



# Redefining Image Analysis with ENVI 6.0, IDL 9.0, and the ENVI Ecosystem


November 2023

Zach Norman  
JP Metcalf

ENV|5

# Before we Begin...

-  The webinar is being recorded
  - Slides & on-demand version of the webinar will be available within a few business days

-  Questions?
  - Please post any questions in the Questions box

# Today's Speakers



**JP Metcalf**

*Solutions Engineering Manager*  
jp.metcalf@nv5.com



**Zach Norman**

*Product Manager*  
zachary.norman@nv5.com

# Agenda

**Introduction and Setting the Stage**

**Choose Your Own Adventure**

**Back to Our Roots: ENVI Workflows for  
Hyperspectral**

**Back to the Future: IDL for VSCode**

**IDL and ENVI Notebooks**

**Enabling Collaboration with ENVI Connect**

**AI-Accelerated Analysis**

**The Next Generation of Applied Deep Learning**

**Persistent Monitoring and Scalable Processing**

**Questions and Discussion**

# It's a Special Release Cycle

- All of our core products, and some new ones, are getting major versions bumps
- These bumps correspond with big features and changes to user experience and key capabilities



## NV5 Geospatial Software's Groundbreaking Products Roar into Market



In a dazzling display of innovation, NV5 Geospatial Software has unleashed a storm of new products that have swept the geospatial market off its feet. With a flair for the future and a nod to the past, the 2020s are witnessing a technological revolution like never before.

NV5 Geospatial Software, a name synonymous with cutting-edge imagery solutions, has catapulted itself to the forefront of the industry with its latest offerings. These game-changing releases have sent shockwaves through the market, captivating the attention of professionals and enthusiasts alike.

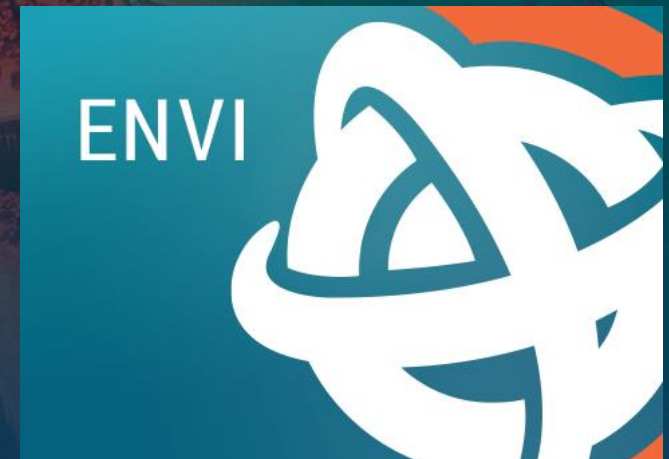
The pièce de résistance of this triumphant launch is NV5's ENVI Ecosystem, a marvel of modern engineering. This suite combines the precision of traditional imagery tools with the magic of accessible products, enabling users to navigate the world of imagery with unparalleled ease of use. It's the bee's knees for analysts, scientists, and everyone in between.

# IDL and ENVI Get a Face-lift

All of our products have gotten some extra love when it comes to their design!

For IDL and ENVI (from left to right):

- New logos
- New product icons (shortcuts, application launchers, etc.)
- New splash screens on product launch



# Products and Capabilities Covered Today

- IDL 9.0
- ENVI 6.0
- ENVI Deep Learning 3.0
- ENVI Connect 2.0
- IDL for VSCode
- IDL and ENVI Notebooks

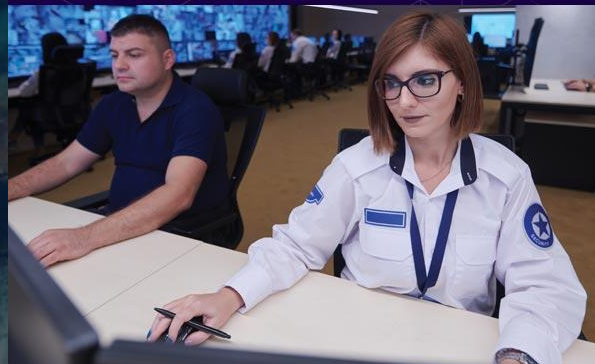
# The **ENVI Ecosystem** is a family of imagery and data analysis solutions that's optimized to deliver value where it counts and enable collaboration across your organization

## Imagery Experts



Imagery experts can perform advanced analysis and create imagery products, or create image processing workflows, and add them to ENVI Connect.

## Analysts



Analysts can access products created by imagery experts and other analysts. They can easily perform literal or non-literal analysis to create products and insights – selecting the data and running analytics is simple.

## Decision Makers



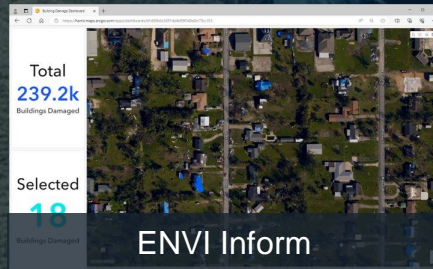
Decision makers can easily access and review results to make informed decisions.



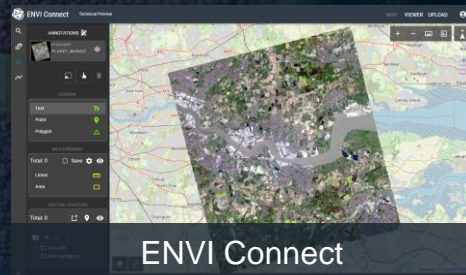
# Choose Your Own Adventure

The flexibility of ENVI and IDL allow you to process data how and where you want

What kind of user are you?



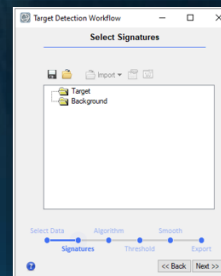
ENVI Inform



ENVI Connect



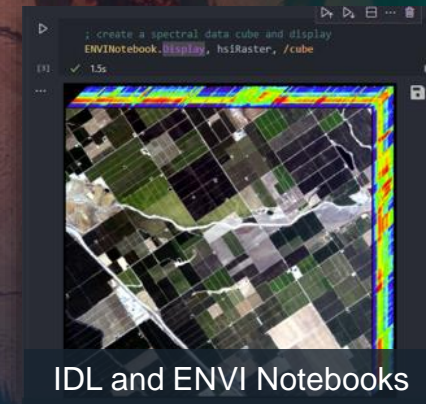
ENVI



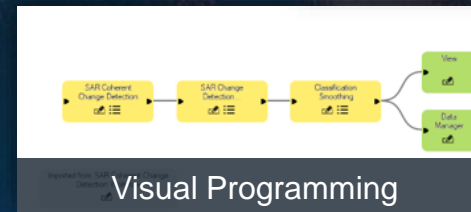
Workflows

```
; open our data
raster = e.openRaster(rasterFile)

;+ make our task to classify
task = ENVITask('MachineLearningClassification')
task.input_raster = raster
task.input_model = ENVIMachineLearningModel(modelFile)
task.execute() IDL (and the ENVI API)
```



IDL and ENVI Notebooks



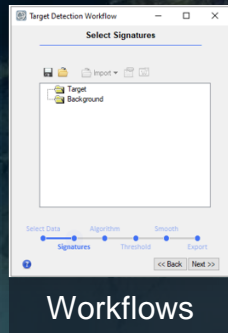
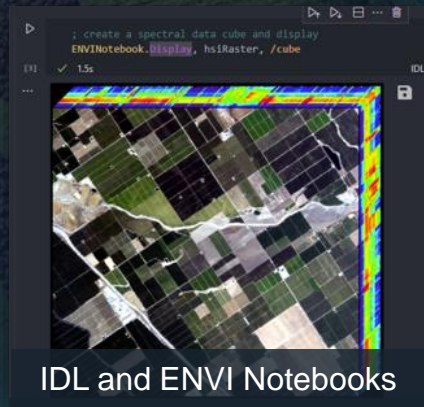
Visual Programming

# Choose Your Own Adventure

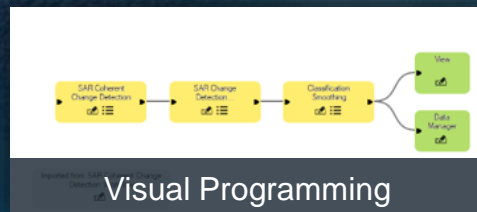
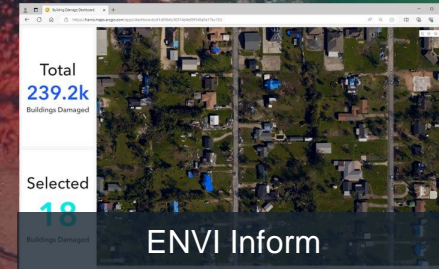
The flexibility of ENVI and IDL allow you to process data how and where you want

```
; open our data
raster = e.openRaster(rasterFile)

;+ make our task to classify
task = ENVITask('MachineLearningClassification')
task.input_raster = raster
task.input_model = ENVIMachineLearningModel(modelFile)
task.execute() IDL (and the ENVI API)
```



Experts can create content that other kinds of users can consume



# Back to our Roots

With ENVI 6.0, one of our key development areas was revisiting and modernizing the spectral user experience

## ENDMEMBER COLLECTION

- Quick and easy tool to map the location of known features
- Examples:
  - I have a spectral library containing the signatures of minerals that I want to map
  - I found several features of interest with ROIs and want to find where else they appear in my image

## TARGET DETECTION

- I have known features that I'm looking for and I want to find where they are in my scene
- Example:
  - Map the location of kaolinite across a mountain range

## MATERIAL ID

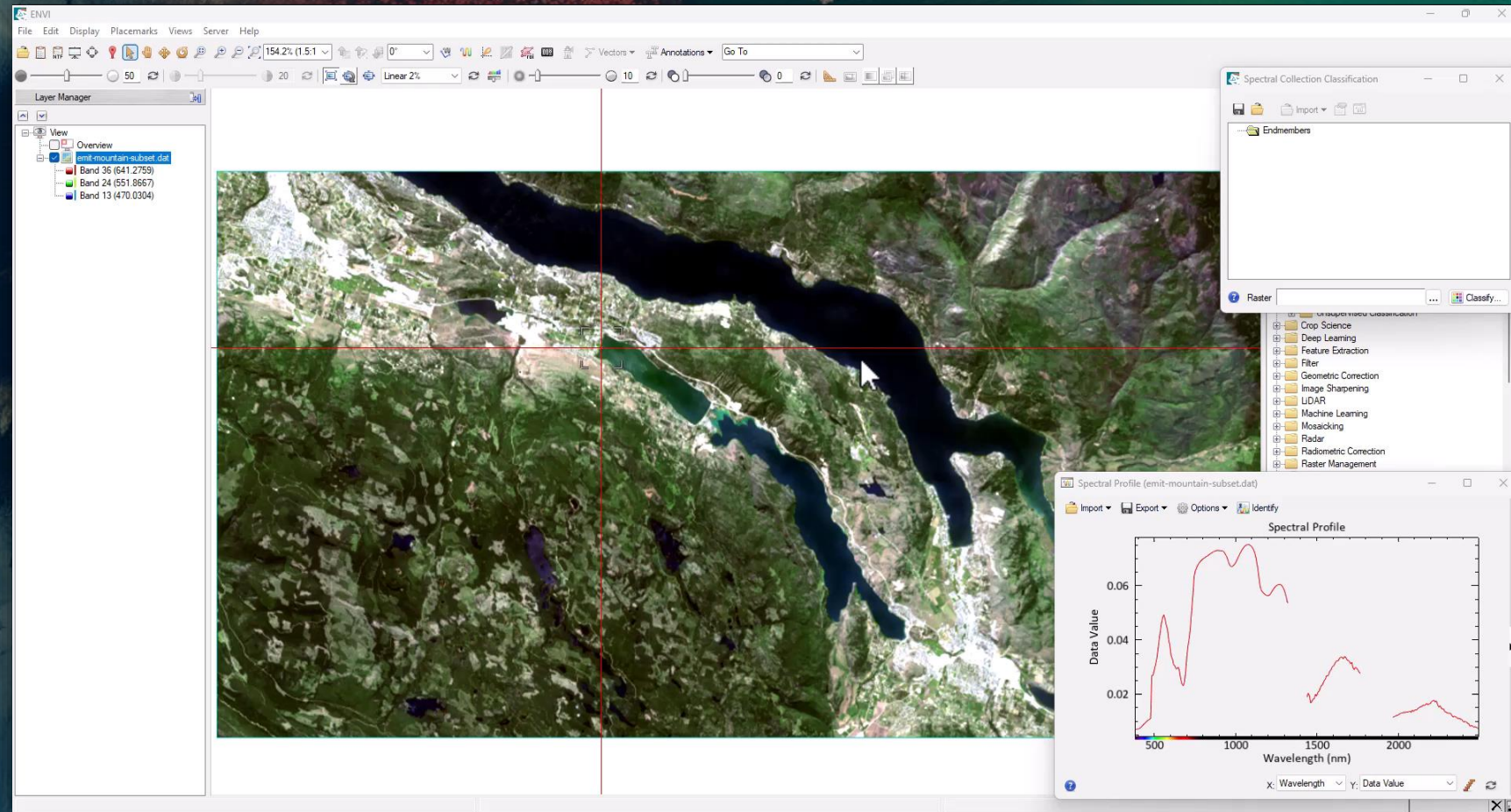
- I don't know anything about my dataset, so I want to find unique features in my image, map their locations, and optionally use Material ID to determine what I found
- Example:
  - Find unique spectra within an image (i.e. water, urban, minerals) and map their locations throughout the rest of your dataset

## SPECTRAL HOURGLASS

- Given spectral information from a dataset, compare that information against known spectra and determine potential matches
- Example:
  - Determine what kind of mineral I have displayed in a spectral profile within ENVI

# Easily Map Features with Endmember Collection

- Endmember Collection allows you to easily map spectra/targets within a given dataset
- You can use spectral libraries, ROIs, plot windows (i.e. pixels within your image), and a few other sources of information
- It's a friendly "try things out" interface that is very easy to use
- Easy to run more than one algorithm at a time and compare results



Short video demonstrating how you can create a landcover classification image using the Endmember Collection dialog and Spectral Profiles in ENVI

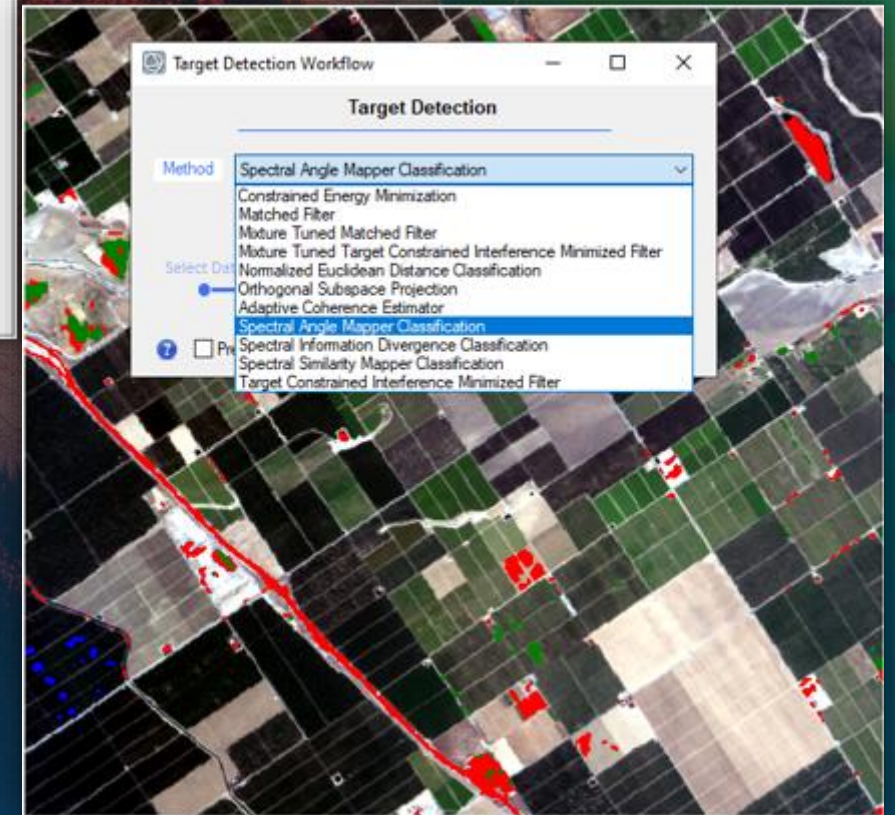
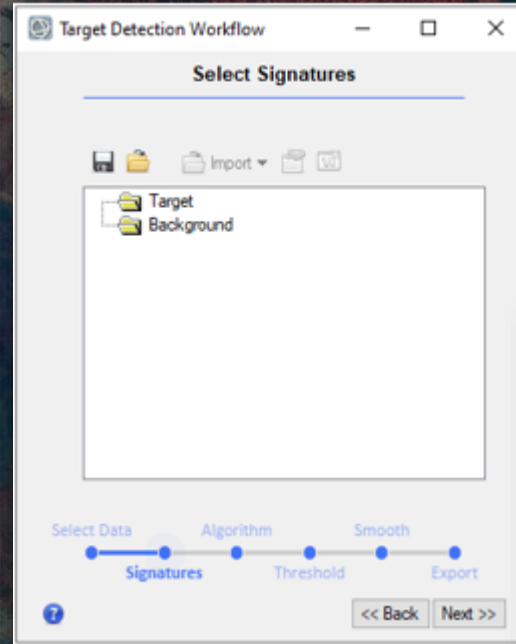
# Endmember Collection: Paint by Pixels

The screenshot displays the ENVI software interface. On the left, the Layer Manager shows a tree view with 'emitas\_envi.dat' selected, containing bands 36, 24, and 13. The main window is split into two panels: the left panel shows the original hyperspectral image, and the right panel shows the resulting landcover classification map. The classification map uses a color-coded system where different colors represent different landcover classes. On the right side, the Toolbox is visible, with the 'Endmember Collection' tool highlighted. Below the Toolbox, the 'Endmember Collection Classification' dialog box is open, showing a list of endmembers: Sparse Veg, Bare Earth 3, Bare Earth 2, Bare Earth 1, Snow, and Water. The dialog also shows the input raster as '[Subset] emitas\_envi.dat' and a 'Classify...' button.

Alternatively, use ENVI ROIs with an EMIT hyperspectral image to perform a more advanced landcover classification

# Target Detection Workflow

- The Target Detection Workflow locates pixels within hyperspectral or multispectral images that match the signatures of in-scene regions.
- The targets may be materials, minerals of interest, or man-made objects
- You can think of target detection as a more advanced image classification tool compared to endmember collection
- **Important note:** Some algorithms in Target Detection require background experience in spectral science



# Target Detection in Action

- The target detection workflow allows you to interactively refine image classification results
- Here we use the thresholds to:
  - Improve the amount of vegetation being correctly identified
  - Remove false-positives from the water detection
- This step is quick, easy, and improves the overall quality of results that you generate
- **Pro tip:** If you are just getting started with target detection, skip the data transform and use Spectral Angle Mapper for the algorithm (as shown here)

The screenshot shows the ENVI software interface. The main window displays a satellite image of a city with green and blue highlights. The 'Threshold' dialog box is open, showing a histogram for the 'Veg2' band with a threshold value of 0.08834621. The 'Layer Manager' on the left shows various layers including 'Threshold Raster', 'Forward\_Minimum\_Noise', and 'Regions of Interest'.

Layer	Threshold Raster
Dataset Name	Threshold Raster
Description	
Dimensions	1,242 x 752 x 1 [BIP] Byte
Projection	None
Pixel Offset	1,519

Short video that shows how Target Detection, compared to Endmember Collection, includes interactive steps to refine the classification results

# Material Identification for Everyone!

- From spectral profiles, new button “Identify” that opens material identification (ID)
- Once the dialog appears, you can switch between different spectral libraries and see potential matches from 5 algorithms
- **Important note:** Material ID requires background experience in spectral science

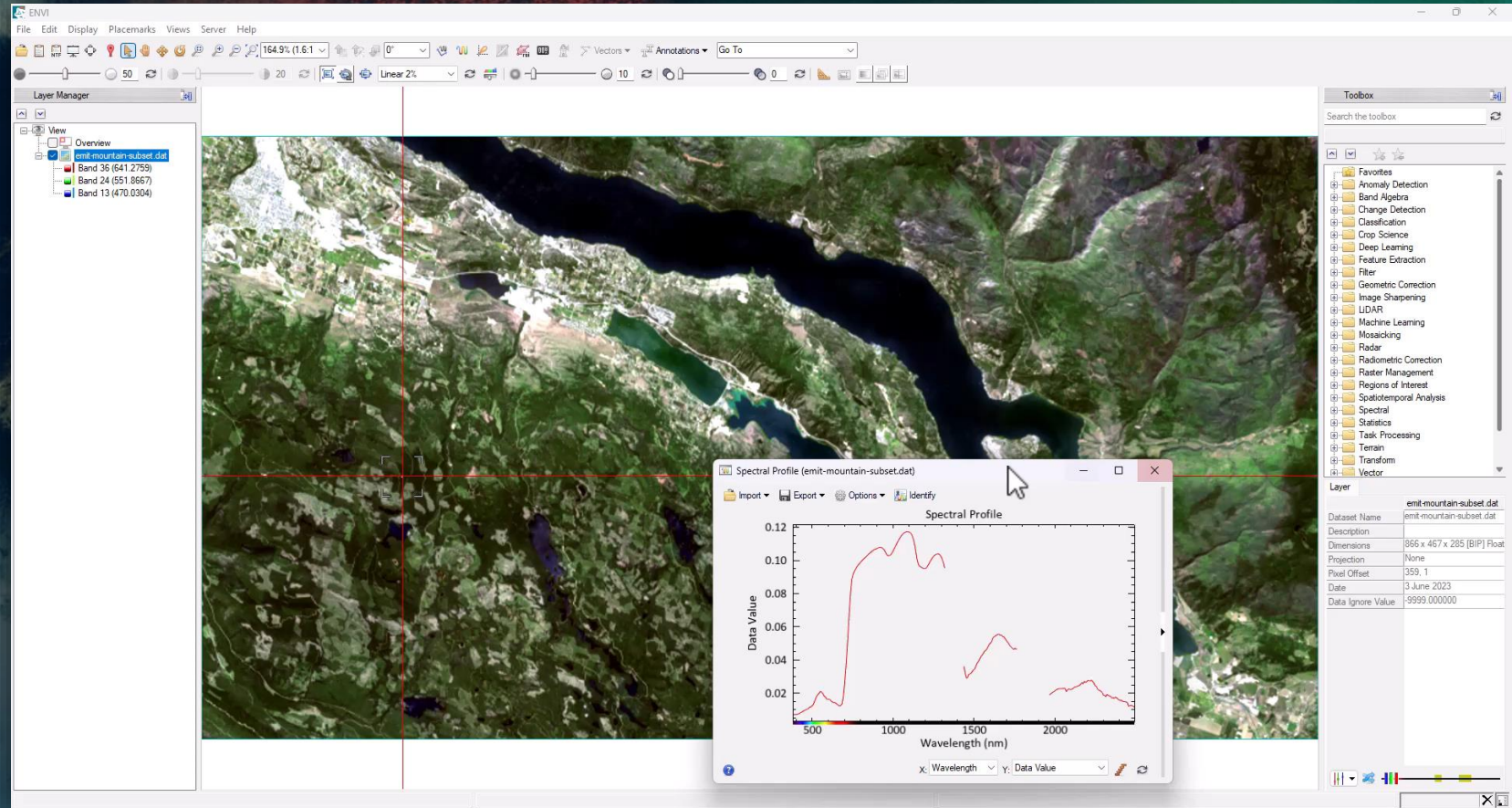
The screenshot displays the ENVI software interface. A spectral profile plot is shown in the center, with a red line representing the data. The x-axis is labeled 'Wavelength (nm)' and ranges from 500 to 2000. The y-axis is labeled 'Data Value' and ranges from 0.05 to 0.20. A red box highlights the 'Identify' button in the plot's toolbar. To the right, a 'Material Identification' dialog box is open, showing a table of potential matches. The table has columns for 'Spectrum Name', '\*SAM', 'SID', 'ED', 'ACE', and 'CEM'. The 'Spectrum Name' column lists various mineral and material names. The other columns contain numerical values. A red arrow points from the 'Identify' button to the dialog box.

Spectrum Name	*SAM	SID	ED	ACE	CEM
DRYGRASS	1	3	2	20	20
SEPIOLITE_SEP3101	2	4	1	6	6
ILLITE-SMECTITE_IS200	3	1	3	14	14
NONTRONITE_SMN454	4	17	4	8	8
BUDDINGTONITE_NHB2301	5	2	5	24	24
SMECTITE_SMM402	6	5	7	3	3
ALUNITE_AL705	7	16	9	26	26
KAOLINITE_KL500	8	9	11	11	11
KAOLINITE_KL502	9	19	19	10	10
ALUNITE_AL706	10	10	16	25	25
SMECTITE_SMC403	11	13	14	4	4
PYROPHYLLITE_PY602	12	11	10	7	7
MUSCOVITE_IL107	13	6	8	9	9
TALC_TL2702	14	18	23	2	2
HALLOYSITE_KLH503	15	20	15	16	16
CALCITE_CO2004	16	15	24	23	23
GYPSUM_SU2202	17	21	20	17	17
TREMOLITE_AMT3001	18	12	12	1	1
DOLOMITE_COD2005	19	8	17	21	21
JAROSITE_JR2501	20	7	13	12	12
ILLITE_IL105	21	14	18	13	13
GREENVEG	22	26	6	18	18
CHLORITE_CH2402	23	22	21	22	22
ACTINOLITE_AM3000	24	24	22	27	27
HEMATITE_FE2602	25	25	26	15	15
GOETHITE_FE2600	26	23	25	19	19



# Material ID in Action

- As you select different pixels, the material ID dialog updates with potential matches
- Clicking on rows of the material ID dialog shows the spectra within the Spectral Profile so you can do a manual comparison
- You can pick different spectral libraries to compare against
- Each column on the right represents a different material ID algorithm that you can sort by



Short video that shows how to access Material ID, process new pixels, and view the potential matching spectral from a spectral library

# Spectral Hourglass

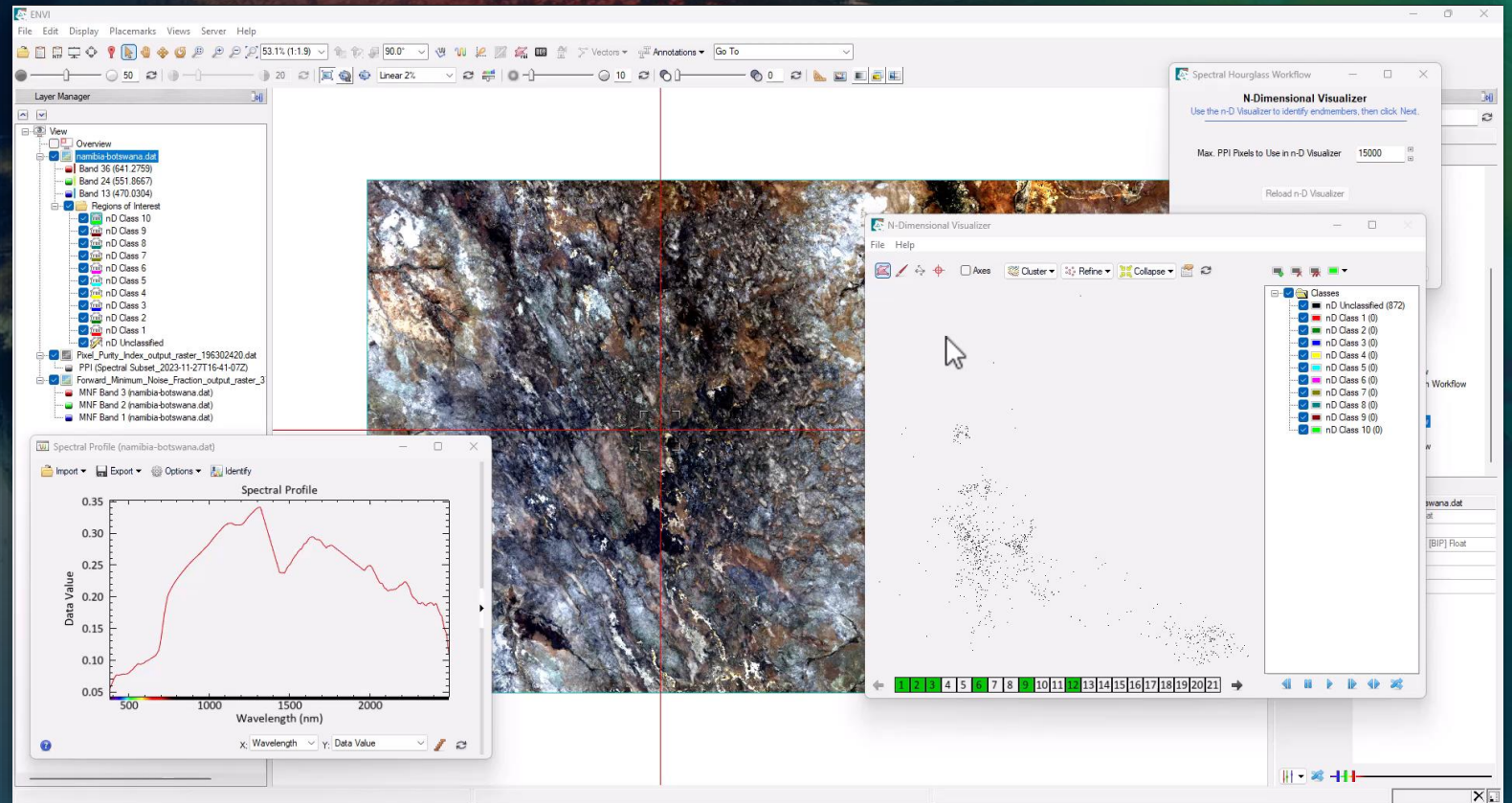
- The Spectral Hourglass Workflow helps you identify and map unique spectra (endmembers) from your scene.
- Useful when you know nothing about your data and want to do some “spectral exploration”
- Material ID is integrated to help you identify the endmembers in your image
- **Important note:** Requires background experience in spectral science

The first step of the spectral hourglass workflow is to reduce the dimensionality of your data with an MNf transform as shown here

Layer	Forward_Minimum_Noise_Fraction_output_raster_3766
Dataset Name	Forward_Minimum_Noise_Fraction_output_raster_3766
Description	Forward MNf Result
Dimensions	1,242 x 1,952 x 244 [BSQ] Float
Projection	None
Date	30 September 2023

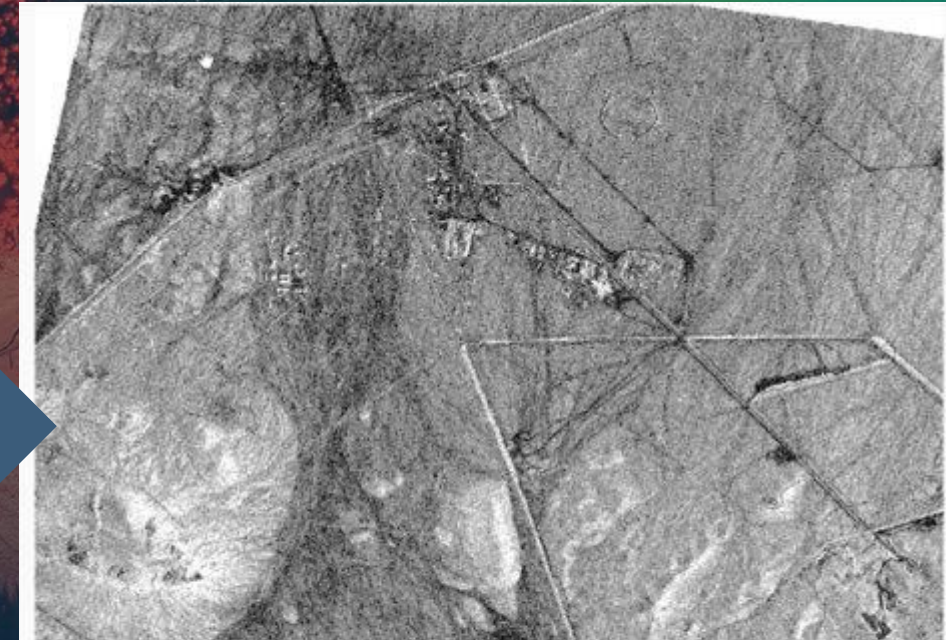
# Spectral Hourglass in Action

- Use the n-D visualizer to identify outliers and unique pixels in your scene
- You can automatically identify potential pixels, as shown in the video, or you can do the work manually
- Once you have your classes, you can map their potential locations throughout the scene
- Here we use linear unmixing to get a relative abundance of each endmember within each pixel because we have low-resolution hyperspectral data



# More than Just Spectral: ENVI SAR Essentials Sneak Preview

- Coming soon – A new user experience for processing and working with SAR data
- Drag-and-drop display of key SAR formats and step-by-step ENVI Workflows
- Capabilities include:
  - Dynamic Aperture
  - Sub-Color Aperture
  - Generate SIDD
  - Detect Amplitude
  - Amplitude Change Detection
  - Coherent Change Detection
  - Motion Change Analyzer



The output from running CCD (Coherent Change Detection). Dark areas correspond to low values of coherence and represent change

# Workflows: More than Just Steps

The screenshot displays the ENVI software interface with several key components:

- ENVI Modeler - Untitled:** A central window showing a workflow diagram with three yellow nodes: "SAR Coherent Change Detection", "SAR Change Detection", and "Classification Smoothing". The "Classification Smoothing" node is connected to "View" and "Data Manager" nodes.
- Classification Smoothing Dialog:** A dialog box on the left with a "Threshold" slider and an "Open Workflow in Modeler" button highlighted with a red box. A red arrow points from this button to the workflow diagram.
- Toolbox:** A panel on the right showing a tree view of tool categories, including "SAR Essentials/Change Detection Workflows/SAR Coherent Change Detection V".
- Layer Manager:** A panel on the left showing the current layer "CCD\_Coherence.dat" with its properties.

Layer	CCD_Coherence.dat
Dataset Name	CCD_Coherence.dat
Description	REFERENCE ACQUISITION TIME
Dimensions	11,059 x 7,193 x 1 [BSQ] Float
Projection	Geographic Lat/Lon
Pixel Size	8.3330e-06 Degrees
Datum	WGS-84
Date	9 December 2011
Data Ignore Value	NaN

The new workflows in ENVI capture your clicks and generate an automated version as an ENVI Modeler workflow

# Workflows: Clicks to Code

- You can convert ENVI Modeler workflows to IDL code to get a jump-start at how you can program with the ENVI API
- With the ENVI Modeler, **\*or\*** the ENVI API, the analytics can then be shared with other types of users
- You can add to other ENVI Desktop instances or deploy them to ENVI Connect

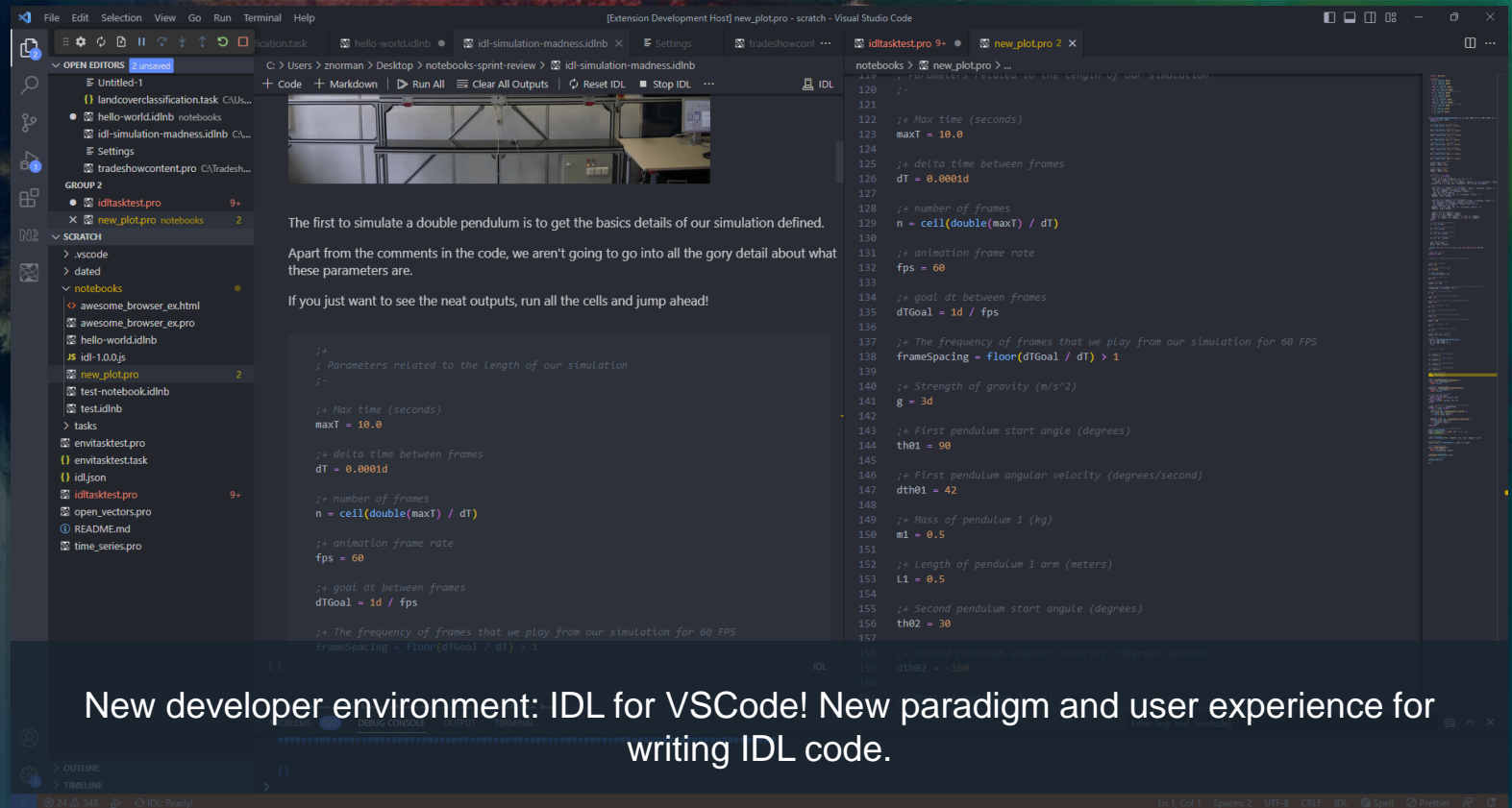
The screenshot displays the ENVI Modeler interface with a workflow diagram on the right and a code window on the left. The workflow consists of three main tasks: 'ML Training Data from ROIs', 'Train Random Forest', and 'Machine Learning Classification'. The code window shows the IDL script generated from this workflow, with a red arrow pointing from the 'Generate IDL Program' menu item to the code.

```
-----  
; ML Training Data from ROIs  
-----  
task_1 = ENVITask('MLTrainingDataFromROIs')  
task_1.input_raster = raster_1  
task_1.input_roi = roi_1  
task_1.normalize_min_max = [-1.0,1.0]  
task_1.Execute  
  
-----  
; Train Random Forest  
-----  
task_2 = ENVITask('TrainRandomForest')  
task_2.input_rasters = task_1.output_raster  
task_2.Execute  
  
-----  
; Machine Learning Classification  
-----  
task_3 = ENVITask('MachineLearningClassification')  
task_3.input_model = task_2.output_model  
task_3.input_raster = raster_2  
task_3.Execute
```

Example showing the IDL code generated from an ENVI Modeler workflow using the machine learning tools in ENVI

# Embracing Open Source with IDL 9.0: [IDL for VSCode](#)

- New, modern developer environment for IDL using Visual Studio Code
- Key benefits:
  - Native multi-language support
  - Make the editor your own with extensions and themes
  - Integrated help content for rich developer experience
  - Basic type detection for seamless auto-complete
  - Automation for formatting, adding docs, and updating docs as you write code
  - Detects more than 100 problems in your code without having to compile



# IDL for VSCode: Auto-complete and Hover Help

The documentation for the latest versions of ENVI is packaged with the extension, making it easier than ever to learn about and use the ENVI API

```
; run
task = ENVITask('MachineLearningClassification')
task.
id
  description
  display_name
  input_model
  input_raster
  name
  normalize_min_max
  output_raster
  revision
  source_uri
  tags
  ENVITask::addParameter
  ENVITask::execute
```

Auto-complete showing properties and methods for the “MachineLearningClassification” ENVI Task

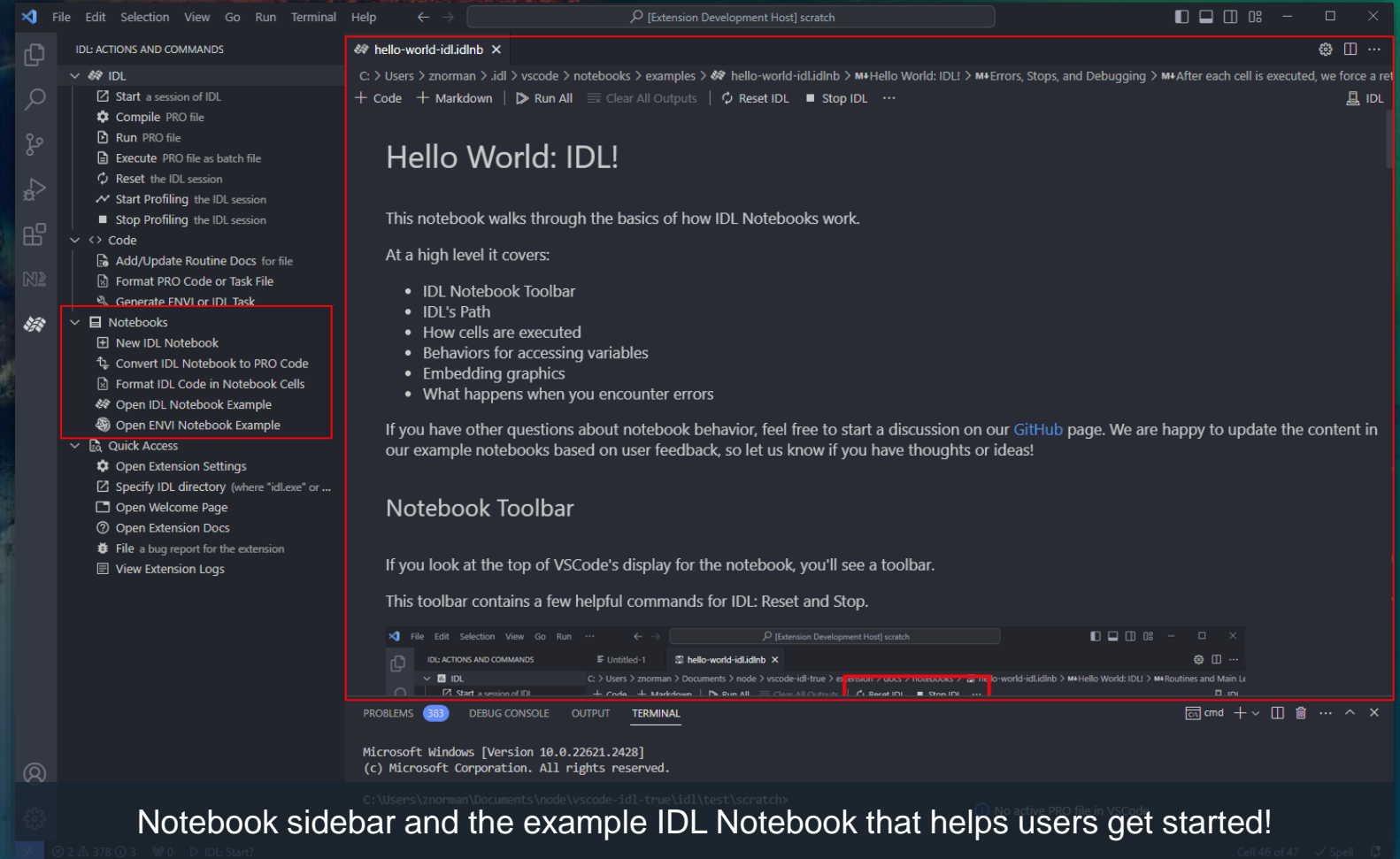
```
input_raster.export, tmp, 'envi'
useRaster Online Docs | Open Examples in Notebook
result = ENVITask('MachineLearningClassification')
; set o
if ~key This task performs classification for all ENVI Machine Learning model types.
output Example
; uri f ; Start the application
modelUr e = envi()
; open ; Open an input raster file
model = RasterFile = filepath('qb_boulder_msi', subdir = ['data'], $
root_dir = e.root_dir)
; run Raster = e.openRaster(RasterFile)
task = ENVITask('MachineLearningClassification')
task.input_raster = useRaster
task.input_model = model
task.output_raster_uri = output_raster_uri
task.normalize_min_max = [0, 10000.]
task.execute
```

Hover-help for the same ENVI Task with examples from the documentation



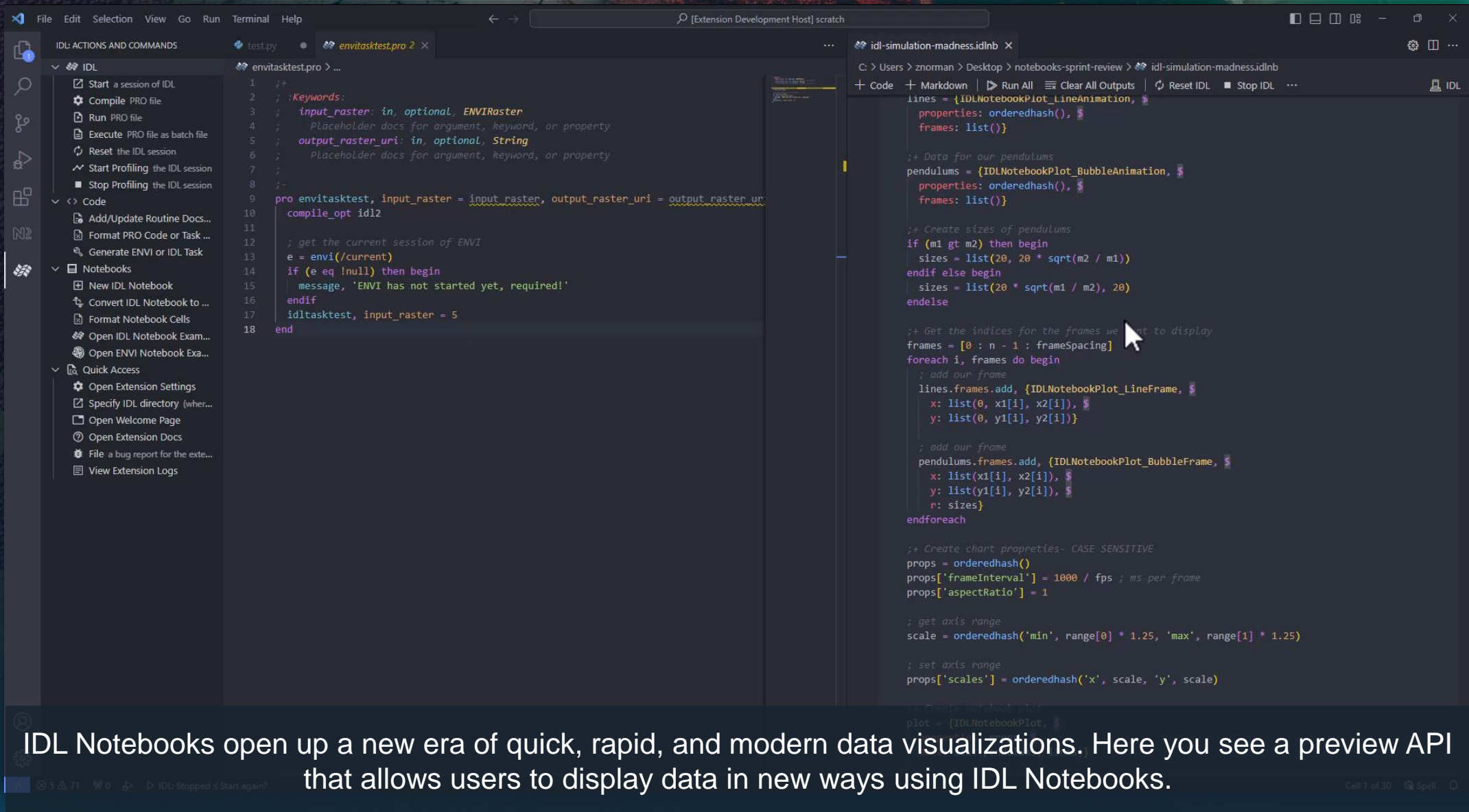
# Introducing IDL Notebooks!

- Enabled through VSCode, we have a native IDL Notebook format and developer environment
- Notebooks are:
  - A friendly format for capturing logic/training and code in one place
  - The way that new developers are learning to program
  - More approachable compared to creating files on disk
- Note: This is *\*not\** using Python or Jupyter behind the scenes and comes with the extension



Notebook sidebar and the example IDL Notebook that helps users get started!

# IDL Notebooks: A Look at the Future



The screenshot displays an IDE interface with three main panels. On the left is a sidebar with 'IDL: ACTIONS AND COMMANDS' and 'Quick Access' sections. The middle panel shows an IDL script named 'envitasktest.pro' with code for defining keywords, a procedure 'pro envitasktest', and a call to 'compile\_opt id12'. The right panel shows a notebook cell with IDL code for creating a plot, including data for pendulums, frame indices, and chart properties. The notebook interface includes buttons for '+ Code', '+ Markdown', 'Run All', 'Clear All Outputs', 'Reset IDL', and 'Stop IDL'. At the bottom, a status bar shows 'IDL: Stopped (Start again?)' and 'Cell 1 of 30'.

IDL Notebooks open up a new era of quick, rapid, and modern data visualizations. Here you see a preview API that allows users to display data in new ways using IDL Notebooks.

# Notebooks: Not Just for IDL

- IDL Notebooks also have special APIs for ENVI
- Similar to IDL, they allow you to embed graphics and maps within notebook cells
- ENVI maps use your VSCode theme to pick a base map

The screenshot shows two side-by-side ENVI notebooks in a VS Code environment. The left notebook contains the following text and code:

This style of visualization features an RGB pretty-picture of the visual bands and then adds a spectral overlay for pixels along the edge.

To create this graphic, set the `cube` keyword when displaying a raster.

```
; create a spectral data cube and display  
ENVINotebook.Display, hsiRaster, /cube
```

The output shows a satellite image with a colorful spectral overlay along the edges of the fields.

The right notebook contains the following text and code:

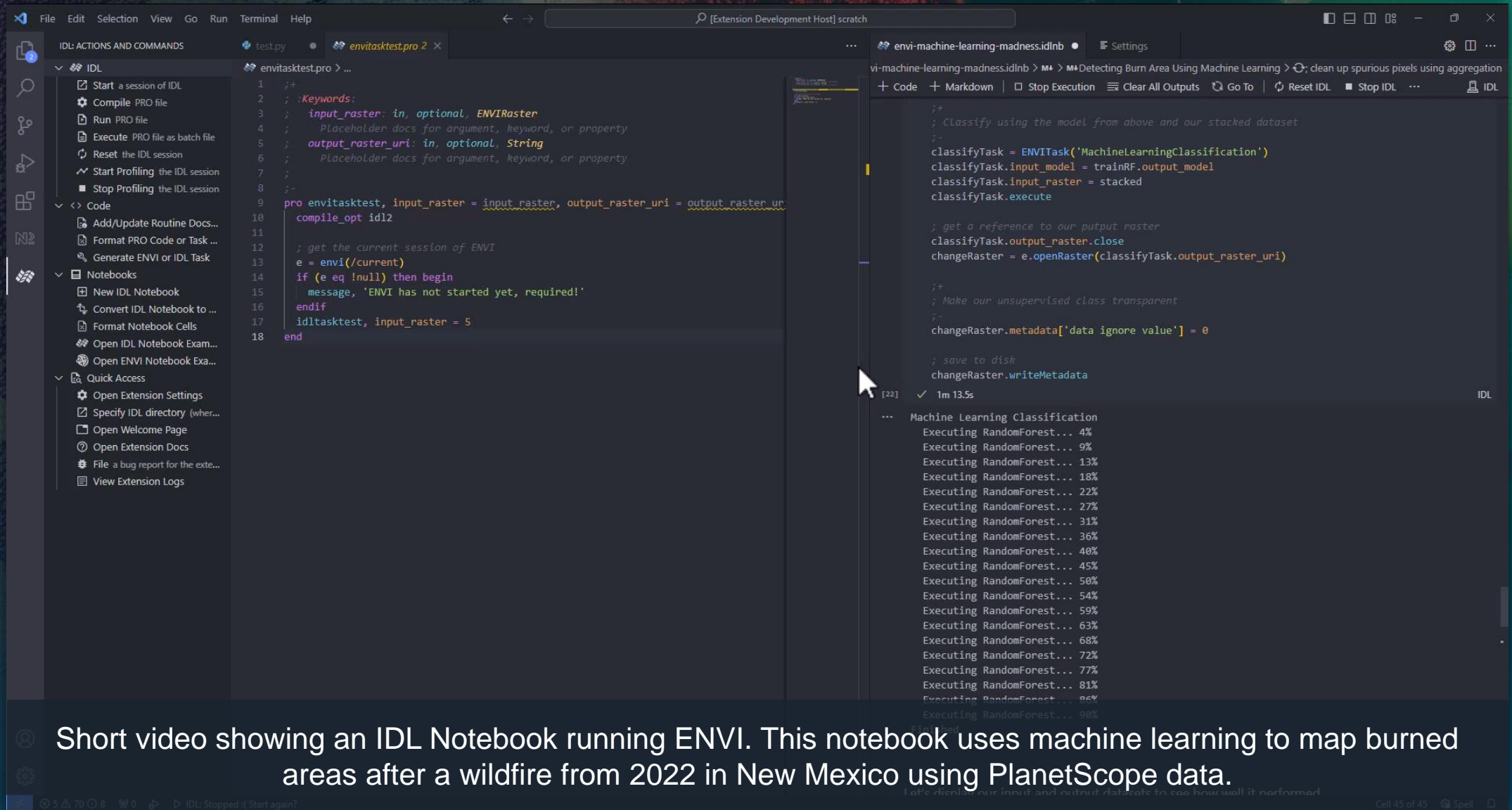
Let's show this in action by displaying the same raster as above with a few ROIs as well. You'll notice a blue polygon over the water is one of the three ROIs added to the map.

```
; display raster  
ENVINotebook.DisplayInMap, raster  
  
; add ROIs to the same map  
ENVINotebook.DisplayInMap, rois
```

The output shows a satellite map with a blue polygon overlaid on a lake, representing a Region of Interest (ROI).

Example ENVI Notebook showing the display of a hyperspectral data cube (left) and a raster and vector data (right)

# Example: ENVI Notebooks in Action



The screenshot shows the ENVI software interface with an IDL Notebook open. The notebook is titled "envi-machine-learning-madness.idlNb" and is running a script that uses machine learning to detect burned areas. The script is written in IDL and includes the following code:

```
1 ;+
2 ; .Keywords:
3 ;   input_raster: in, optional, ENVIRaster
4 ;   Placeholder docs for argument, keyword, or property
5 ;   output_raster_uri: in, optional, String
6 ;   Placeholder docs for argument, keyword, or property
7 ;
8 ;-
9 pro envitasktest, input_raster = input_raster, output_raster_uri = output_raster_uri
10 compile_opt idl2
11
12 ; get the current session of ENVI
13 e = envi(/current)
14 if (e eq !null) then begin
15   message, 'ENVI has not started yet, required!'
16 endif
17 idltasktest, input_raster = 5
18 end
```

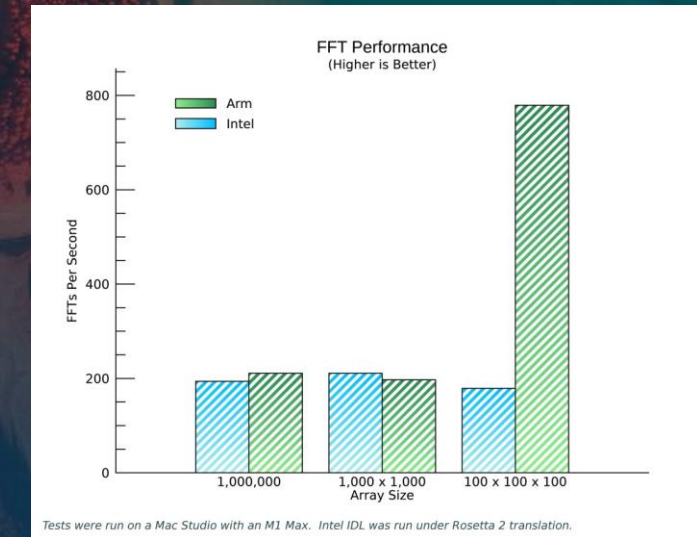
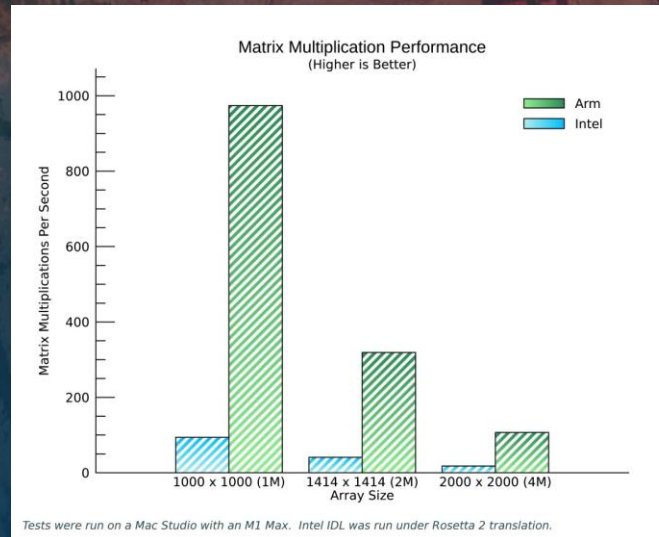
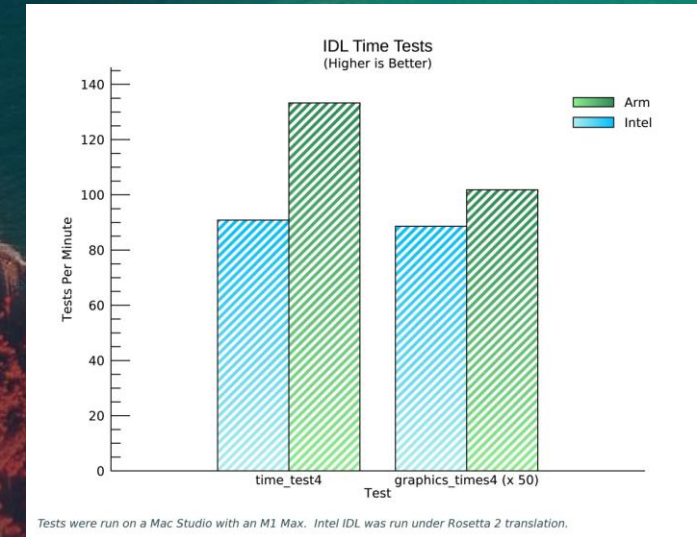
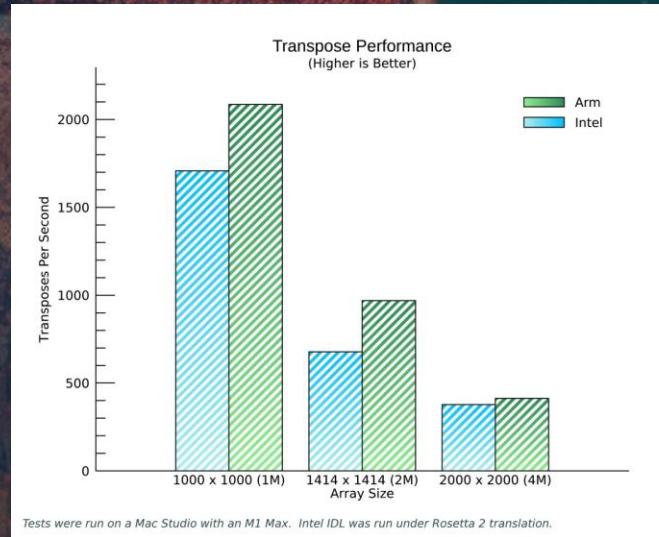
The notebook output shows the progress of the machine learning classification task:

```
[22] ✓ 1m 13.5s
... Machine Learning Classification
Executing RandomForest... 4%
Executing RandomForest... 9%
Executing RandomForest... 13%
Executing RandomForest... 18%
Executing RandomForest... 22%
Executing RandomForest... 27%
Executing RandomForest... 31%
Executing RandomForest... 36%
Executing RandomForest... 40%
Executing RandomForest... 45%
Executing RandomForest... 50%
Executing RandomForest... 54%
Executing RandomForest... 59%
Executing RandomForest... 63%
Executing RandomForest... 68%
Executing RandomForest... 72%
Executing RandomForest... 77%
Executing RandomForest... 81%
Executing RandomForest... 86%
Executing RandomForest... 90%
```

Short video showing an IDL Notebook running ENVI. This notebook uses machine learning to map burned areas after a wildfire from 2022 in New Mexico using PlanetScope data.

# IDL 9.0: IDL for Apple Silicon

- As a part of IDL 9.0, we are including support for Arm processors on the Mac!
- This offers performance gains because you no longer need Rosetta (graphics on right)
- This only applies to IDL and not ENVI at this point in time

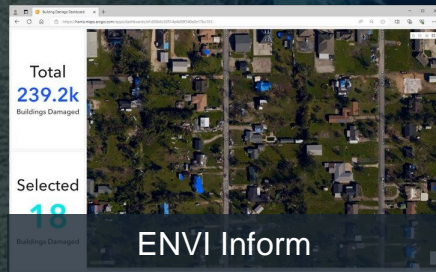


Performance metrics showing (higher is better) how native Arm support for Mac is much faster than using an emulator like Rosetta

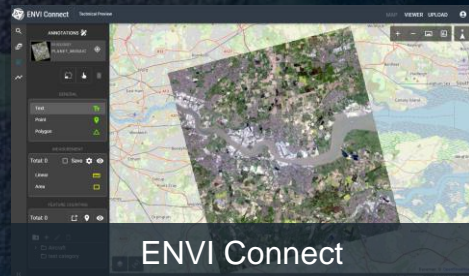
# Choose Your Own Adventure

The flexibility of ENVI and IDL allow you to process data how and where you want

What kind of user are you?



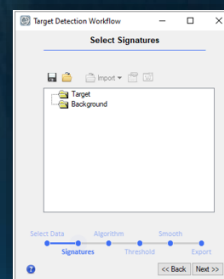
ENVI Inform



ENVI Connect



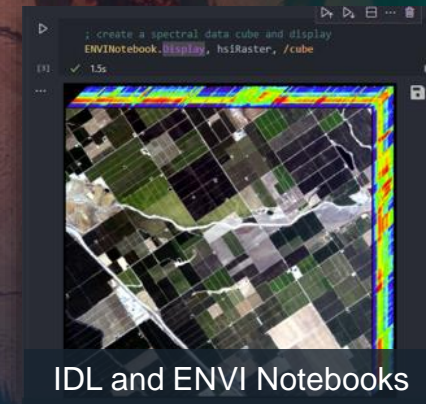
ENVI



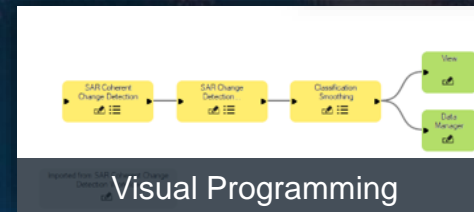
Workflows

```
; open our data
raster = e.openRaster(rasterFile)

;+ make our task to classify
task = ENVITask('MachineLearningClassification')
task.input_raster = raster
task.input_model = ENVIMachineLearningModel(modelFile)
task.execute()
IDL and the ENVI API
```



IDL and ENVI Notebooks



Visual Programming

# Choose Your Own Adventure

The flexibility of ENVI and IDL allow you to process data how and where you want



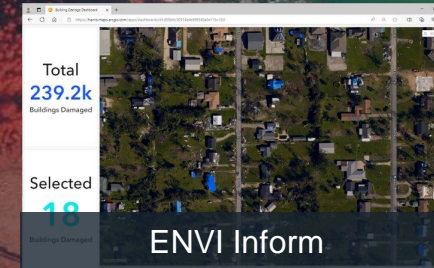
Experts create automated analytics



Analysts have data-modality based workflows for analyzing imagery and videos and can re-use the analytics and information that experts create



Experts use science-based workflows to create information layers





# View. Collaborate. Solve.

**ENVI® Connect** Is a Web Application That Enables Users To Easily Work Together and Solve Geospatial Problems.

ENVI Connect lets users quickly discover, visualize, and extract information from data as well as generate products. ENVI Connect increases and simplifies collaboration for experts and non-experts so they can more effectively tackle problems with geospatial data, extending the scientific reach across an organization.

## Use ENVI Connect to:

- › Work With Imagery
- › Find and Discover Data
- › Visualize Data
- › Perform Literal Image Exploitation
- › Perform Non-Literal Exploitation
- › Generate Products
- › Perform Tipping and Cueing
- › Collaborate With Others





# Science Made Accessible with ENVI and ENVI Connect

The screenshot displays the ENVI software interface with a workflow diagram in the ENVI Modeler window. The workflow consists of the following steps:

- Input Parameters** (pink node)
- Normalization Statistics** (yellow node)
- ML Training Data from ROIs** (yellow node)
- Train Random Forest** (yellow node)
- Machine Learning Classification** (yellow node)
- Output Parameters** (pink node)

The workflow is connected to a map view showing a classified raster. The Layer Manager on the left lists the following classes:

- 0: Unclassified
- 1: Ground
- 2: GrassOrSparseV
- 3: Forest
- 4: Water
- 5: Snow
- 6: ManMade
- 7: Clouds

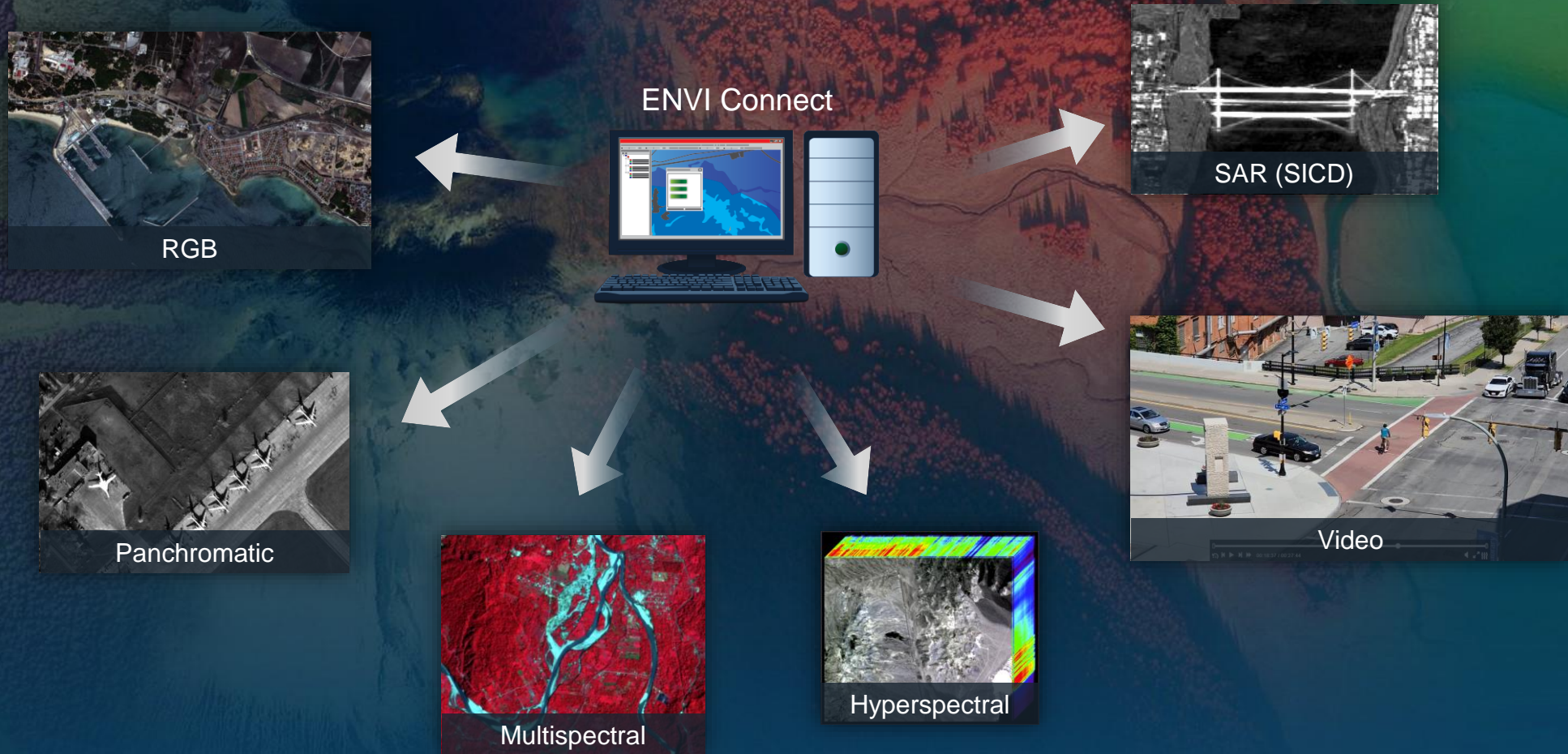
The right-hand side of the interface shows the Toolbox with the 'Machine Learning/Classification/Supervised' category selected. A table at the bottom right provides details for the output raster:

ming_Classification_output_raster_115	
Dataset Name	Machine_Learning_Classification_outp
Description	
Dimensions	5,796 x 4,085 x 1 [BSQ] Byte
Projection	UTM, Zone 48 North
Pixel Size	3 Meters
Datum	WGS-84

Experts can create automated analytics using ENVI and IDL then deploy to lightweight, simple tools like ENVI Connect. Enabling other kinds of users to process imagery and gain insights without needing to use a desktop application

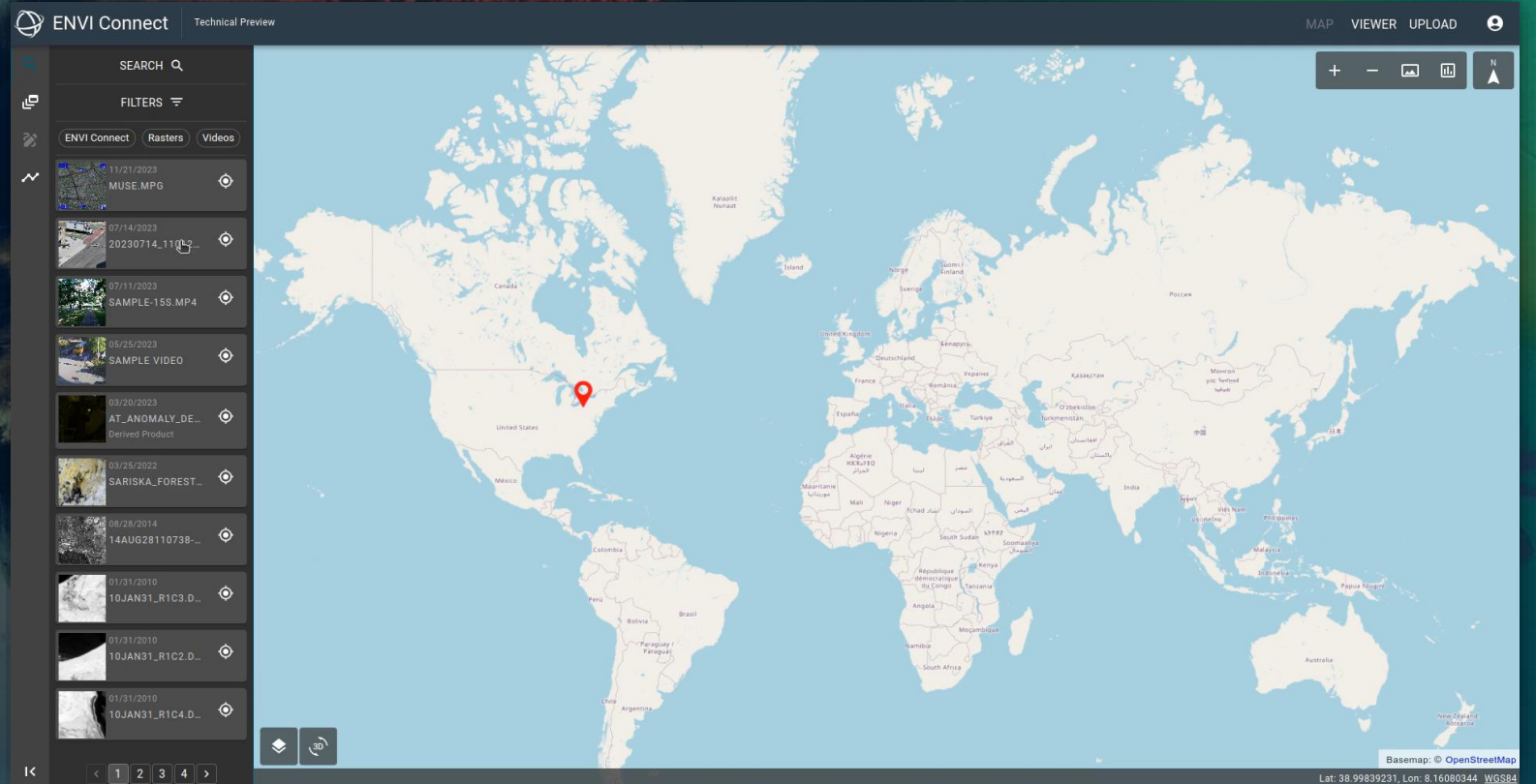
# ENVI Connect: The Enterprise Solution for Imagery Analysis

ENVI Connect handles the same types of data as ENVI Desktop to support operational analysts



# Deep Learning for Video Analysis

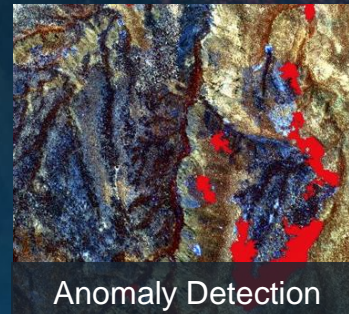
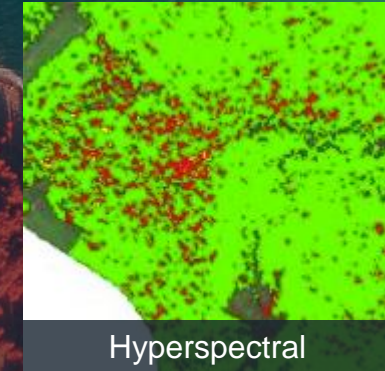
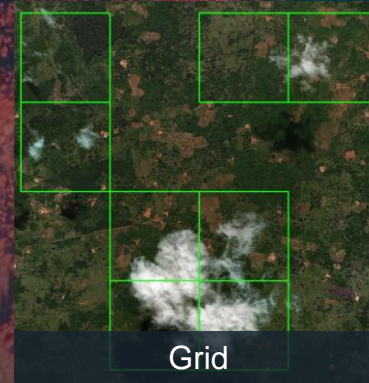
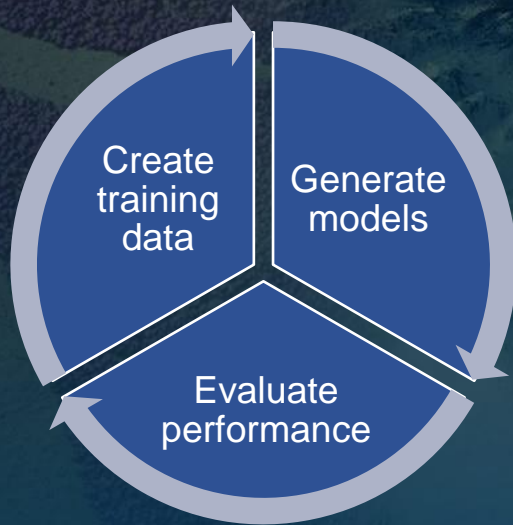
- Video analysis workflow:
  - Ingest into ENVI Connect and process with AI as ingested
  - Find video over AOI (Area Of Interest)
  - Navigate to video dashboard
  - Investigate automated detections
  - Contextualize observations



Video exploitation in ENVI Connect is intuitive, easy to use, and helps draw your attention to key points in videos that need further analysis

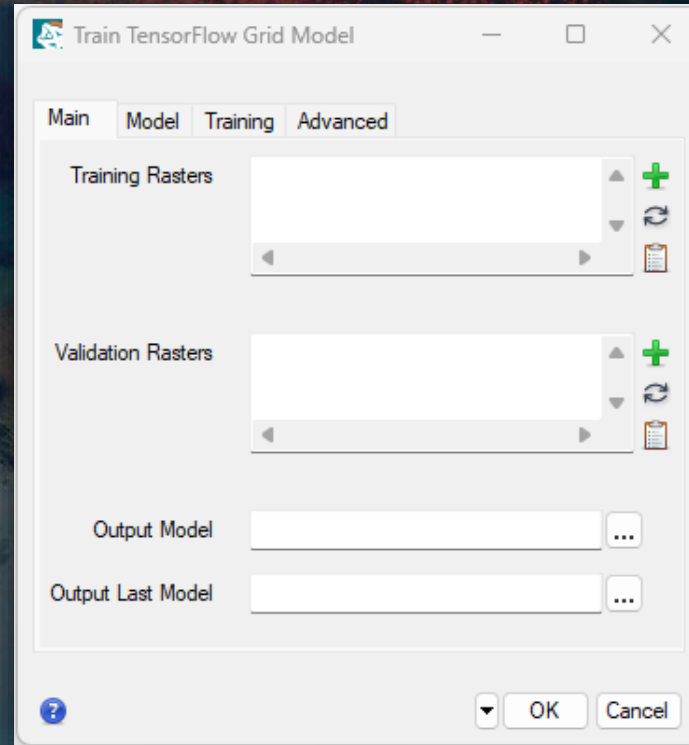
# Deep Learning: Not Just for Enterprise

- ENVI provides all the tools needed to create custom deep learning and machine learning models
- We make the deep learning workflow simpler by providing an easy set-up and tools you can use without needing to program

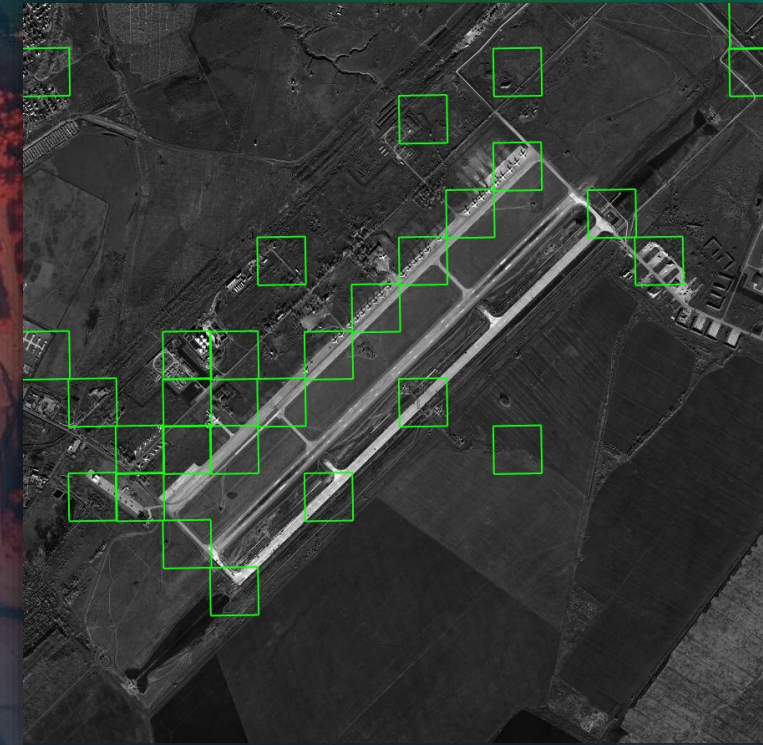


# ENVI Deep Learning 3.0: Grids

- New type of deep learning that creates a binary, gridded output with likely locations of features
- Reduce false positives and processing time by only working with positive grid cells
- Plug and play with existing models
- For any previously labeled data, you get grids for **FREE**
  - That's right, you don't have to label any other data to make a grid model!



Grid training dialog that accepts all kinds of previously generated training data



The primary output from grid which shows potential locations in an image with aircraft

# Grid: Reducing False Positives

Use grids to remove likely false positives. Here we remove 160 false positives with a minimally trained object detection model!



# Grid: Time Savings

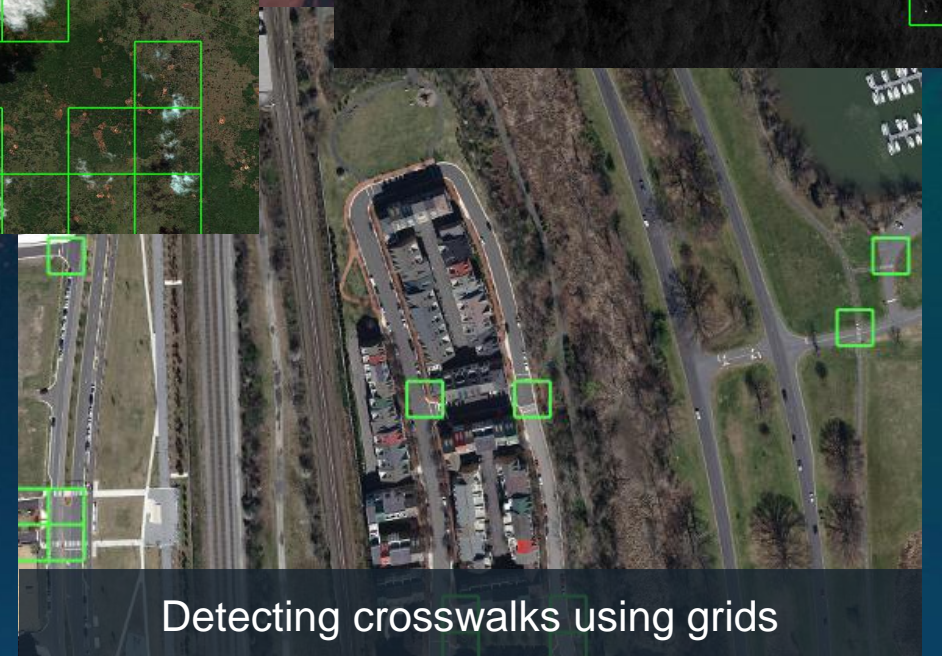
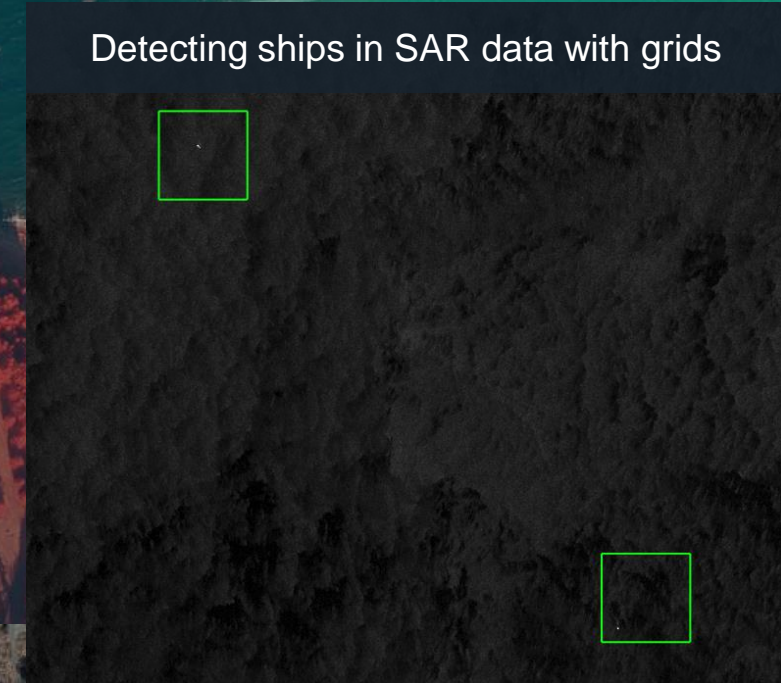
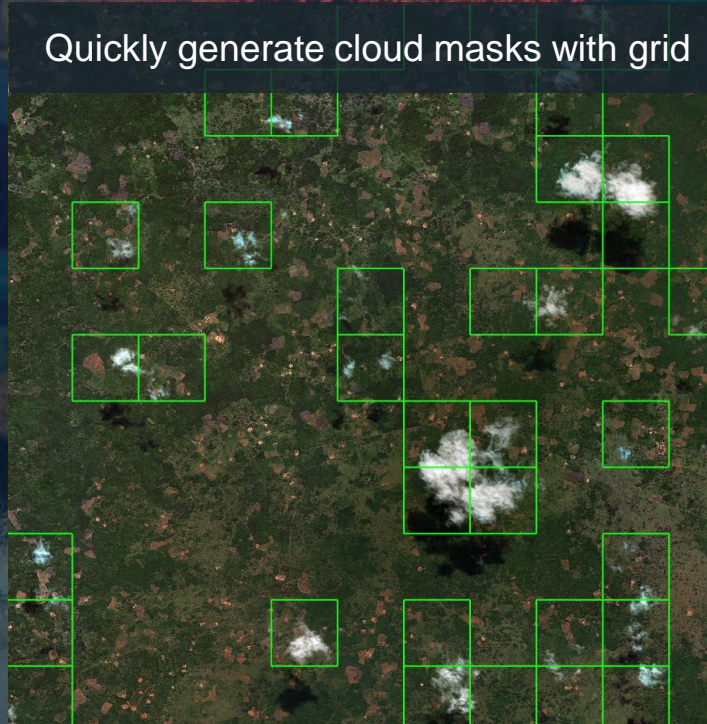
- Using grids, we can not only reduce false positives, but we can save processing time as well
- For rare features, this can have a dramatic impact
- Real world time savings for aircraft detection:
  - 41 Panchromatic WorldView scenes
  - Without grid: ~9 hours
  - With grid: ~30 minutes



Pairing grids and segmentation models can process a WorldView image in 40 seconds compared to 13 minutes without grid

# Positive Impacts from Using Grid

- Grid models are free and re-use existing training data!
- Reduce false positives and directly reduce manual labor to correct results from deep learning
- Save processing time to directly save time (and money) for cloud-based processing
- Improve throughput of hardware-limited applications that can't automatically scale to meet processing demands
- Makes it feasible to use more complex models and architectures that can better detect features

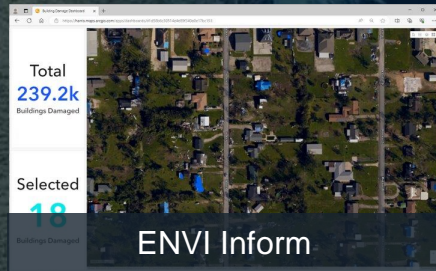




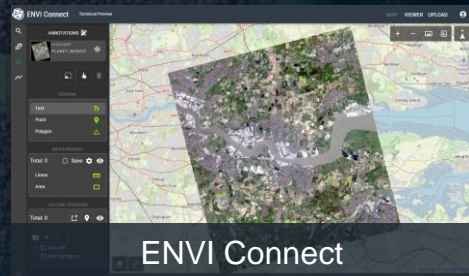
# Choose Your Own Adventure

The flexibility of ENVI and IDL allow you to process data how and where you want

What kind of user are you?



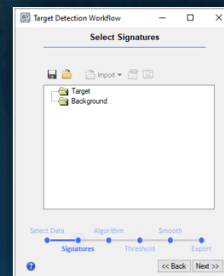
ENVI Inform



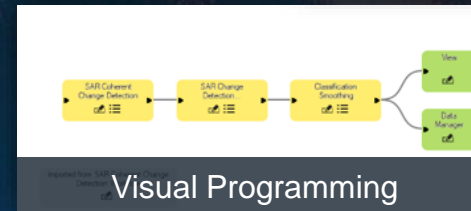
ENVI Connect



ENVI



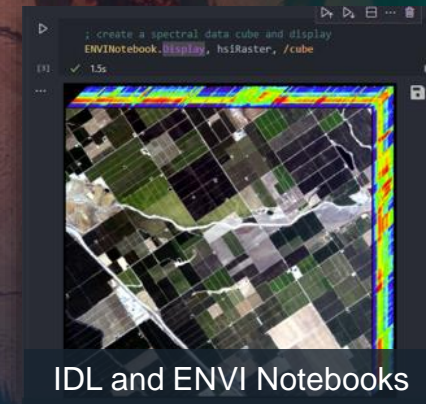
Workflows



Visual Programming

```
; open our data
raster = e.openRaster(rasterFile)

;+ make our task to classify
task = ENVITask('MachineLearningClassification')
task.input_raster = raster
task.input_model = ENVIMachineLearningModel(modelFile)
task.execute() IDL and the ENVI API
```



IDL and ENVI Notebooks

# Choose Your Own Adventure

The flexibility of ENVI and IDL allow you to process data how and where you want



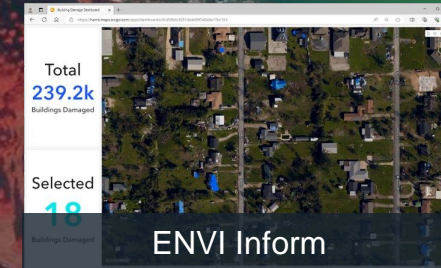
Experts create automated analytics



Process large volumes of data or persistently monitor areas of interest using scalable infrastructure

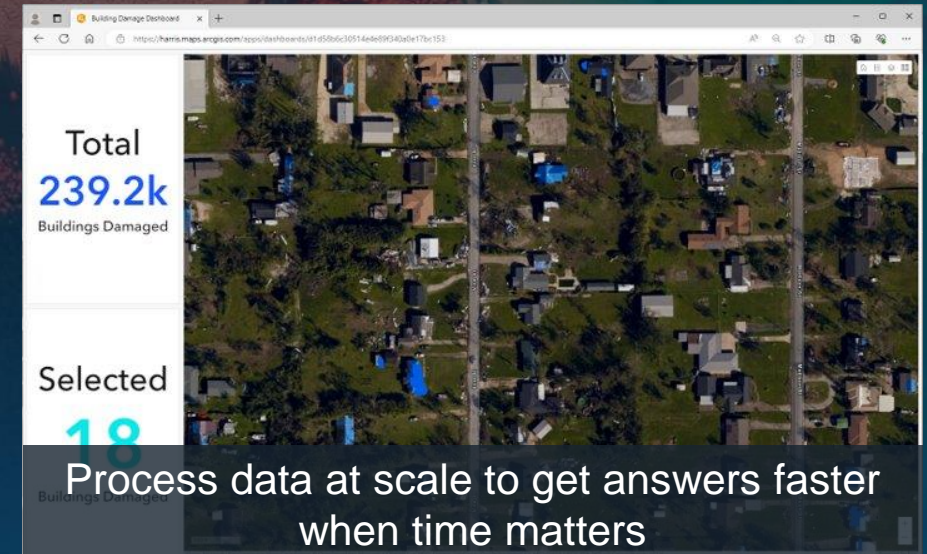
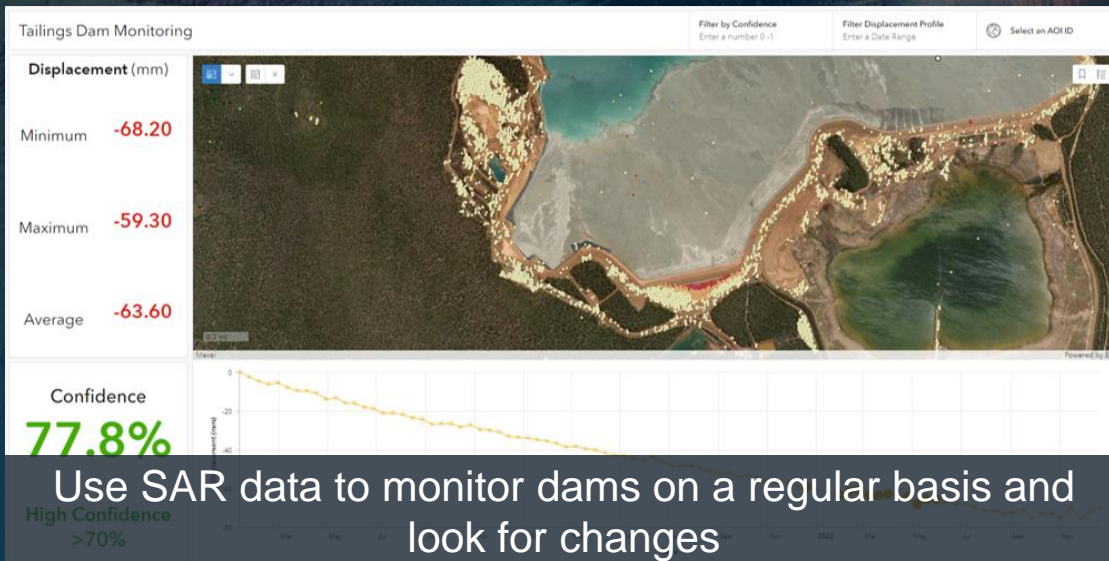
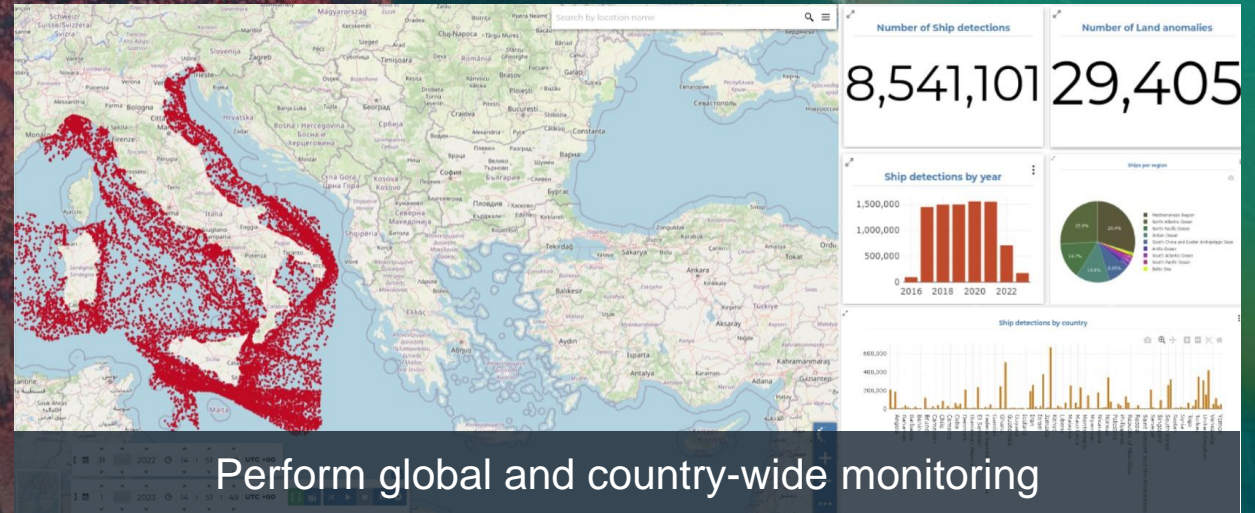


Decision makers and analysts can get just the information layers that they need, when they need them, and integrated into existing GIS applications



# ENVI Inform: Automated Monitoring and Scalable Processing

- Take the analytics that experts create and run them in the cloud
- Easily process large areas or monitor areas for continuous observation



# Recap: Demonstration goals

Today was about showcasing how our family of products come together to solve real-world problems

## SCIENCE MADE ACCESSIBLE

- Step-by-step spectral workflows to make image science more approachable
- A new future of SAR analysis is coming soon!
- Improve productivity for programmers with IDL for VSCode

## EMPOWER USERS TO COLLABORATE

- Deploy analytics that experts create where you need them to run
- Experts can create information layers and publish to other tools like ENVI Connect

## DATA ANALYSIS MADE INTUITIVE

- Friendly, web-accessible tools for working with and processing imagery
- AI accelerated exploitation
- Automation and monitoring at scale

# Products and Release Timelines

- IDL 9.0 – Available today!
- ENVI 6.0 – Available today!
- ENVI Deep Learning 3.0 – Either just before or right after the holidays
- ENVI Connect 2.0 – Either just before or right after the holidays
- IDL for VSCode – Available today! Download through VSCode or the web
- IDL and ENVI Notebooks – Included in IDL for VSCode

## Questions and Discussion

**Zach Norman**

*Product Manager*

[zachary.norman@nv5.com](mailto:zachary.norman@nv5.com)

**JP Metcalf**

*Solutions Engineering  
Manager*

[jp.metcalf@nv5.com](mailto:jp.metcalf@nv5.com)

**NV5 Geospatial**

[www.NV5GeospatialSoftware.com](http://www.NV5GeospatialSoftware.com)

[geospatialinfo@nv5.com](mailto:geospatialinfo@nv5.com)

303-786-9900