residents are moving from; what neighborhoods are likely to be gentrified, and where the lower-income displaced residents

are moving to. The forecasting model factors in historical tidal flooding data, projected future storm surge, and sea level rise as well as residential and commercial real estate market trends. The team quantifies gentrification in terms of socioeconomic status over time, building uses, and housing and rental prices. They have been experimenting with different modeling tools, from basic regressions to deep learning. Currently they are using ensemble models such as random forest.

People in higher-end neighborhoods might start considering a move after being subjected to one or more dramatic storm surges, or by more routine flooding that is increasing in intensity and/or frequency. In using the model to hindcast, Midtown Miami was identified as an area that would be prime for climate gentrification, which was borne out by changes that did occur a decade ago. Populations displaced by climate gentrification tend to move farther from the coast, typically driven by price. However, these areas may be swampy and prone to nuisance flooding. Overall, better understanding of climate gentrification is needed in part so that it can be managed in ways that are more socially equitable.

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Following Eddie's presentation, Tony Grubesic, the Director of the Center for Geospatial Sciences, spoke on **Unmasking Invisible Infrastructure Networks with UAVs.**

The Common Ground Alliance is a professional group of 16 stakeholders that seeks to prevent damage to underground utility infrastructure. They estimate that damage to underground infrastructure in the US costs more than $30 billion annually. In 2021, there were more than 200,000 damage incidents throughout the US and Canada, mostly caused by: failure to notify the center that marks the surface in advance of an excavation, failure of those digging to maintain sufficient distance from marked infrastructure, or an error in how the utilities were marked on the ground. There is insufficient coordination among all the relevant parties, which is compounded by volume: a big, growing city such as Phoenix each month has more than 2500 housing permits, all of which should generate utility markings.

The goal of the study was to test a method for unmasking subsurface infrastructure systems and identify future excavation activities using data collected by unmanned aerial vehicles (UAVs, or drones). The researchers used high-resolution digital orthophotography combined with fieldwork to identify locator marks spray-painted on the surface as a way to monitor urban infrastructure projects. They accomplished this for the Cholla Cove neighborhood in Phoenix without checking the municipal permit system or interfacing with infrastructure providers.

Each type of utility uses a different color to create locator markings and each has standardized notations for describing the underground features. This locator language conveys where the infrastructure is, how deep it is, and what kind of utility is there. Utility marking is a legal requirement throughout the United States.

The study team collected data over 90 acres of the Cholla Cove neighborhood in August 2023 and in January 2024 using a WingtraOne (GenII) UAV flying at an average height of 250 ft. Pix4D was used to process the raw image data. Pixel size was 0.45 inches. The team manually identified and processed close to 400 locator marks in the resulting orthomosaic, assigning each mark a latitude/longitude coordinate pair. Almost half of the marks were white locator marks (which box out where the upcoming project was to take place), with electric, gas, and water being the next three most common marks. The

team aggregated the points into a hexagonal grid and used a Getis-Ord statistic to identify hotspots of locator marks. For one of the hotspots that was identified, comparison of the two sets of UAV imagery showed that a road centerline catch basin had been widened and tactile pavers at sidewalk pedestrian crossings had been installed.

Tony views the results as a half-step in developing a geospatial intelligence pipeline of municipal excavation projects. The observance of locator marks is perhaps a more reliable indication of upcoming neighborhood projects than reviewing permits because, on smaller projects in particular, contractors often fail to pull a permit for upcoming work - but they are more conscientious about ensuring locator marks will be created. The locator industry and city planning agencies typically don't coordinate with each other. Monitoring locator marks using UAVs could be a way for municipalities to detect and enforce unpermitted excavations.

It would be difficult to train convolutional neural networks to identify the marks because they require substantial amounts of semantic information to label small objects. Other challenges are that the marks themselves get scuffed over time, and that they may be partially occluded on the imagery.

Discussion

Steve asked whether any of the groups mentioned were interested in getting the ortho information. Tony replied that the City of Phoenix doesn't have the ability to store and analyze that type of data at scale.

Mike asked if they set waypoints and used ground control. Tony said they have post-processing kinematics (PPK) on the drone, which only requires one station.

Tony shared this link to a recently-published book that he co-authored, which includes a chapter on today's topic: UAVs for Spatial Modelling and Urban Informatics.

Contact

edward.helderop@ucr.edu

agrubesi@ucr.edu