



ENVI DEEP LEARNING MODULE

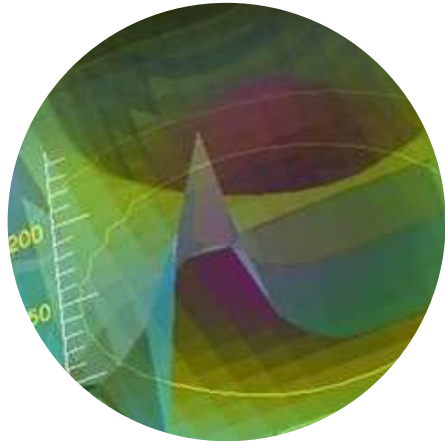
ANDREA MARCHESI

Account Manager

12° Workshop Tematico di Telerilevamento, 25-26 giugno 2019

Oratorio San Filippo Neri, Via Manzoni 5 - Bologna

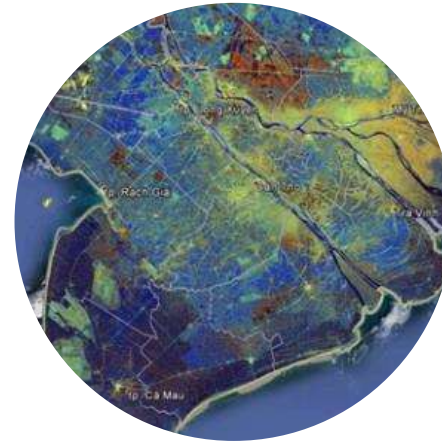
HARRIS® TECHNOLOGY TO CONNECT,
INFORM AND PROTECT™



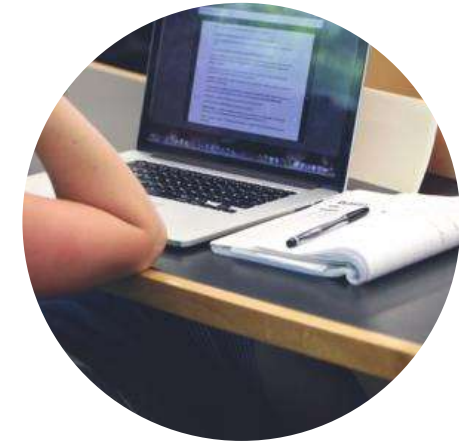
IDL



ENVI



SARscape



**Training
& Consulting**



Jagwire



**Machine
Learning**



**IntelliEarth
Marketplace**



**Geospatial Services
Framework**

What are some of the unique features of ENVI DL?

ENVI DL leverages TensorFlow™ technology to train deep learning models within the ENVI user interface.

Since ENVI Deep Learning is seamlessly integrated with ENVI, you can:

- Pre-process data using ENVI tools
- Iterate through a series of guided steps to interactively label data, train models, perform classification, and edit the results.

There is no reason to leave the ENVI platform for any part of the process.

ENVI does not require the use of a programming interface to run, allowing non-programmers to quickly get up to speed with their projects.

An easy-to-use API and the ENVI Modeler can assist more advanced users in processing multiple images in complex workflows.

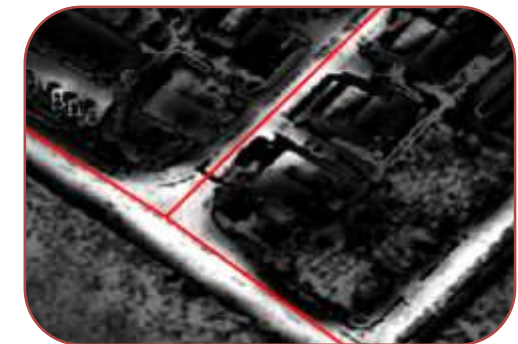
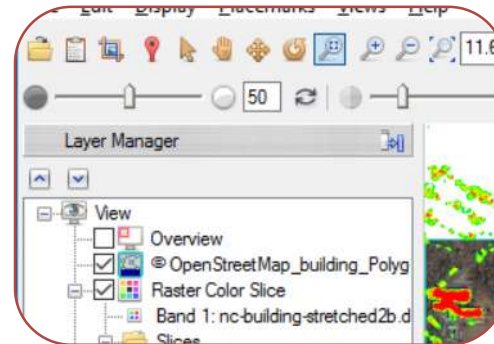
*What are some of the unique features of ENVI DL?
Example: The ENVI advantage to create training data.*

Use ENVI images or ROIs to create training data.

Use the ENVI tools to locate the features.

Run ENVI spectral analysis and use results as training data input.

Import labeled data from Open Street Maps, ArcGIS® Pro, and more.



What are some of the unique features of ENVI DL?

ENVI DL works with multispectral or hyperspectral imagery. It is not limited to RGB or panchromatic data

ENVI DL works with SAR data, but only after careful preprocessing, e. g. with ENVI SARscape

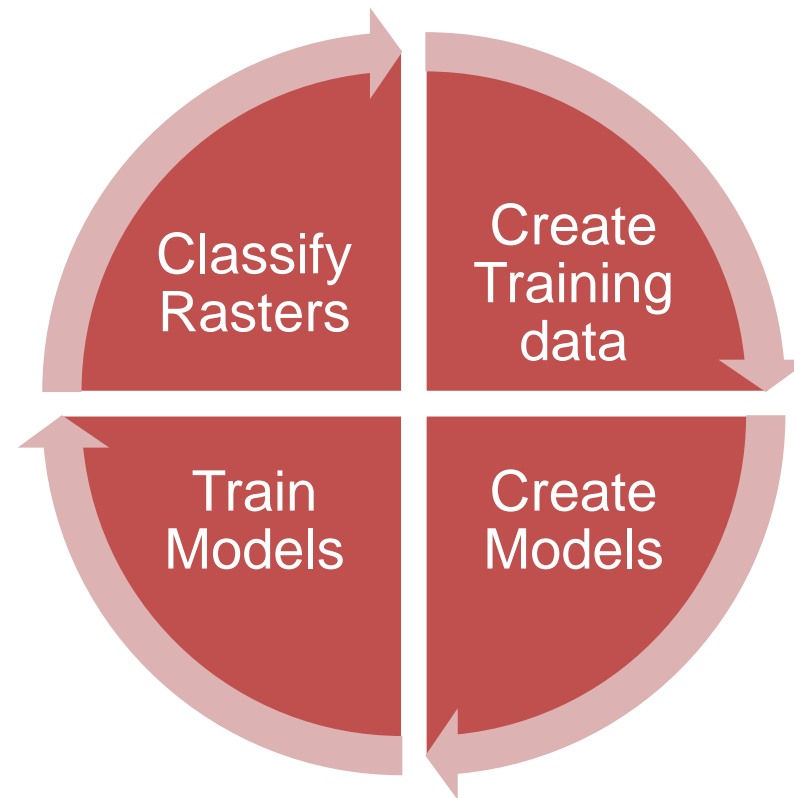
ENVI DL comes along with product updates / patches / bug fixes, maintenance and support when issues arise

ENVI DL works with DTMs/DSMs derived from 3-D point clouds

ENVI DL works with time series stacks (build as a single multi-band raster that contains the time series as different bands)

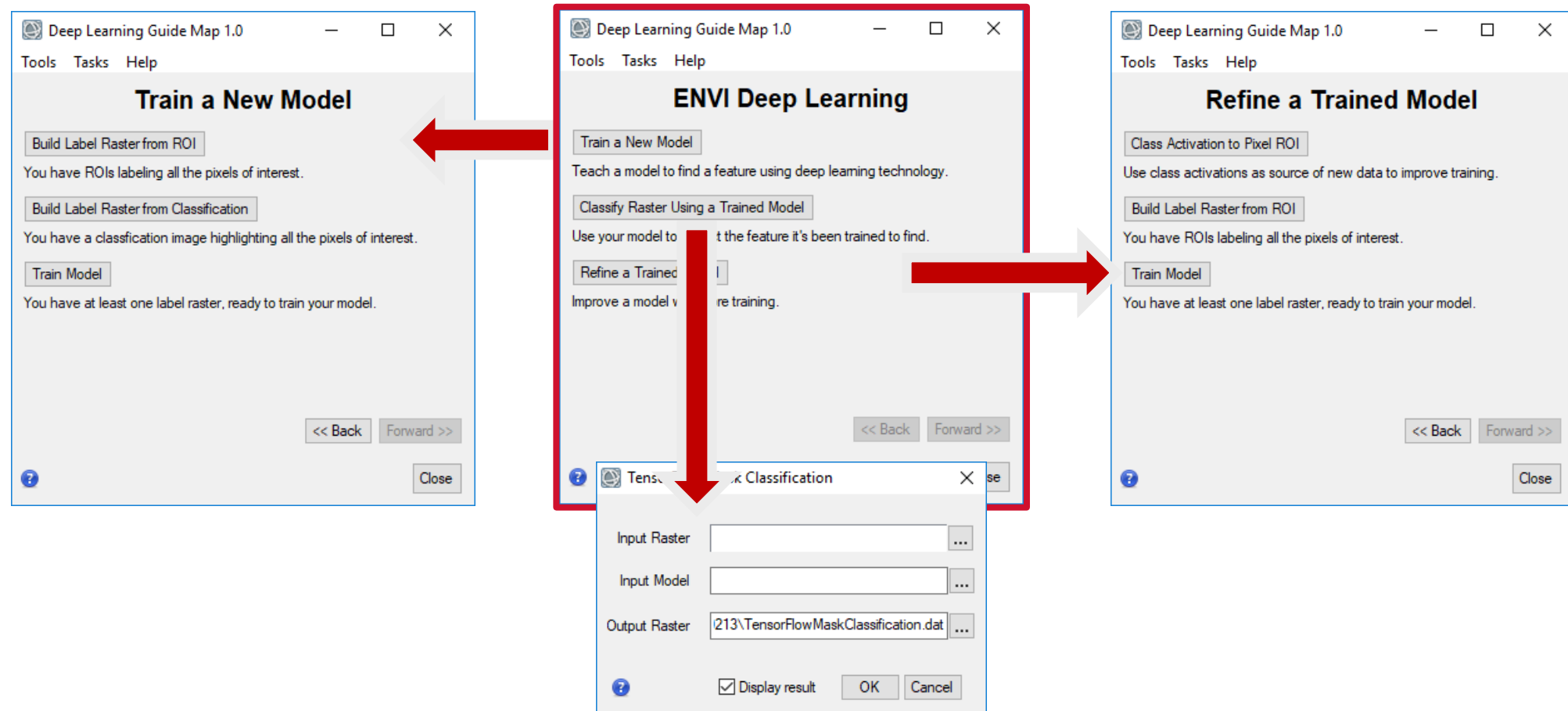
ENVI DL works with ArcGIS® software

*The process of extracting features from images involves several steps.
More than one iteration may be required to yield the best results.*



Built on TensorFlow

Users have access to a 'Guide Map' to help them navigate the appropriate steps for their projects.



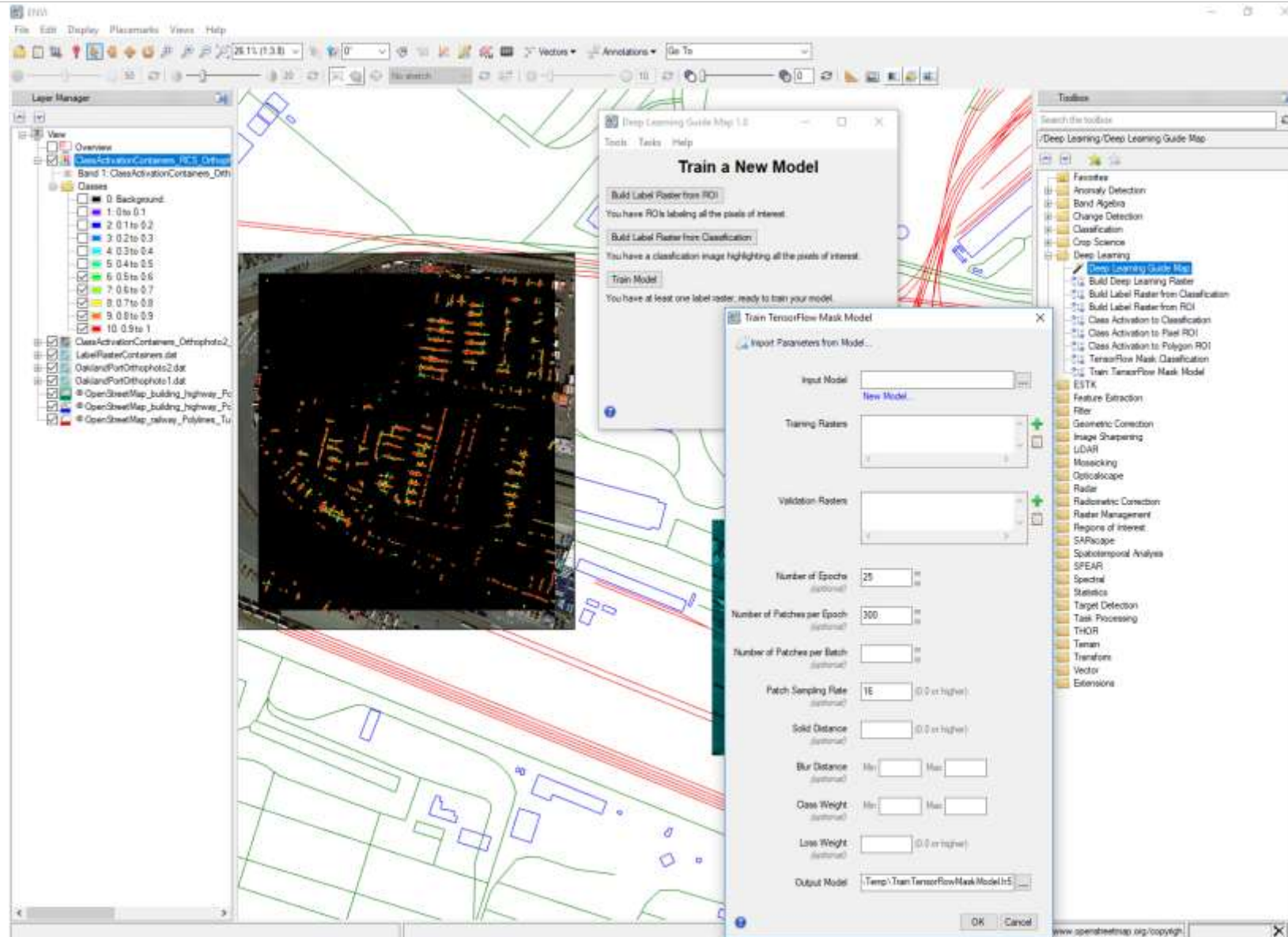
ENVI 5.5.2, ENVI DL 1.0
ArcGIS® Pro 2.3, ENVI Py 1.3

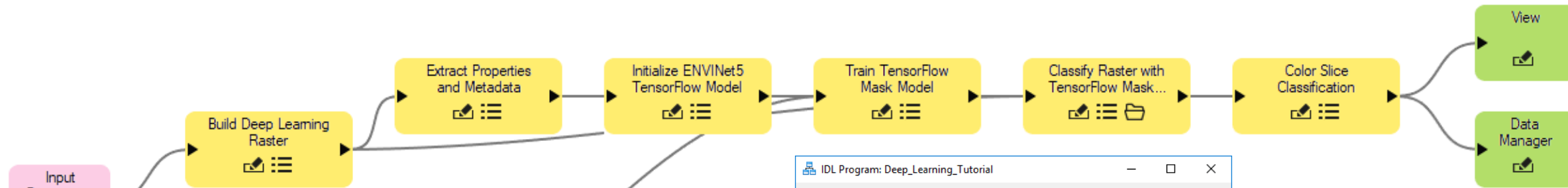
Platform	Hardware	Operating System	Supported Versions
Windows	Intel/AMD 64-bit	Windows	10, 2016 Server
Linux	Intel/AMD 64-bit	Linux	Kernel 3.10 or higher, glibc 2.17 or higher

ENVI Deep Learning uses TensorFlow™, which has a minimum set of hardware and software requirements:

- NVIDIA GPU card with CUDA® Compute Capability 3.5 or higher. See the list of [CUDA-enabled GPU cards](https://developer.nvidia.com/cuda-gpus) (https://developer.nvidia.com/cuda-gpus).
- [NVIDIA GPU drivers](https://www.nvidia.com/Download/index.aspx?lang=en-us) (https://www.nvidia.com/Download/index.aspx?lang=en-us):
CUDA 9.0 requires **version 384.x or higher**.

A minimum of **8 GB of GPU** memory is recommended, particularly when training deep-learning models.





This example takes a raster and an ROI as inputs and uses them to train a deep learning model. The trained model is then used to classify the input raster.

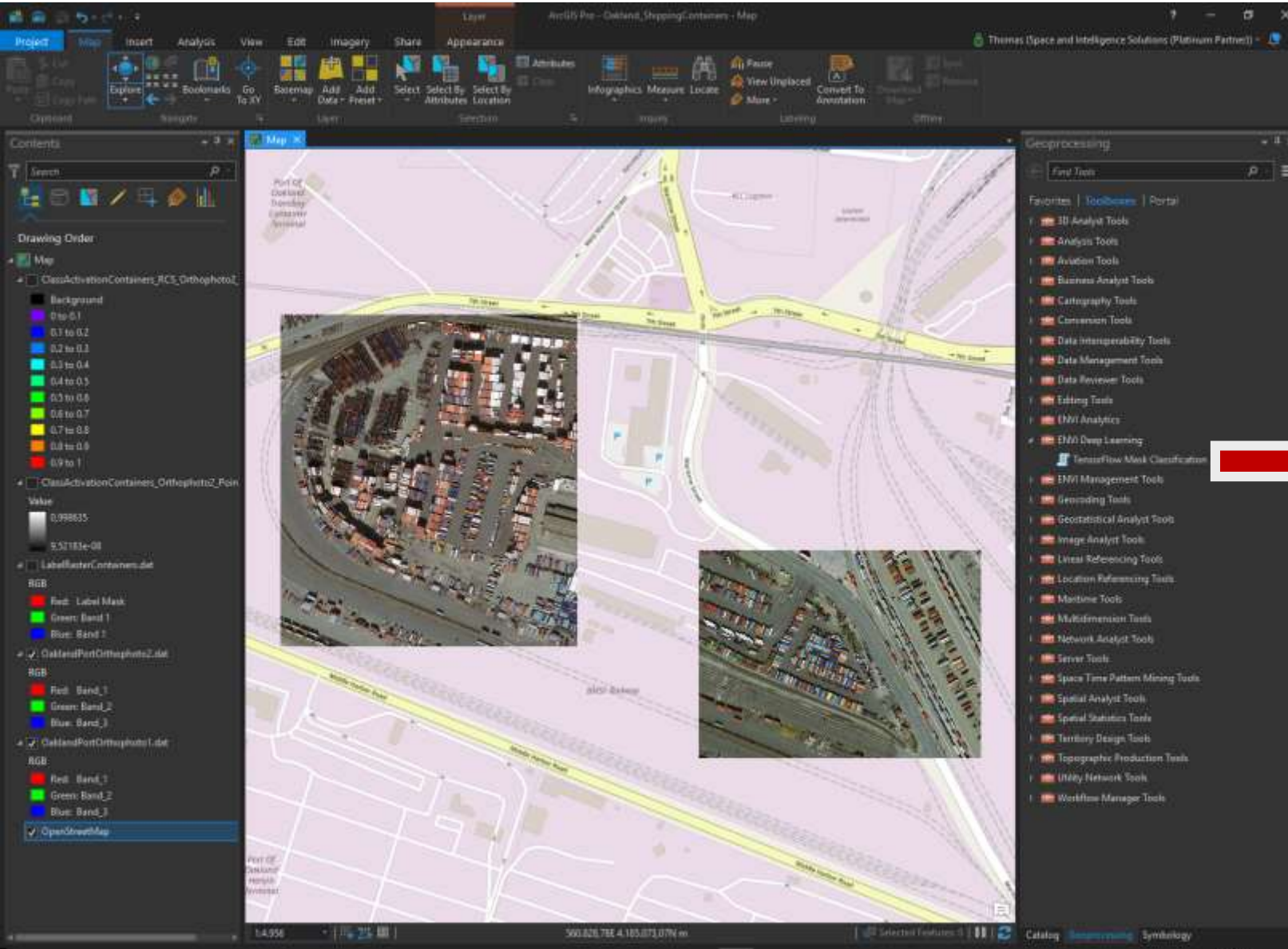
```
IDL Program: Deep_Learning_Tutorial
-----
; Build Label Raster from ROI
;
task_1 = ENVITask('BuildLabelRasterFromROI')
task_1.input_roi = parameters_1.input_roi
task_1.input_raster = parameters_1.input_raster
task_1.Execute

; Build Deep Learning Raster
;
task_3 = ENVITask('BuildDeepLearningRaster')
task_3.input_raster = parameters_1.input_raster
task_3.Execute

; Extract Properties and Metadata
;
propertyExtractor_1 = Obj_New('ENVIExtractObjectPropertyTask')
propertyExtractor_1.input_object = task_3.output_raster
propertyExtractor_1.Execute

; Initialize ENVINet5 TensorFlow Model
;
task_4 = ENVITask('InitializeENVINet5Model')
task_4.nbands = propertyExtractor_1.nbands
task_4.Execute

; Train TensorFlow Mask Model
;
task_5 = ENVITask('TrainTensorFlowMaskModel')
task_5.input_model = task_4.output_model
task_5.training_rasters = task_1.output_raster
task_5.validation_rasters = task_1.output_raster
task_5.Execute
```



ENVI Deep Learning

TensorFlow Mask Classification

TensorFlow Mask Classification (envi)
This task classifies a raster using a trained TensorFlow mask-based model. The result is a class activation raster whose pixel values represent the probability (0 to 1) of matching the feature of interest.

TensorFlow Mask Classification

Parameters Environments

* Input Raster

* Input Model

Output Raster URI

GSF Dashboard

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👤
⚙️

Task List Task Jobs

Items per page: 10 1 - 4 of 4

DLExtractIcebergs

ISODATAClassification

SpectralIndex

TensorFlowMaskClassification

+ 🔄

- 📷 Capture
- 📶 Upload
- 🔧 Workflows
- 📦 Tools
- 📁 After capture tasks
- 📁 After upload tasks
- 📍 Destinations
- ⚙️ Task settings...
- ⚙️ Application settings...
- ⚙️ Hotkey settings...
- 📁 Screenshots folder...
- 📁 History...
- 📁 Image history...
- 📢 News +
- 🚨 Debug
- ❤️ Donate...
- 📄 About...

Filename	Status	Progress	Speed	Elaps...	Rema...	URL
🕒 2018-10-11_07-38-03.mp4	History	10/11/2018 7:39:30 AM				C:\Users\Traininglead\Docum...
🕒 2018-10-25_12-45-25.mp4	History	10/25/2018 12:46:08 PM				C:\Users\Traininglead\Docum...
🕒 2018-10-25_12-47-29.mp4	History	10/25/2018 12:48:03 PM				C:\Users\Traininglead\Docum...
🕒 2018-10-25_12-48-27.mp4	History	10/25/2018 12:50:04 PM				C:\Users\Traininglead\Docum...
🕒 2018-10-25_13-01-46.mp4	History	10/25/2018 1:02:45 PM				C:\Users\Traininglead\Docum...
🕒 2018-10-25_13-31-31.mp4	History	10/25/2018 1:32:34 PM				C:\Users\Traininglead\Docum...
🕒 chrome_2018-11-29_08-53-3...	History	11/29/2018 8:53:34 AM				C:\Users\Traininglead\Docum...
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🕒 2018-11-29_09-13-03.mp4	History	11/29/2018 9:14:21 AM				C:\Users\Traininglead\Docum...

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- ❖ The Deep Learning module was designed to hide the complexity of convolutional neural networks from image analysts who regularly use ENVI.
- ❖ Yet it allows users who want more control over the training process to fine-tune parameters to achieve the best accuracy.
- ❖ Users can also take advantage of the ENVITask API framework and ENVI Modeler to customize deep-learning workflows.
- ❖ The image-driven insights that ENVI Deep Learning provides will help professionals solve geospatial problems that can't be solved with GIS data alone.
- ❖ The reduced complexity limits functionality and capabilities to create and train, and subsequently to apply deep learning models.



ENVI DL v 1.1

(Release desired in August 2019)



Thank You!

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