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INDUSTRYNEWS

ANNOUNCEMENTS

Woolpert, https://woolpert.com/, Tapped for $250M USAF Geospatial Support and Services IDIQ. The five-year contract will support U.S. Air Force emergency planning and response for wartime and contingency, as well as human-caused and natural disasters.

The 771st Enterprise Sourcing Squadron, Strategic Sourcing Flight (EGB) at Wright-Patterson Air Force Base has tasked Woolpert with providing geospatial support and services under a five-year, $250 million, multiple award, indefinite delivery, indefinite quantity contract. The contract will support improved shared situational awareness, planning, and decision-making across the U.S. Air Force, including emergency planning and response for wartime and contingency, as well as human-caused and natural disasters.

This contract follows a geospatial IT task order supporting the Air Force Installation and Mission Support Center and Air Force Materiel Command awarded to Woolpert last year under a previous, recently completed USAF geospatial support and services IDIQ contract.

Under the new contract, Woolpert will utilize a comprehensive data analysis and management solution, developed in cooperation with the 448th Supply Chain Management Wing under the previous contract, to illuminate, secure, and monitor the USAF supply chain against natural and human-caused hazards. The solution leverages multiple domains of Woolpert's proven technical expertise, including geospatial data management, data science and engineering services, and cloud-based geospatial service development.

The firm has performed numerous contracts for the Department of the Air Force since 2019, including providing imagery and consulting services for its Installation Geospatial Information and Services Program, also known as the GeoBase program.

Woolpert Vice President Matt Johnson said that this most recent contract award exemplifies Woolpert's advanced geospatial analytical capabilities and the global company's ability to meet the increasing geospatial and information technology needs of the DAF.

"We are honored to continue our support for the Department of Defense's geospatial mission and are thankful to be able to demonstrate our value in providing improved situational awareness," Johnson said.

* * *

Swift Engineering, www.swiftengineering.com/, SULE High-Altitude, Long-Endurance Platform Reaches Stratosphere at 56,000 Feet in 24-Hour-Plus Flight.

Swift Engineering has announced that its SULE (Swift Ultra Long Endurance) aircraft achieved a major milestone in a flight that reached 55,904 ft. MSL (Mean Sea Level) on Sept. 29-30, 2024.

The groundbreaking, 24-hour flight opens up new possibilities for scientific research and environmental monitoring as well as defense and aerospace applications. SULE took off from and landed at Spaceport America in New Mexico. The successful flight more than doubled the previous altitude record for the aircraft which had achieved a level of 25,000 ft.

"As a HAPS solution, the solar-powered SULE is designed to stay airborne for multiple weeks at a time," said Hamed Khalkhali, President of Swift Engineering. "Its wide range of applications includes communications relay, internet/comms in underserved or remote areas, ISR needs, forest fire monitoring, traffic management, disaster relief, agriculture, change detection and many others. In addition, it is significantly lower in cost to manufacture and operate compared to other available offerings."

The Swift suite of UAS (Unmanned Aircraft Systems) spans the shorter range, rapidly deployable VTOL (Vertical Take-off and Landing) Swift Crane to the longer endurance, longer range, gas-powered Swift Accipiter suitable for most military and law enforcement applications.

SULE delivers an even longer range/endurance platform with a 72-foot wingspan and 15-pound payload capacity that can provide seamless communications relay capabilities to all Swift platforms as well big-picture awareness beyond the range of Crane and Accipiter.

Swift Engineering is also participating in a two-year program with NASA focused on the development of unmanned aircraft that can achieve extended endurance with decreased cost and increased data capture capabilities. The program will include multiple on-the-ground tests of systems and subsystems as well as flights of 24 hours, 48 hours and seven days.

* * *

The GIS Certification Institute (GISCI) celebrates a transformative year, marking significant achievements that underscore its mission to elevate the geospatial profession and empower Geographic Information Systems (GIS) professionals worldwide. From the prestigious CESB accreditation of its GIS Professional® (GISP) certification to a strategic collaboration with the American Society for Photogrammetry and Remote Sensing (ASPRS), GISCI's advancements reflect a renewed commitment to excellence, accessibility, and innovation.

A pivotal moment for GISCI came with CESB's accreditation of the GISP certification, recognizing the program's rigorous standards and its dedication to professional practice and educational quality. The CESB recognition reinforces the GISP as the premier credential, strengthening GIS professionals' pathways to career advancement and affirming GISCI's role in promoting best practices across the industry.

Another significant advancement for the GISP certification was forging a partnership with Pearson VUE, to create additional Geospatial Core Technical Exam testing centers across 175 countries. This expanded network, available for the December 2024 exam window, will increase testing centers from 800 to 4,500, reflecting GISCI's commitment to making certification accessible worldwide and empowering GIS professionals with broader growth opportunities.

To further support its vision, GISCI also welcomed new leadership in 2024, including Allen Ibaugh, GISP, as President of the Board, bringing a wealth of industry experience and a forward-looking approach to advancing GISCI's certification programs. Additionally, GISCI introduced a new partnership with the American Society for Photogrammetry and Remote Sensing (ASPRS), bringing deep expertise in photogrammetry and remote sensing to its Board of Directors, enriching GISCI's initiatives and supporting knowledge-sharing that will benefit the entire geospatial sector.

With these accomplishments, GISCI reaffirms its dedication to fostering ethical practices, advancing careers, and building a robust, globally connected GIS community. As the geospatial industry grows, GISCI's achievements in 2024 demonstrate a firm commitment to supporting GIS professionals and driving innovation within the field. For more information on GISCI, GISP certification, or recent initiatives, please visit www.gisci.org.

* * *

USGS Selects **Woolpert**, https://woolpert.com/, to Provide Elevation-Derived Hydrography Across Northwest and Central Ohio. The data will be used to support the 3D Hydrography Program and advance statewide flood mitigation efforts.

The U.S. Geological Survey has selected Woolpert to process and delineate elevation-derived hydrography (EDH) across Northwest and Central Ohio in support of the 3D Hydrography Program (3DHP).

3DHP is the first systematic remapping of U.S. hydrography since the original USGS 1:24,000-scale topographic mapping program was active, which included the National Hydrography Dataset (NHD). Maps were produced by USGS at that scale as early as 1904, with revisions made until 2006. 3DHP uses updated, high-accuracy elevation data collected as part of the 3D Elevation Program (3DEP).

Under this task order, Woolpert will process 1,439 square miles of previously collected Quality Levels 1 and 2 lidar data to produce new, highly detailed EDH data for the designated area of interest spanning the Scioto River and Big Darby Creek. Woolpert acquired that lidar data under multiple 3DEP contracts between 2018-2021.

"The EDH team at Woolpert is excited to support our partners at the USGS on yet another 3DHP project, especially one so close to home for many of our staff in Ohio," Woolpert Project Manager Matt Worthy said. "Building on our previous efforts in Alaska, Oregon, Tennessee, and Idaho, and through technical exchanges with other groups within Woolpert such as the 3DEP lidar team and multiple geospatial teams that leverage artificial intelligence and machine learning, this team continues to identify innovative solutions which improve the quality of the data for our clients."

Woolpert Vice President and Program Director Brian Stevens said that the EDH data will be used to define and model Ohio's rivers, tributaries, and floodplains, helping support and advance statewide flood mitigation efforts. The project is being funded by the Ohio State Office of Natural Resources Conservation Service.

"Engineers, natural resource managers, and other state agencies will be able to utilize this new, highly accurate data for mapping, modeling, and analyzing surface water and flow patterns," Stevens said. "From reengineering roadways to prevent flooding and improving drainage surrounding agricultural areas and farmland, this new data and the efforts of the 3D Hydrography Program are critical to improving Ohio's flood-risk management and planning efforts."

The data is expected to be delivered in spring 2025.

EVENTS

The US National Committee for the ICA is pleased to announce travel funding opportunities for US cartographers and scholars at US institutions to attend the 2025 ICC. Opportunities are available for both early and non-early-career scholars. Funds are made available through the Cartography and Geographic Information Society and the National Science Foundation.

The deadline to apply is 15 January 2025. See details at https://cartogis.org/usnc-ica.

CALENDAR

- 29-31 January, **ISPRS, EARSeL & DGPF Joint Istanbul Workshop**, Istanbul, Turkey; https://isprsistanbul2025.org/
- 10-12 February, **Geo-Week**, Denver, Colorado; www.geo-week.com.
- 3-8 August, IEEE International Geoscience and Remote Sensing Symposium, Brisbane, Australia; https://2025.ieeeigarss.org.
- 16-22 August, **32nd International Cartographic Conference**, Vancouver, Canada; https://cartogis.org/usnc-ica.

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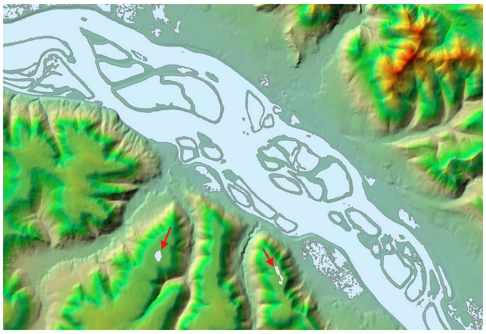
HIGHLIGHT ARTICLE

COLUMNS



ANNOUNCEMENTS

DEPARTMENTS

19 Landslide Evolution Assessment Based on Sequential InSAR Methods in the Kunming Transmission Line Corridor

Gang Wen, Yizuo Li, Chuhang Xie, Zezhong Zheng, Yi Ma, Fangrong Zhou, Baiyan Su, and Huahui Tang

The security of the transmission line corridor is an important guarantee for the sustainable supply of electricity and an important prerequisite for the rapid development of the economy. Transmission corridors located in high mountains and valleys are often threatened by geological disasters, which seriously affect their stable operation. This research uses interferometric synthetic aperture radar (InSAR) methods to analyze deformation changes before the landslide in the Kunming transmission corridor using 79 Sentinel-1A SAR images from July 2020 to October 2021.

27 Adaptive Orientation Object-Detection Method for Large-scale Remote Sensing Images Based on Multi-scale Block Fusion

Yanli Wang, Zhipeng Dong, Mi Wang, and Yi Ding

Object detection is crucial to extracting and analyzing information autonomously from high-resolution remote sensing images (HRSIs). To address ideal blocking for large-scale HRSI object detection, this research uses a novel adaptive orientation object-detection method for large-scale HRSIs based on multi-scale block fusion.

35 RSODNet: Lightweight Remote Sensing Image Object Detection Combined with BCDNS Compression Algorithm

Xinyu Zhu, Zhihua Zhang, Wei Wang, Yuhao Hou, and Shuwen Yang

In recent years, with the gradual increase of neural network Params (the aggregate of trainable elements in a model, including weights, biases, and other adjustable elements) and calculation volume, model compression within an acceptable range of network accuracy variations has emerged as a prominent research focus in the field of deep learning. Model pruning and knowledge distillation have been widely used for reducing the complexity and storage cost of neural networks. This research designs the Remote Sensing Object Detection Network (RSODNet), a lightweight model for remote sensing image object detection, and proposes bridging cross-task distillation network slimming (BCDNS) as a method that integrates model pruning and knowledge distillation.

53 Monitoring and Predictive Analysis of Surface Deformation Using Combined SBAS-InSAR Technology and CS-Elman Neural Network: A Case Study of Wenchuan County, Sichuan Province, China

Kuayue Chen, Baoyun Wang

Earthquakes deposit loose materials in gullies, making seismic mountain gorges prone to landslides and debris flows. Monitoring and predicting ground deformation in these areas is essential. This research introduces a CS-Elman prediction model based on SBAS-InSAR monitoring.

See the Cover Description on Page 4

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COVER DESCRIPTION

Towering over the desert in southwestern Libya, the Messak Settafet plateau resembles the wall of a giant fortress, with its dark, erosion-resistant sandstone separating the Ubari Sand Sea to the north and the Marzūq Sand Sea to the south.

The Operational Land Imager-2 (OLI-2) on Landsat 9 captured these images of the plateau on November 17, 2024. The large outcrop of Cretaceous rock features a sharp escarpment on its north side. The cliff, some 300 meters (1,000 feet) high in places, is lined with a thin dark shadow in the top image above. Dark debris from rockfalls is visible to the north. Note that an optical illusion called relief inversion can make high-elevation areas appear low and vice versa when shadows appear on the northern side of a feature.

Although the plateau now receives less than 10 millimeters (0.4 inches) of rain annually, clues in the landscape make clear it was once much wetter. Deeply incised dried stream valleys, or wadis, crisscross the plateau, indicating significant past water flow. The small, bright features scattered across the plateau are sand and silt deposits left where water once pooled.

A dusty road winds its way up the escarpment's edge near the center of the image and runs along the plateau's top. The second image above shows where that road leads—to the El-Feel oil field in the middle of the plateau. Secondary roads lead to rows of oil wells, power lines, pipelines, office buildings, and a runway. The faint grid-like pattern of lines around the oil field is a remnant of seismic surveys used to determine the best places to drill. Oil was discovered here in 1997, and the oil field began producing in 2004.

Oil companies are not the first to exploit Messak Settafet's resources. Archaeologists have unearthed evidence that hominins—a taxonomic group that encompasses Homo sapiens and other extinct species such as Homo neanderthalensis and Homo erectus—have mined the plateau for quartzite to make tools since the Stone Age.

Signs of ancient toolmaking cover much of the plateau's surface. According to one archaeological survey, people discarded so many stone tools and rock fragments on the plateau over hundreds of thousands of years that roughly 75 artifacts per square meter now carpet the surface. That makes this one of the earliest known examples of hominins modifying an entire landscape, according to the University of Cambridge archaeologists who conducted the survey.

Other signs of ancient activity include the bright spots that dot the image. These areas were likely quarrying pits where people dug up rocks and crafted them into tools, the archaeologists reported. Since these depressions would have retained extra water after rains, they left these sandy and silty deposits. They also likely attracted game. Based on the density of notched "tethering" stone artifacts found within the deposits, they were likely used as hunting and trapping sites.

Archaeologists have also documented large amounts of petroglyphs, cave paintings, and other rock art on and around the plateau, though such works are too small to be seen in these images. For instance, Wadi Mathendous, a prehistoric archaeological site located in the southern part of the plateau, contains engravings of rhinoceroses, crocodiles, hippopotamuses, fighting cats, giraffes, long-horned buffaloes, and elephants. The art is thought to be about 8,000 years old.

For full story, visit https://landsat.visibleearth.nasa.gov/view.php?id=153611

NASA Earth Observatory images by Michala Garrison, using Landsat data from the U.S. Geological Survey. Story by Adam Voiland.

This image record originally appeared on the Earth Observatory. Visit https://earthobservatory.nasa.gov/images/153611/human-fingerprints-on-an-ancient-landscape to view the full, original record.

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Modernizing the Concept of Quality Levels for Elevation Data

ASPRS Lidar Working Group
Matt Bethel, Chair

The 3D Elevation Program (3DEP) initiative began in 2012 with the preparation of standards for the collection of three-dimensional (3D) elevation data and the modernization of data management and delivery systems (Sugarbaker *et al.*, 2014). The 3DEP initiative is based on the results of the National Enhanced Elevation Assessment (NEEA) that was funded by National Digital Elevation Program (NDEP) agencies and completed in 2011 (Dewberry, 2012). The study identified more than 600 requirements for enhanced (3D) elevation data to address mission-critical information requirements of 34 Federal agencies, all 50 States, and a sample of private sector companies and Tribal and local governments.

When the USGS published the Lidar Base Specification Version 1.0 (Heidemann, 2012) and the NEEA report in 2012, these documents considered five Quality Levels of enhanced elevation data to satisfy the nationwide requirements (Table 1).

While the actual values of the Quality Levels have adjusted slightly over the years to be more in line with ASPRS Accuracy Standards for Digital Geospatial Data (ASPRS, 2024), the premise of Quality Levels (QLs) being defined by the combination of Point Density/Point Spacing and Vertical Accuracy have remained the defining factors. Those five Quality Levels (QL1 - QL5) have become widely accepted throughout the lidar user and producer communities. The 3D Elevation Program targeted Quality Level 2 data or better (point density of at least 2 points per square meter (ppsm) and a nonvegetative vertical accuracy of RMSEz <= 10cm) as the minimum for the Conterminous United States and territories, with QL5 in Alaska. However, with recent advances in lidar, photogrammetric, and survey technologies, it has become feasible to collect point clouds of higher density and/or increased accuracy. People outside of 3DEP have been using Quality Levels to quickly describe elevation data; and terminology, such as QL2/1/0+ or QL1/2 HD have crept into the lexicon, adding uncertainty to the actual "Quality Level" of the data. This can lead to confusion in the community, as a project can have 2 points per square meter or 8 points per square meter and still be considered QL2. Hence, ASPRS is considering a new nomenclature to better represent the accuracy and density of lidar and photogrammetrically-derived point clouds.

ASPRS Lidar Division is proposing a new nomenclature that moves the description of Quality Levels from discrete categorizations to more of a continuous matrix. We are calling this the "Quality Matrix" instead of "Quality Levels". Figure 1 (*see next page*) is a graphical representation of this concept.

The naming convention of a dataset consists of the prefix "QM" to distinguish from QL, as well as two attributes, the vertical accuracy _A[i] (as represented by NVA measurements in cms) and _D[i] (the computed target/design point density in points per square meter). In the example in Figure 1 a project that had a NVA RMSEv of 12cm and a Point Density of 20 points per square meter would be called a "QM_A12_D20" project.

Table 1. Quality Level descriptions first noted in the National Enhanced Elevation Assessment (NEEA). From https://www.dewberry.com/services/geospatial-mapping-and-survey/national-enhanced-elevation-assessment-final-report

Elevation Quality Levels (QL)	**Source**	**Horizontal Resolution Terms**			**Vertical Accuracy Terms**	
		Point Density	**Nominal Pulse Spacing (NPS)**	**DEM Post Spacing**	**Vertical RMSEz**	**Equivalent Contour Accuracy**
QL 1	Lidar	8 pts/m^2	0.35 m	1/27 arc-sec ~1 meter	9.25 cm	1-ft
QL 2	Lidar	2 pts/m^2	0.7 m	1/27 arc-sec ~1 meter	9.25 cm	1-ft
QL 3	Lidar	1 – 0.25 pts/m^2	1 – 2 m	1/9 arc-sec ~3 meter	≤18.5 cm	2-ft
QL 4	Imagery	0.04 pts/m^2	5 m	1/3 arc-sec ~10 meters	46.3 cm – 139 cm	5 – 15 ft
QL 5	IFSAR	0.04 pts/m^2	5 m	1/3 arc-sec ~10 meters	92.7 cm – 185 cm	10 – 20 ft

This matrix can still be used to pass/fail any 3DEP related project that relies on QLs. For example, any project with a QM value of A<=10 and D=2-8 would be considered to pass QL2 requirements. This matrix simply allows for a more complete description of the relationship between density and accuracy. There could be projects with points that have extremely low RMSE values (e.g. 2cm), and extremely low-density values (e.g. 1 ppsm), such as from a total station capture. These data could be notated as QM_A2_D1. Conversely, extremely dense, less accurate point clouds, such as point clouds derived from amateur Structure from Motion captures could be notated in this schema as well (e.g., QM_A50_D300).

We feel these changes in nomenclature will allow for a greater community embrace of "Quality" metrics while allowing for characterization of data that has not typically fallen into the discrete Quality Level classes invented specifically for the 3D Elevation Program.

The ASPRS Lidar Division is looking for input into this approach. Suggestions are welcome.

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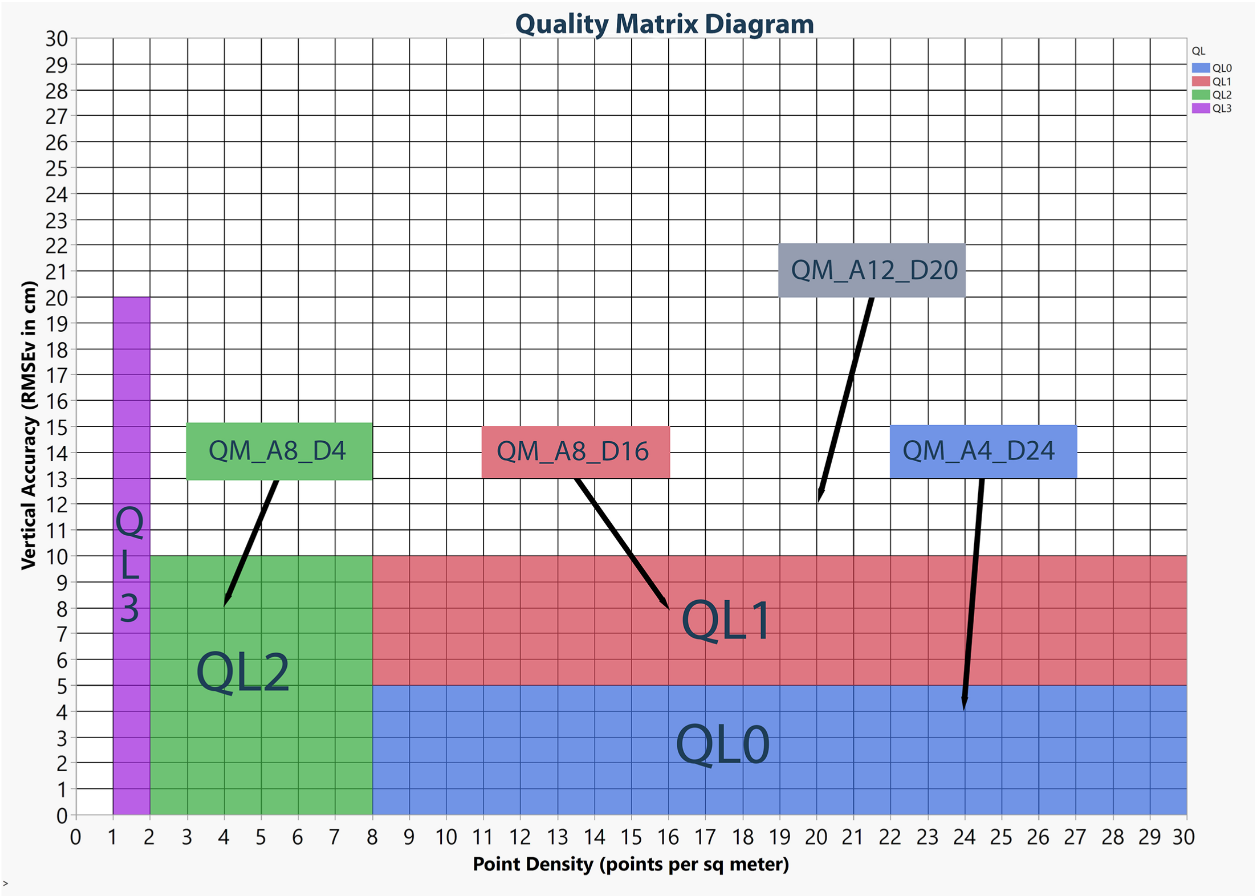


Figure 1. Graphical representation of proposed Quality Matrix and associated representation of frequently used Quality Level classes

GIS Tips & Tricks

By Al Karlin, Ph.D., CSM-L, GISP and Dean Djokic, Ph.D.

New Terrain Tools in Arc Hydro

While most of the GIS Tips & Tricks columns originate from questions my GIS students ask, and I try not to favor any one GIS software, this month, I would like to highlight two new terrain characterizing tools available in the ArcGIS Pro – Arc Hydro toolbox that Dean Djokic, a colleague at Esri and I developed. The Arc Hydro toolbox is distributed for ArcGIS Pro at no cost and is easily downloaded from the Esri website: https://www.esri.com/en-us/industries/water-resources/arc-hydro. Care must be taken to download an Arc Hydro version that is appropriate for your particular ArcGIS Pro version. For best results, use ArcGIS Pro v 3.3 and Arc Hydro Pro v3.2.17 (or higher). Installation requires "Administrator" privileges. Once installed, the Arc Hydro Pro toolset will appear in your Geoprocessing pane (Figure 1).

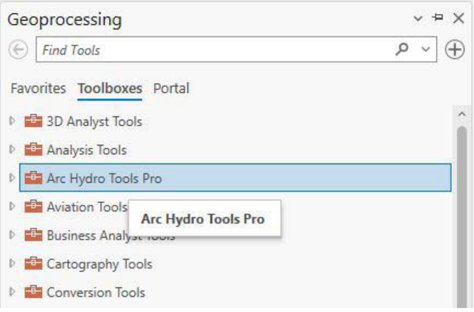


Figure 1. The Arc Hydro Pro Toolbox in the Geoprocessing Pane.

Opening the Arc Hydro Pro toolbox reveals twelve toolsets, each containing multiple tools and scripts. For this month's GIS Tips & Tricks, we will focus on two tools, the "Identify Flat Areas" (Figure 2), a script in the DEM Manipulation Toolset, and the BotHat Transformation tools found under the Terrain Preprocessing Toolset (Figure 3).

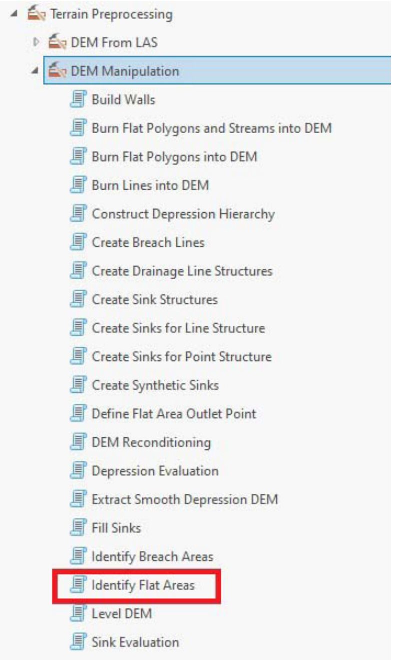


Figure 2. The new "Identify Flat Areas" script in the DEM Manipulation Toolset.

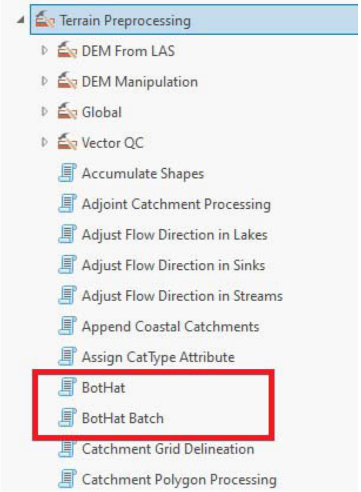


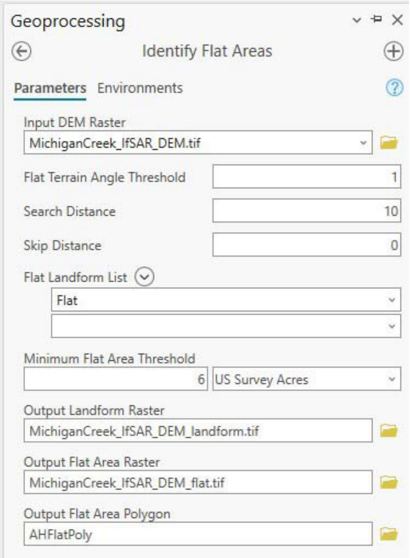
Figure 3. The BotHat and BotHat Batch scripts under the Terrain Preprocessing Toolset.

TIP #1—THE "IDENTIFY FLAT AREAS" TOOL IS THE GEOMORPHON LANDFORMS TOOL

To identify flat areas for use in hydro-flattening Digital Elevation Models, the Esri Water Resources Team fashioned the Spatial Analyst | Surface | Geomorphon Landforms tool into a more specific purpose tool. The Geomorphon Landforms tool is "wrapped" in a script that sets the terrain parameters for Angle Threshold, Search Distance, and Skip Distance to generally acceptable values, and then sets the Geomorphons to "Flat" (0,0,0,0,0,0,0,0) cells to be output with a default square meter (2000:0.5 acres) minimum threshold (coincidentally the minimum area for a waterbody for Florida Water Management District). There are two raster outputs; one the 10 most common geomorphons and another raster of only the flat cells. The tool finishes by constructing a polygon Feature Class of the Flat Areas (Figure 4). For more information on Geomorphons, see the Esri Help at: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/geomorphon-landforms.htm or the original reference publication at: https://www.sciencedirect.com/science/article/abs/pii/S0169555X12005028 . NOTE: A similar Geomorphon tool is available in QGIS for the Grass toolset in the Raster folder as r.geomorphon.

In the following example, I use an IfSAR-derived 5m x 5m cell size DEM representing the Michigan Creek Hydrological Unit Code (HUC) – 12 (190705060601) in the Charley

Creek-Yukon River Watershed. The Michigan Creek HUC12 is approximately 102 sq. km (25,200 acres). The DEM is approximately 320MB (9500 x 9000: 5m x 5m cells). Processing time on an Intel 13 Generation i7 (1.7GHz) with 32 GB RAM was 38 seconds (for Identify Flat Areas) and 25 seconds for BotHat Transformation (Batch mode).



Input DEM Raster: MichiganCreek_IfSAR_DEM.tif
Flat Terrain Angle Threshold: 1
Search Distance: 10
Skip Distance: 0
Flat Landform List: Flat
Minimum Flat Area Threshold: 6 US Survey Acres
Output Landform Raster: MichiganCreek_IfSAR_DEM_landform.tif
Output Flat Area Raster: MichiganCreek_IfSAR_DEM_flat.tif
Output Flat Area Polygon: AHFlatPoly

Figure 4. The dialog box for the "Identify Flat Areas" tool. I updated the Minimum Flat Area Threshold values to 6 and specified US Survey Acres. Note, Arc Hydro will create a "layers" Feature Dataset in your project's GeoDataBase; the Output Polygon Feature Class will be directed to the Layers Feature Data set.

The Geomorphon_DEMname.tif raster will contain the 10 most common Geomorphon classes with those classes identified in the legend. The DEMname_flat.tif raster will only contain those classes (Flat is the default) specified in the Dialog Box as "flat", and the AHFlatPoly Feature Class is a polygon representation of those areas specified in the Flat Landform List in the dialog box (Figure 4). The results of the analysis are shown in Figure 5, where the predominant color (yellow) represents the areas of steep slope (remember this IS Alaska), the red areas are ridges (again Alaska), and the blue areas are valleys, most likely rivers and channels.

To visualize the gray pixels that represent the flat areas, I zoomed-in (Figure 6) to a smaller region near the Michigan Creek. Again, as expected, the geomorphon flat areas appear to be the hydro-flattened main channel and the smaller inter-channel islands. The two smaller areas along elevated plateaus (red arrows) may represent waterbodies, marshes, or artifacts.

TIP #2—The BotHat Transformation tools

The BotHat transformation is a digital image processing technique that extracts small elements and details from an image. It is formally called the Top-hat Transformation and can be performed as either the difference between an image and it's "opening" (= White TopHat/TopHat) or the difference between the image and it's "closing" (=Black TopHat or BotHat). The transformation, unlike the geomorphic landform, can help identify small, non-specific features, such as channels, in the DEM. For more information, see: https://www.researchgate.net/figure/Top-bot-hat-transformation-of-the-DR-image_fig9_362882106.

Esri implemented the BotHat Transformation in two Arc Hydro Pro tools. The first tool (Figure 7) allows the user to specify one processing window (Processing Window Size) which controls the number of pixels in the window (=kernel) for analysis. The default is a 3 x 3-pixel window.

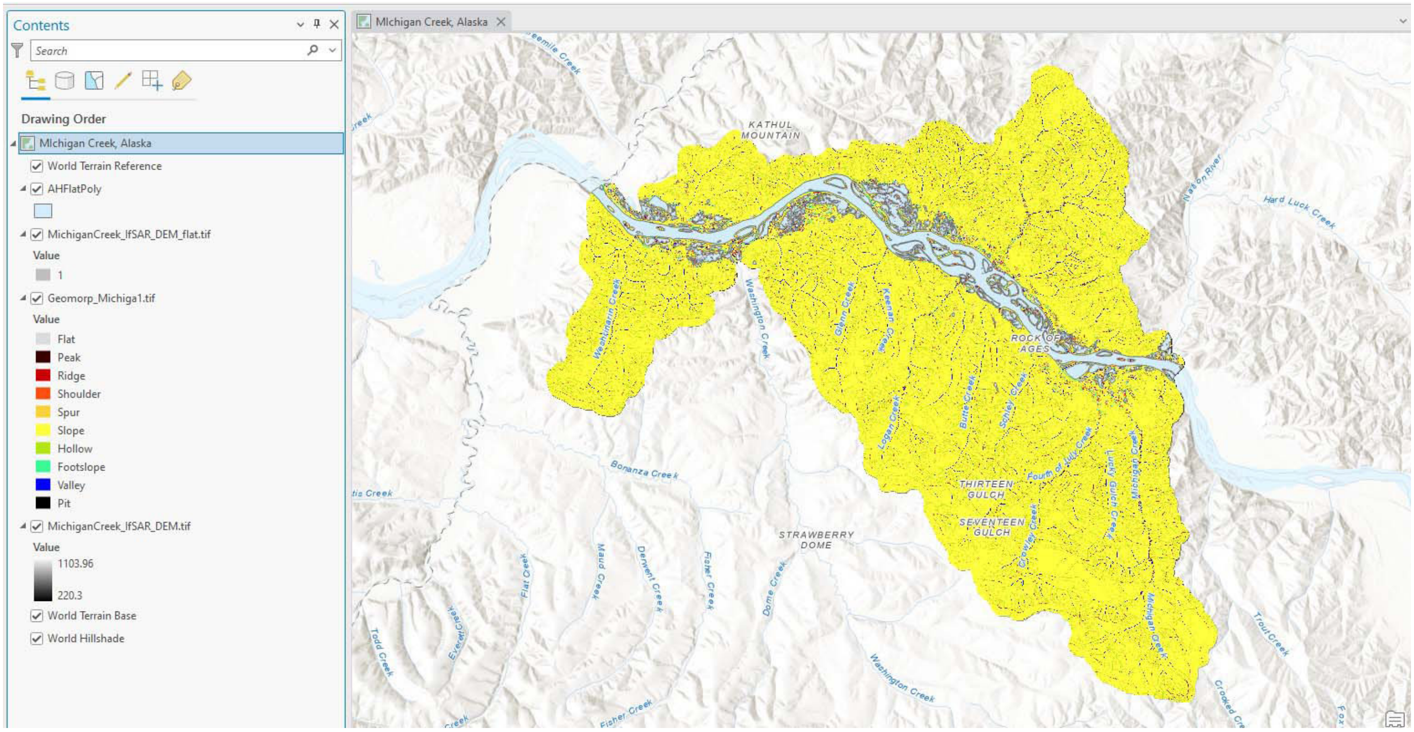


Figure 5. The 10 most-common Geomorphic landforms in the Michigan Creek HUC12.

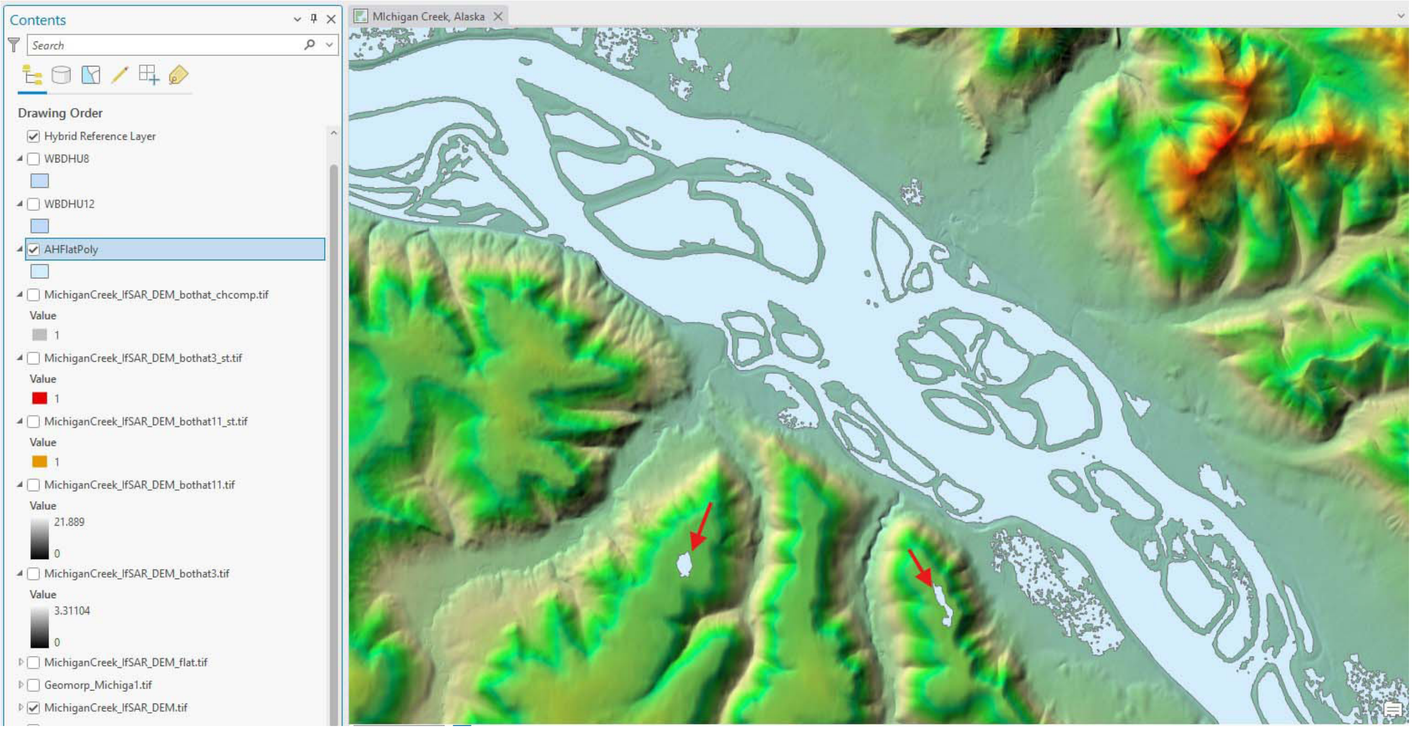
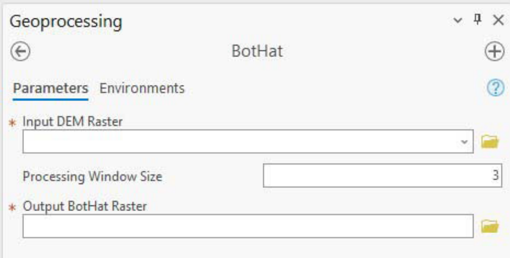


Figure 6. Zoomed-in area of the Michigan Creek HUC12 showing Geomorphon "Flat" areas.

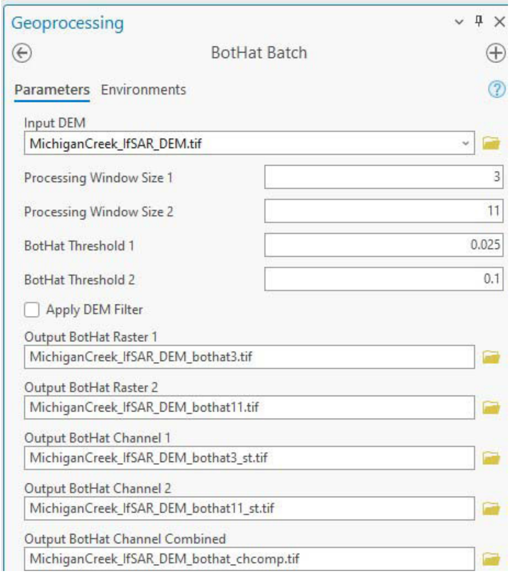
A common usage of the BotHat Transformation involves calculating the BotHat raster with two different window sizes, usually 3 x 3 and 11 x 11, and combining them into a single resulting raster. The BotHat Batch tool (Figure 8) allows the user to specify two window sizes (default is 3 x 4 and 11 x 11), outputs the individual rasters, and then combines the individual rasters into a combined raster (Figure 8) using some common default threshold size values for each. This tool is provided for convenience; it uses the same algorithms as the BotHat tool (Figure 7), but outputs several BotHat rasters without additional user intervention. The results of the BotHat Batch tool are shown in Figure 9, where the orange cells are the results of the 11 x 11 window and the red cells are the results of the 3 x 3 window. Upon even casual inspection, these results indicate possible channelized features in the DEM.

The BotHat transformation is also available in the WhiteBox Tools (discussed in a previous GIS Tips & Tricks column; May 2024). In the WhiteBox Tools, The Tophat Transformation can be found in the "Image Processing Tools | TopHat Transform. To enable the BotHat transformation, choose the "black" Variant as in Figure 10.



* Input DEM Raster	
Processing Window Size	3
* Output BotHat Raster	

Figure 7. The BotHat tool dialog box in Arc Hydro for Pro.



Input DEM	MichiganCreek_IfSAR_DEM.tif
Processing Window Size 1	3
Processing Window Size 2	11
BotHat Threshold 1	0.025
BotHat Threshold 2	0.1
☐ Apply DEM Filter	
Output BotHat Raster 1	MichiganCreek_IfSAR_DEM_bothat3.tif
Output BotHat Raster 2	MichiganCreek_IfSAR_DEM_bothat11.tif
Output BotHat Channel 1	MichiganCreek_IfSAR_DEM_bothat3_st.tif
Output BotHat Channel 2	MichiganCreek_IfSAR_DEM_bothat11_st.tif
Output BotHat Channel Combined	MichiganCreek_IfSAR_DEM_bothat_chcomp.tif

Figure 8. The BotHat Batch Dialog Box in Arc Hydro for Pro showing two processing windows for routine feature extraction.

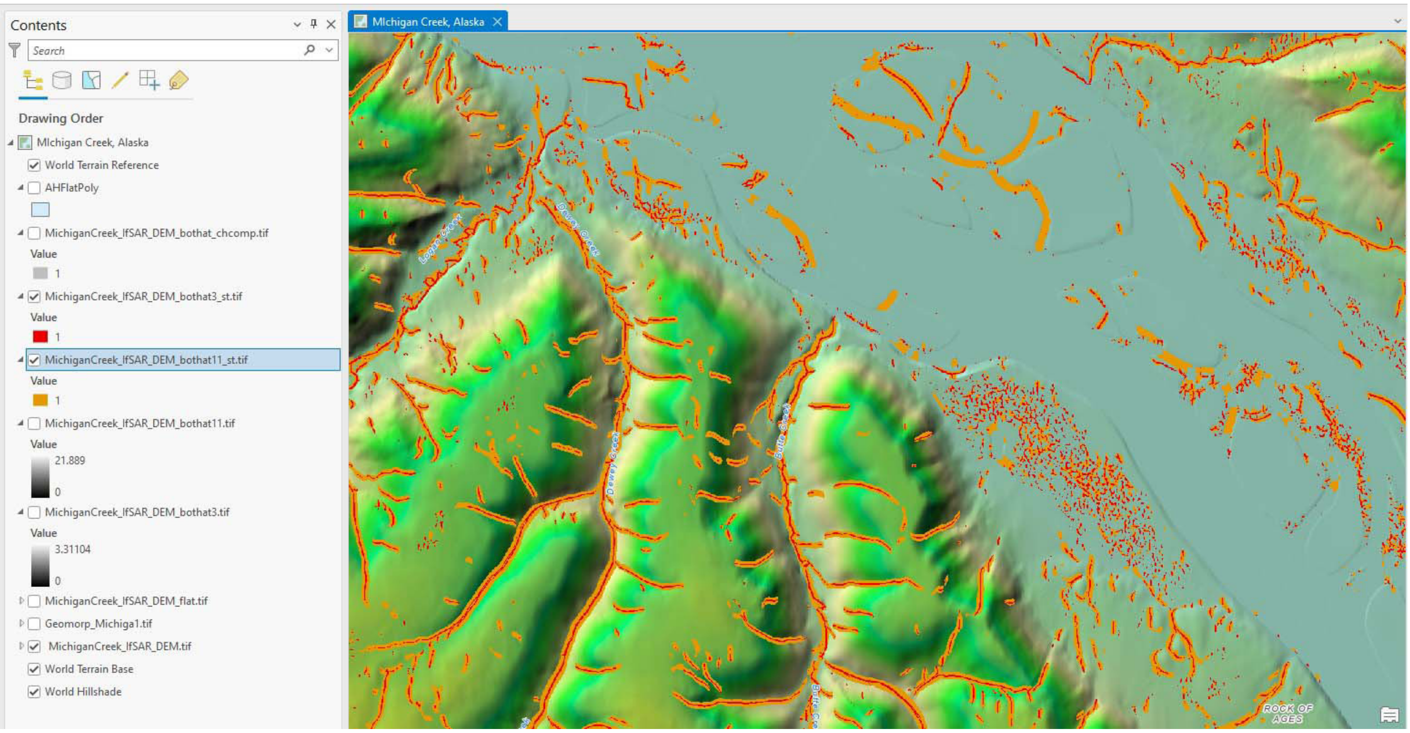
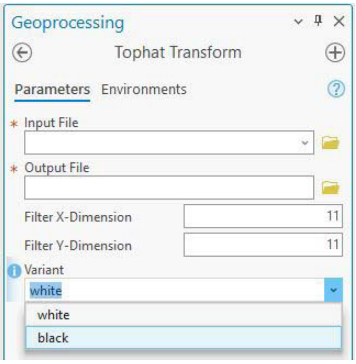


Figure 9. The results of the BotHat Batch processing showing the 3 x 3 window in red and the 11 x 11 window in orange for a portion of the Michigan Creek HUC12.



Filter X-Dimension 11

Filter Y-Dimension 11

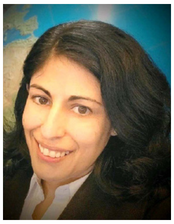
Variant white

Figure 10. The WhiteBox Tool for computing the TopHat Transform tool showing the "black" (BotHat) variant.

Send your questions, comments, and tips to GISTT@ASPRS.org.

Al Karlin, Ph.D., CMS-L, GISP is with Dewberry's Geospatial and Technology Services group in Tampa, FL. As a senior geospatial scientist, Al works with all aspects of lidar, remote sensing, photogrammetry, and GIS-related projects.

Dean Djokic, PhD, is an experienced water resources professional with a Doctor of Philosophy (PhD) in Civil Engineering from The University of Texas at Austin. He is the lead Arc Hydro architect and developer at Esri, contributing and mentoring within Esri's water resources practice for more than 25 years.



Amanda D. Aragón, and Robert A. “Bob” Ryerson, PhD, FASPRS

Diversity, Equity, and Inclusion

As part of our ongoing commitment to fostering an inclusive and forward-thinking community, we began by discussing this column as a status report on DEI (Diversity, Equity, and Inclusion) in ASPRS and the geospatial profession at large. The concept has contracted in one sense and expanded in another. This column serves as both a call to action and an invitation for input. What does fairness in the workplace mean to you? How can we ensure that ASPRS continues to grow as an organization serving a community where diverse perspectives are not only welcomed but valued? Your feedback will guide us as we seek to understand the challenges and opportunities in making our field more inclusive.

Our Mission

We aim to explore how fairness and inclusivity are evolving in our workplaces and in the community ASPRS serves. Whether in government, industry, NGOs, or academia. DEI and other related phrases have become buzzwords, yet they reflect a deep-seated commitment to fostering environments where everyone, regardless of background, can contribute and succeed. We want to understand where we stand as a community and how we can do better.

This column serves as a platform for us to collectively reflect on the fairness practices within our sector. We want to learn from you—the professionals in this space—about what is working, what needs improvement, and what role ASPRS can play in promoting these efforts.

Why Fairness and DEI Matter

Before we go any further on our focus, we should provide some background and definitions. DEI is “a term used to describe policies and programs that promote the representation and participation of different groups of individuals. DEI encompasses people of different ages, races, ethnicities, abilities, disabilities, genders, religions, cultures and sexual orientations. It also covers people with diverse backgrounds, experiences, skills and expertise.”[1] Much has been written on DEI – from definitions to guidelines on how to implement a successful program.[2]

But what IS the status in ASPRS and in our sector? We have seen that even the mention of DEI risks triggering animosity and negative reactions.[3] Indeed, some prominent people have called the use of the term racist – as can be seen by searching “DEI” and “racist.” Some suggest that the term DEI not be used – the term fairness has been suggested instead.

But perhaps the first question we should deal with is why is there all of this focus on DEI or fairness? Simply stated, because it is important. In one of the more succinct and complete statements along this line Bloomberg Businessweek Magazine has stated that “diversity and inclusion aren’t afterthoughts. They’re central to our success. Innovation drives our business forward – and we know that disruptive, breakthrough ideas come about when diverse teams look at challenges from different angles. Our culture values difference, fosters inclusion and promotes collaboration, because the data shows us that when every employee is empowered to impact our business, we all win.”[4]

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[1] https://www.techtarget.com/searchhrsoftware/definition/diversity-equity-and-inclusion-DEI

[2] https://www.techtarget.com/searchhrsoftware/feature/7-keys-to-a-successful-diversity-and-inclusion-initiative

[3] https://www.bloomberg.com/news/videos/2024-03-14/how-diversity-became-a-dirty-word-in-corporate-america

[4] https://www.bloomberg.com/company/values/diversity-and-inclusion/

Historical Context in ASPRS

ASPRS was, relatively, an early leader in recognizing women with Tamsin Barnes (1985) and Marilyn M. O'Cuilinn (1990) serving as Presidents. Since then, eleven other women have served in that role. Identifying gender in what today would be called traditional classes is easy in ASPRS compared to the sector as a whole. However, in ASPRS there is no record that we are aware of that shows how those of different races have been involved – in either leadership or member activities. And we have even less information about gender, race, and origin of those active in industry. We have therefore concluded that what we can tell you about DEI in ASPRS is how ASPRS has organized itself and what has been done in DEI.

As we have come to acknowledge, beyond race and gender, true DEI is a personal journey and encompasses a range of factors, including age, disability, sexual orientation, economic background, and life experiences, all of which contribute to creating a more dynamic, inclusive, and innovative professional environment.

Current Landscape of DEI in the Sector

With our new focus on the sector, we would like to gain some insight into how DEI and fairness have been implemented in government, academia, and industry. We want to do this for two reasons. The first is to have a better understanding of what has been and is being done well, leading to positive outcomes. Such information will prove useful to those in our sector who wish to implement programs or improve their existing programs. The second reason is that we want to contribute an overview of the situation in the community ASPRS serves to the ISPRS DEI activity at the Congress in 2026.

Ideally, as professionals, we would like to elicit information from a survey of a fully random and representative sample. We have been unable to find such a sample in our sector. We do believe that there are enough people in our sector who care about fairness and who can tell us what has been done at their place of employment and how successful it was. From the responses we receive, we will write a future column on the value of fairness in the workplace, what approaches seem to work, and those that may have led to less successful outcomes.

Fairness

Share Your Experience

We believe that everyone's voice matters. Your insights on fairness in your workplace will help us understand the strengths and gaps in current policies, allowing us to share what works best with the broader community. By contributing to this conversation, you will help shape future thinking and potentially guide ASPRS's approach to fostering fairness and inclusion.

Please respond to the corresponding author with answers to the following questions.

1. Do you work in industry, government or academia ?
2. Is there a fairness or equity policy in your workplace?
3. Please describe in a few sentences the essence of the policy or (better) provide a link to a web page that describes the policy.
4. Please describe in a few sentences what fairness and inclusivity in the workplace mean to you.
5. If there is a policy, is it working? If it is working what are the important factors that cause it to work? If it is not working, why not? (Note: No one will be identified or associated with any comment)
6. Is there something that you expect ASPRS could do on the issue of fairness in the workplace?
7. Do you have any other comments on this whole issue?
8. Please provide your name. (This is to ensure that we can verify responses. No one will be quoted and named without permission. No one but the authors of this column will see responses)
9. What age bracket are you in? (Under 25, 26-35, 36-45, 46-60, >60.
10. How do you identify your gender?
11. How do you identify your race?
12. Are you disabled or part of another minority?

Become Involved and be heard

1. Would you like to become involved in the ASPRS DEI Committee or working group and have one of our members reach out to you?
2. Would you like to publicly share a professional DEI story that is relatable with other members of the ASPRS community either in a column or at a public forum and have one of our members reach out to you?
3. Do you have any other suggestions or feedback?

Please respond with your answers to the corresponding author Dr. Bob Ryerson bryerson@kimgeomatics.com with the subject "Fairness." (Note that Dr. Ryerson is retired and has no commercial interest in the field.)

We hope to get one hundred or more responses to allow us to prepare a future column on what works and what ASPRS might be able to recommend regarding policies and approaches.

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by Qassim Abdullah, Ph.D., PLS, CP

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Landslide Evolution Assessment Based on Sequential InSAR Methods in the Kunming Transmission Line Corridor

Gang Wen, Yizuo Li, Chuhang Xie, Zezhong Zheng, Yi Ma, Fangrong Zhou, Baiyan Su, and Huahui Tang

Abstract

The security of the transmission line corridor is an important guarantee for the sustainable supply of electricity and an important prerequisite for the rapid development of the economy. Transmission corridors located in high mountains and valleys are often threatened by geological disasters, which seriously affect their stable operation. This research investigates the landslide in the Kunming transmission corridor using 79 Sentinel-1A SAR images from July 2020 to October 2021. Using interferometric synthetic aperture radar (InSAR) methods, deformation changes before the landslide are analyzed. Factors like precipitation, lithology, and vegetation coverage demonstrate a correlation with landslide occurrence. Seasonal variations in deformation were related to precipitation. The landslide's primary causes are attributed to precipitation, carbonate karstification, and vegetation coverage. Ultimately, this research establishes a correlation between deformation changes and influencing factors in the Kunming transmission corridor, contributing to a deeper understanding of landslide evolution and ensuring the corridor's security for sustainable electricity supply and economic development.

Introduction

The security of the transmission line corridor is an important guarantee for the sustainable supply of electricity and an important prerequisite for the rapid development of the economy. Transmission line corridors situated in high altitude areas are susceptible to geological hazards. The surface deformation and geological disasters (i.e., landslide, collapse) around the transmission tower often affect its stability, resulting in the inclination and collapse of the tower (Tarighat *et al.* 2021). To guarantee the safety of power system, it is extremely necessary to monitor the safety of transmission line corridor (Matikainen *et al.* 2016; He *et al.* 2021).

Recently, interferometric synthetic aperture radar (InSAR) technology has been widely used to investigate geological hazards (Zheng *et al.* 2022). Compared with traditional monitoring technology, such as leveling (Poland *et al.* 2006; Baldi *et al.* 2009), global navigation satellite system (GNSS) measurement (Chen *et al.* 2018), 3D laser scanning (Luo *et al.* 2017), etc., InSAR is capable of all-weather monitoring and has high accuracy of deformation monitoring results, showing distinctive advantages in monitoring the occurrence of surface deformation in a large area (Jiang *et al.* 2019; Shao *et al.* 2021). In the field of landslide deformation monitoring, the early monitoring method is mainly differential interferometric synthetic aperture radar (D-InSAR) (Gabriel *et al.* 1989; Massonnet *et al.* 1993; Xie *et al.* 2021). However, this method has incoherence and error in deformation monitoring (Lee and Liu 2001). Hence, time-series InSAR (TS-InSAR) algorithm is applied to study the spatial–temporal features of surface deformation in detail (Yang *et al.* 2016; Zhou *et al.* 2017; Zhao *et al.* 2018). The theoretical research on persistent scatterer InSAR (PS-InSAR) algorithm was initiated by Ferretti *et al.* (2001) and used to landslide monitoring in Ancona area, Italy. In addition, the small baseline subset InSAR (SBAS-InSAR) method was put forward by Berardino *et al.* (2002) to reduce the effect of spatiotemporal decorrelation. Later, experts made some improvements based on these two time-series InSAR algorithms (Zhang *et al.* 2012; Bateson *et al.* 2015; Osmanoğlu *et al.* 2016; Zheng *et al.* 2024). Hooper (2008) presented a multi-temporal InSAR method based on PS and SBAS theory, which can extract more deformation signals and have higher overall signal-to-noise ratio. An InSAR analysis method was raised by Zhang *et al.* (2011) for recognizing and collecting the temporary coherence point (TCP) between two SAR acquisitions. Meanwhile, other researches integrated other measurement data, such as leveling data, global navigation satellite system–measured data, etc., to carry out surface deformation monitoring studies (Ye *et al.* 2004; Burgmann *et al.* 2006; Mazzotti *et al.* 2009; Parcharidis *et al.* 2011). In addition, the InSAR method also has some defects, which can only derive deformation rates in the line of sight (LOS) (Hanssen 2001). To get more surface deformation information, it is better to use multi-source data for comprehensive analysis (Béjar-Pizarro *et al.* 2017; Confuorto *et al.* 2017). In areas with large topographic relief, ascending and descending *Sentinel-1A* images are used to decrease the error caused by overlaying and promote the stability and accuracy of monitoring (Herrera *et al.* 2013; Sun *et al.* 2016).

In this study, the ascending and descending *Sentinel-1A* images are adopted to calculate the deformation rates of the landslide in the Kunming transmission line corridor based on SBAS-InSAR and PS-InSAR technology. On the basis of the monitoring results, a sequential deformation analysis is made. The influencing features of the landslide are obtained, which can provide reference for landslide monitoring.

Research Region and Data Sets

Research Region

The research region is located in the town of Kuanzhuang in Kunming, China, with the longitude of 102°39′33.27″ E and latitude of 25°28′32.9″ *N* (Figure 1a). The elevation range of the landslide area is

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Adaptive Orientation Object-Detection Method for Large-scale Remote Sensing Images Based on Multi-scale Block Fusion

Yanli Wang, Zhipeng Dong, Mi Wang, and Yi Ding

Abstract

Object detection is crucial to extracting and analyzing information autonomously from high-resolution remote sensing images (HRSIs). To address ideal blocking for large-scale HRSI object detection, this study uses a novel adaptive orientation object-detection method for large-scale HRSIs based on multi-scale block fusion. An adaptive orientation object-detection framework based on a convolutional neural network is applied to detect diverse objects of large-scale HRSIs through different block scales; average precision (AP) values of diverse object-detection results are calculated at different block scales. Then, block scales matching the largest AP values of diverse objects are determined based on statistical results of the AP values of the diverse object at different block scales. Finally, object-detection results at block scales matching the largest AP values of diverse objects are fused by the non-maximum suppression algorithm to achieve large-scale HRSI object-detection results. Experimental findings reveal that the proposed method is better than any single block-scale object-detection method, resulting in satisfactory large-scale HRSI object-detection results.

Introduction

Object detecting is a crucial element in the process of autonomous extraction and analysis of high-resolution remote sensing images (HRSIs; Han *et al.* 2015; Diao *et al.* 2016; Li *et al.* 2017; Wang *et al.* 2018; Dong *et al.* 2019). Object detection for HRSIs identifies whether the image contains any interesting objects and then locates them (Cheng and Han 2016; Li, Wan *et al.* 2020; Song *et al.* 2021). Some research has been performed on the object detection of HRSIs. The three-stage model for HRSI object detection is commonly used. This mode is applied to detect objects in HRSIs by extracting candidate regions of the objects, by acquiring their features, and by classifying them based on the features. For instance, some researchers applied the sliding window and visual saliency modeling to extract candidate regions of the objects (Sun *et al.* 2012; Cheng *et al.* 2013). Then, the features of the candidate regions of the objects are obtained using a multi-scale histogram of oriented gradients featuring pyramids and spatial sparse coding bag of words (Han *et al.* 2014). Finally, object detection of the HRSIs is achieved by using the support vector machine to classify the extracted object features (Xiao *et al.* 2015).

Under certain circumstances, the three-stage model usually yields good results for HRSI object detection; however, near-Earth orbital high-resolution remote sensing satellites collect a large number of HRSIs with diverse and complex conditions daily. This model's adaptation to detect diverse objects for a significant number of HRSIs with diverse and complex conditions is a challenge because the model has a lack of robustness and universality.

Deep learning has received a lot of interest from academic researchers in recent years. In deep learning models, the convolutional neural networks (CNNs) are the most commonly used (He *et al.* 2014; Girshick 2015; Dai *et al.* 2016; Girshick *et al.* 2016; Liu, Wang *et al.* 2016; Redmon *et al.* 2016; Redmon and Farhadi 2017, 2018; Ren *et al.* 2017). The CNN does not need to construct image features artificially. Based on its special network structure and huge data and annotation, the CNN can learn and extract effective image features when training data are sufficient. Furthermore, the same image feature map uses the local receptive field to share convolution kernel parameters.

In comparison with other network models, the CNN includes fewer network parameters (Zhu *et al.* 2015; Liu, Anguelov *et al.* 2016; Qian *et al.* 2019; Qian *et al.* 2020; Yang *et al.* 2021; Dong *et al.* 2022). As a result, CNN-based object detectors are commonly used in HRSI object detection. For instance, Han *et al.* (2017) used Faster R-CNN to detect objects for the NWPU VHR-10 dataset. In the NWPU VHR-10 dataset, the image size was approximately 1000×1000 pixels. Long *et al.* (2017) applied regional CNN to realize playground, oil tank, overpass, and airplane detection in images; the size of the image ranged from 1044×915 pixels to 1288×992 pixels, which is a small-sized image. Wang *et al.* (2019) adopted multi-scale visual attention networks to realize diverse object detection for HRSIs. In the process of object detection, all images were cropped to 512×512 pixels.

Wu *et al.* (2019) used multi-band features of extraction and learning, quick image pyramid matching, and a boosting technique to detect diverse objects in small-sized HRSIs of approximately 1000×1000 pixels, and Ren *et al.* (2018) used modified Faster R-CNN to detect diverse small objects in small-sized HRSIs of approximately 1000×1000 pixels. Guo *et al.* (2018) suggested a multi-scale CNN to realize diverse object detection for HRSIs. For large-scale image object detection, the image was cropped into 1000×1000-pixel blocks, with an overlap of 200 pixels between each successive block.

Chen *et al.* (2018) adopted a single-shot multi-box detector to realize diverse object detection of HRSIs. When detecting large-scale images, the image was cropped into 800×800 pixels, with an overlap of 100 pixels occurring between adjacent blocks. Deng *et al.* (2018) used the feature pyramid network and Faster R-CNN to realize multi-class object detection for HRSIs. For large-scale image object detection, the large-scale images were divided into small-scale image blocks with a 50-pixel overlap.

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RSODNet: Lightweight Remote Sensing Image Object Detection Combined with BCDNS Compression Algorithm

Xinyu Zhu, Zhihua Zhang, Wei Wang, Yuhao Hou, and Shuwen Yang

Abstract

In recent years, with the gradual increase of neural network Params (the aggregate of trainable elements in a model, including weights, biases, and other adjustable elements) and calculation volume, model compression within an acceptable range of network accuracy variations has emerged as a prominent research focus in the field of deep learning. Model pruning and knowledge distillation have been widely used for reducing the complexity and storage cost of neural networks. This study designs the Remote Sensing Object Detection Network (RSODNet), a lightweight model for remote sensing image object detection, and proposes bridging cross-task distillation network slimming (BCDNS) as a method that integrates model pruning and knowledge distillation. The experiment results indicate that RSODNet outperforms the YOLOv8 model in various metrics while maintaining almost unchanged Params and calculation volume. The BCDNS method eliminates redundant channels while preserving a priori knowledge of the initial model intact. This study offers technical support for compressed models used in object detection from remote sensing images..

Introduction

In recent years, the rapid advancement of remote sensing technology has led to extensive utilization of satellites and unmanned aerial vehicles (UAVs) (Chen *et al.* 2022), leading to a significant enhancement in both the quality and quantity of remote sensing images (Kang and Liu 2022). Remote sensing images are widely applied in various fields such as natural disaster early warning (Ghaffarian *et al.* 2021), resource exploration (Zhang, Nwaila *et al.* 2023), ecological monitoring (Zhang *et al.*,*et al.* 2020), navigation (Li *et al.* 2024), land use assessment (Fan *et al.* 2022), agricultural research (Wang *et al.* 2021), and urban construction planning (Gagliardi *et al.* 2023). Consequently, effective extraction of ground object features within regions of interest has become a focal point in the field of object detection from remote sensing images (Zhao *et al.* 2023). Object detection is crucial in remote sensing research (Ma and Wu 2023; Qin *et al.* 2024; Dissanayake *et al.* 2024). The primary goal is to discern the content depicted in these images by identifying their attributes based on inherent features, subsequently enabling accurate localization and classification of ground object features (Yang, Zhao *et al.* 2022). Despite notable advancements made through deep learning techniques in conventional object detection, detecting objects within satellite-based remote sensing images remains an arduous task (Li and Che *et al.* 2021). Environmental factors such as altitude, light intensity, shadows, and weather conditions significantly affect the interpretability of remote sensing images (Liu *et al.* 2023; Yi *et al.* 2024). Furthermore, object detection from remote sensing images is challenging due to the lower resolution, distribution irregularities, varied orientations, diverse arrangements, large-scale differences, inconsistent aspect ratios, and complex backgrounds (Kang and Liu 2022; Shen *et al.* 2023; Xie *et al.* 2023).

Before the widespread application of deep learning in computer vision, traditional object detection algorithms relied on manual feature extraction, resulting in unsatisfactory performance (Chen *et al.* 2022). However, with the increase in data and advancements in artificial intelligence technology, manually designed features are no longer sufficient for processing remote sensing big data (Li *et al.* 2019). Consequently, scholars have turned to deep learning methods for remote sensing object detection, using image data sets and high-performance computers (Zhu *et al.* 2017; Liu *et al.* 2023). The rise of convolutional neural networks (CNNs) in 2012 was a significant milestone. Many advanced CNNs have been developed that can automatically extract image features and enhance object representation without manual design (Hu *et al.* 2021; Li and Che *et al.* 2021), such as AlexNet (Krizhevsky *et al.* 2012), VGGNet (Simonyan and Zisserman 2014), GoogleNet (Szegedy *et al.* 2015), ResNet (He *et al.* 2016), SqueezeNet (Iandola *et al.* 2016), and DenseNet (Huang *et al.* 2017). CNN-based methods outperform traditional approaches and have become the predominant technique for remote sensing object detection (Kang and Liu 2022; Shen *et al.* 2023).

Currently, there are two main types of object detection models based on the number of stages involved in the process (Yi *et al.* 2024). Two-stage models identify objects through a region proposal network, followed by classification and regression using feature extraction (Chen *et al.* 2023). Main two-stage models include R-CNN (Girshick *et al.* 2013), SPPNet (He *et al.* 2015), Fast R-CNN (Girshick 2015), R-FCN (Dai *et al.* 2016), Faster R-CNN (Ren *et al.* 2017), Mask R-CNN (He *et al.* 2017), Cascade R-CNN (Cai and Vasconcelos 2018), NAS-FPN (Ghiasi *et al.* 2019), and others. These models exhibit high accuracy but have slow detection speeds due to their complex structure and high calculation volume (Kang and Liu 2022; Xie *et al.* 2023). Single-stage detection models simplify the problem into a regression task using convolution layers to predict object class and bounding box location simultaneously, resulting in faster detection speeds (Kang and Liu 2022). However, they generally have lower accuracy than two-stage networks (Yan and Zhang 2021). Main single-stage models include YOLO (Redmon *et al.* 2016; Redmon and Farhadi 2017, 2018), SSD (Liu *et al.* 2016), RetinaNet (Lin *et al.* 2017), CenterNet (Duan *et al.* 2019), DSSD (Fu *et al.* 2017), RefineNet (Lin *et al.* 2016), and others.

The YOLO (You Only Look Once) family of deep learning-based object detection models (Redmon *et al.* 2016), initially proposed in 2016 (Samaniego *et al.* 2023), is a series of real-time single-stage end-to-end object detection models. It combines the strengths of various traditional object detection models and has become increasingly prominent in the field of deep learning object detection (Li 2023). In 2023,

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PE&RS Media Kit

PE&RS 2025 Advertising Rates & Specs

THE MORE YOU ADVERTISE THE MORE YOU SAVE! PE&RS offers frequency discounts. Invest in a three-times per year advertising package and receive a 5% discount, six-times per year and receive a 10% discount, 12-times per year and receive a 15% discount off the cost of the package.

	Sustaining Member Exhibiting at a 2025 ASPRS Conference	**Sustaining Member**	**Exhibitor**	**Non Member**
All rates below are for four-color advertisments				
Cover 1	$1,850	$2,000	$2,350	$2,500
In addition to the cover image, the cover sponsor receives a half-page area to include a description of the cover (maximum 500 words). The cover sponsor also has the opportunity to write a highlight article for the journal. Highlight articles are scientific articles designed to appeal to a broad audience and are subject to editorial review before publishing.				
Cover 2	$1,500	$1,850	$2,000	$2,350
Cover 3	$1,500	$1,850	$2,000	$2,350
Cover 4	$1,850	$2,000	$2,350	$2,500
Advertorial	1 Complimentary Per Year	1 Complimentary Per Year	$2,150	$2,500
Full Page	$1,000	$1,175	$2,000	$2,350
2 page spread	$1,500	$1,800	$3,200	$3,600
2/3 Page	$1,100	$1,160	$1,450	$1,450
1/2 Page	$900	$960	$1,200	$1,200
1/3 Page	$800	$800	$1,000	$1,000
1/4 Page	$600	$600	$750	$750
1/6 Page	$400	$400	$500	$500
1/8 Page	$200	$200	$250	$250
Other Advertising Opportunities (see page 5 for full descriptions)				
Employment Promotion	$500 (30 day web + 1 email) $300 (30 day web)	$500 (30 day web + 1 email) $300 (30 day web)	$500 (30 day web + 1 email) $300 (30 day web)	$500 (30 day web + 1 email) $300 (30 day web)
Dedicated Content Email blast	$2,500	$2,500	$2,500	$2,500
Newsletter Display Advertising	1 Complimentary Per Year	1 Complimentary Per Year	$500	$500
PE&RS Announcement E-Mail	$1000	$1000	$1000	$1000

A 15% commission is allowed to recognized advertising agencies

Ad Size	Width	Height
Cover	8.625”	11.25”
Full Page	8.375”	10.875”
2/3 Page Horizontal	7.125”	6.25”
2/3 Page Vertical	4.58”	9.625”
1/2 Page Horizontal	7.125”	4.6875”
1/2 Page Vertical	3.4375”	9.625”
1/3 Page Horizontal	7.125”	3.125”
1/3 Page Vertical	2.29”	9.625”
1/4 Page Horizontal	7.125”	2.34”
1/4 Page Vertical	3.4375”	4.6875”
1/8 Page Horizontal	7.125”	1.17”
1/8 Page Vertical	1.71875”	4.6875”

Send ad materials to:
Rae Kelley (rkelley@asprs.org)

- Publication Size: 8.375” × 10.875” (W x H)
- Live area: 1/2” from gutter and 3/8” from all other edges
- Software Used: PC InDesign
- Supported formats: TIFF, EPS, BMP, JPEG, PDF, PNG PC InDesign, Illustrator, and Photoshop

For more information, contact Bill Spilman at bill@innovativemediasolutions.com | (877) 878-3260 toll-free | (309) 483-6467 direct | (309) 483-2371 fax