Public Works
LOS ANGELES COUNTY

Using Deep Learning Algorithms to Create Land Cover 2.0

October 13, 2021

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GIS Manager

Background

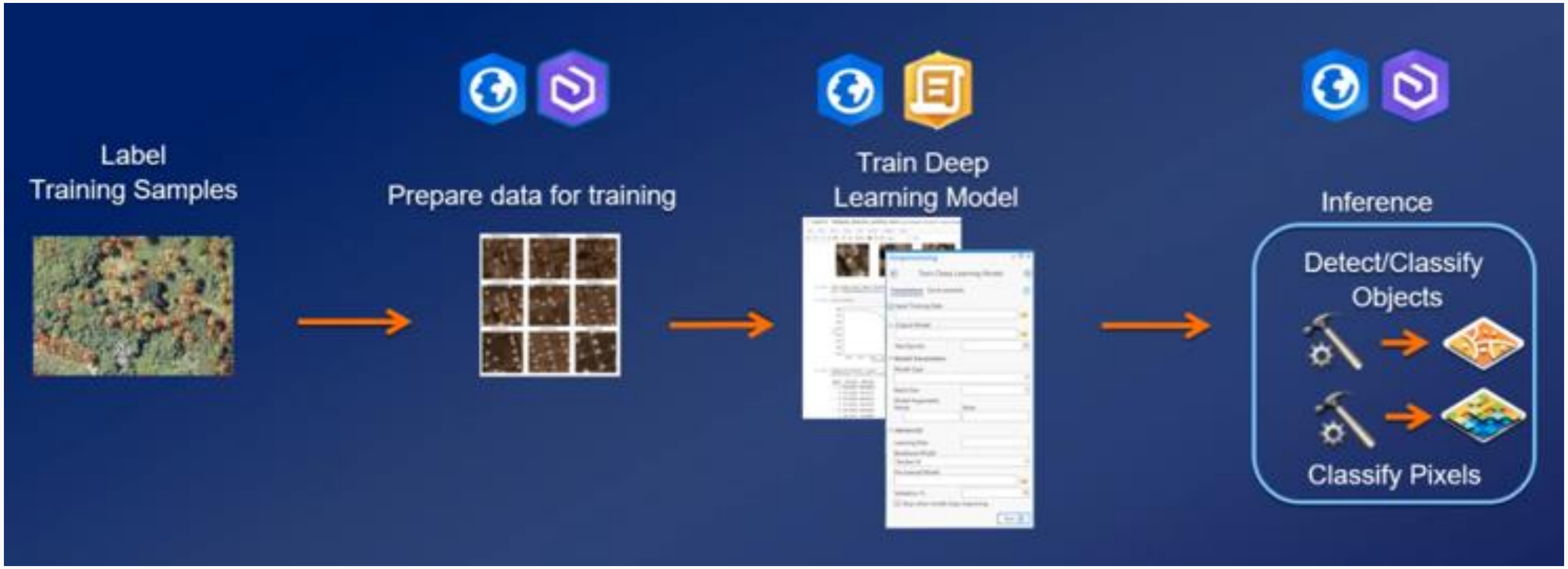
- Land Cover 1.0 was produced for us (LARIAC4) by University of Vermont
- Used eCognition
- Advantages:
  - First of its kind in LA
- Disadvantages:
  - Cannot replicate work
  - Limited classes

Goals

- PW Stormwater Planning Division will update the parcel-based assessment fee for Measure W
  - The calculated tax is based upon the parcel's impermeable area as determined by the County Landcover Survey or other applicable tool.
- Create a parcel fee change report
- Include additional classes (e.g. gravel)
- Have control over the deep learning algorithms

New Methodology for Land Cover 2.0

- Deep learning with imagery in ArcGIS



Source: Esri

End-to-end process from raw imagery to structured information products

Hardware & Software Acquisition

- 3 high performance computers with Graphical Processing Units (GPUs)
  - Precision 7920 Xeon 4216 2.1GHz, 16 Core processor, includes 1TB PCIe NVMe drive
  - Additional 64GB upgrade on CCPP
  - Separate open market purchase the Nvidia Quadro RTX5000, 16GB, 4DP, VirtualLink graphics card
- 32-inch monitors
- Esri Image Analyst extension

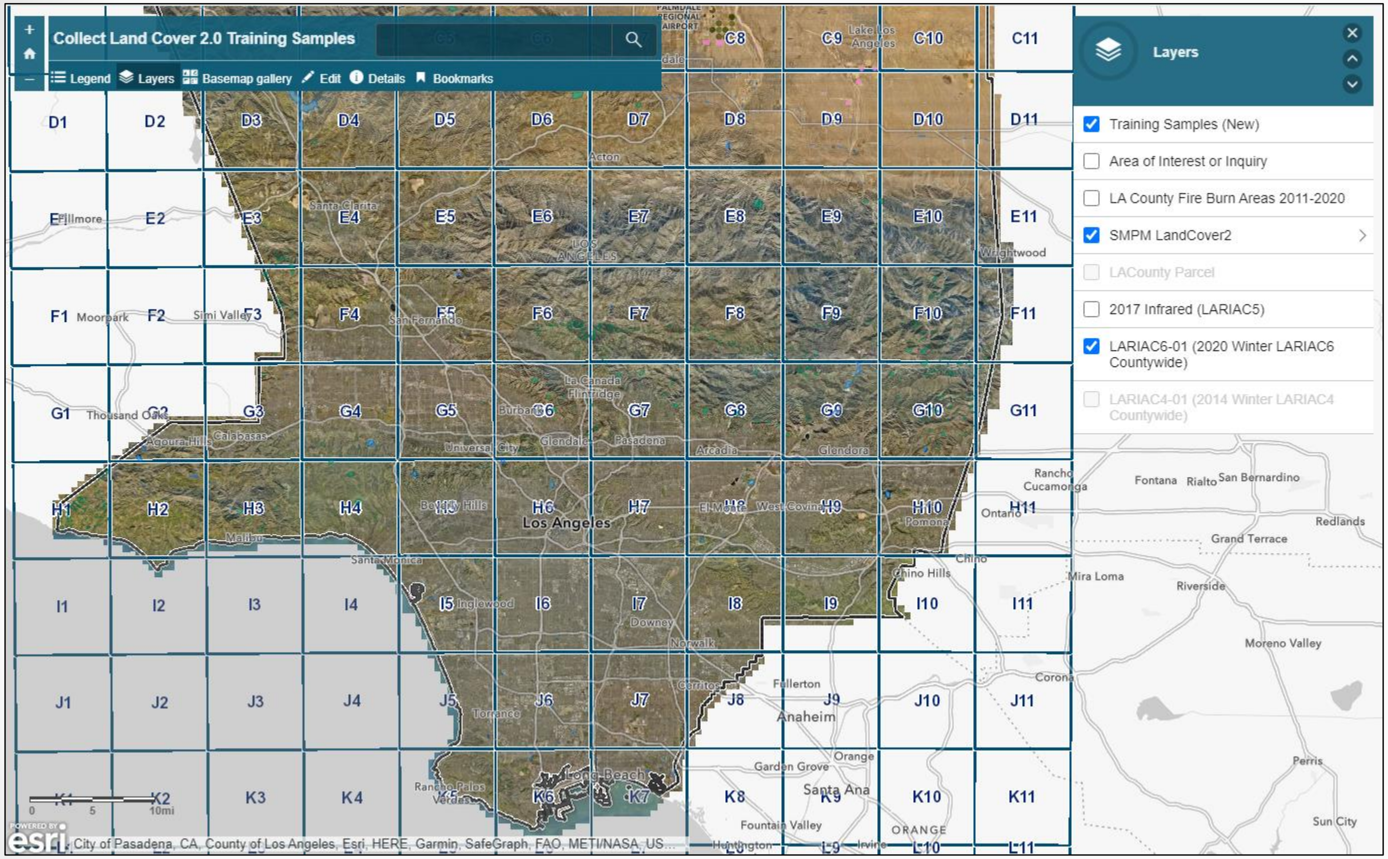
Data Inventory

- LARIAC4 LiDAR (2016)
- LARIAC5 Imagery (2020): 4-inch, 4 band RGB-IR ortho
- LARIAC5 Building outlines (2020)
- CAMS street centerlines
- Parcels with gravel

Land Cover Classes

Land Cover 1.0	Land Cover 2.0
Tree Canopy	Tree Canopy
Grass/Shrubs	Urban Grass/Shrubs
Tall Shrubs	Rural Shrubland
Bare Soil	Bare Soil
Water	Water Bodies
Buildings	Buildings
Roads/Railroads	Roads/Railroads
Other Paved	Other Paved
	Gravel
	Pools/Fountains

Collect Land Cover 2.0 Training Samples Web App



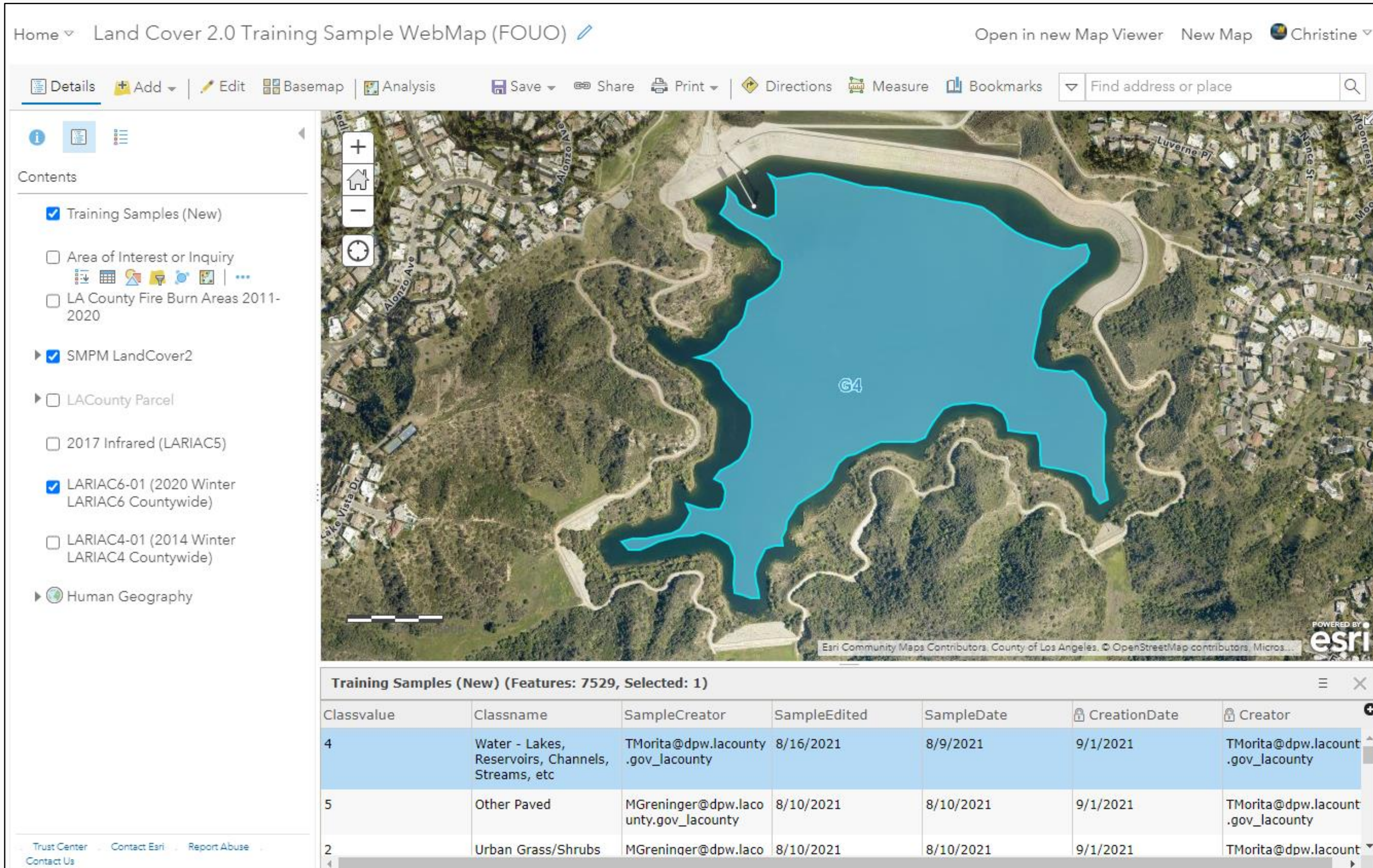
Not included:

Buildings
Roads/railroads

Create Training Polygons

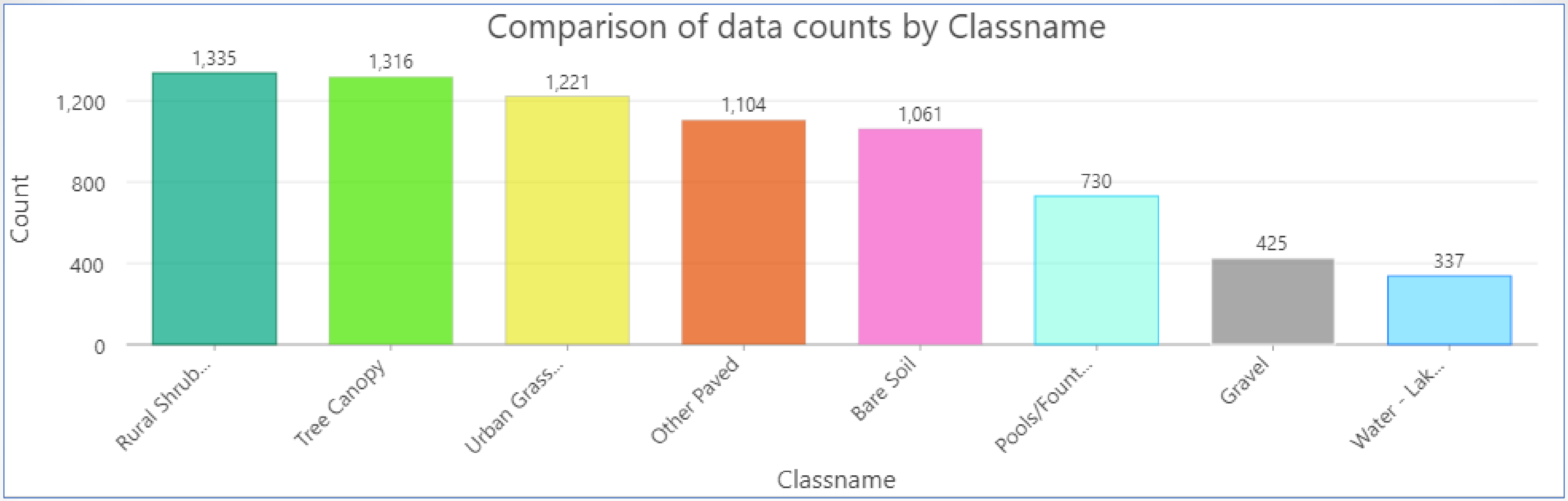
Create Training Polygons

QA/QC Web App



Home
Land Cover 2.0 Training Sample WebMap (FOUO)
Open in new Map Viewer
New Map
Christine
Details
Add
Edit
Basemap
Analysis
Save
Share
Print
Directions
Measure
Bookmarks
Find address or place
Contents
Training Samples (New)
Area of Interest or Inquiry
LA County Fire Burn Areas 2011-2020
SMPM LandCover2
LACounty Parcel
2017 Infrared (LARIAC5)
LARIAC6-01 (2020 Winter LARIAC6 Countywide)
LARIAC4-01 (2014 Winter LARIAC4 Countywide)
Human Geography
Trust Center
Contact Esri
Report Abuse
Contact Us
G4
Training Samples (New) (Features: 7529, Selected: 1)
Classvalue | Classname | SampleCreator | SampleEdited | SampleDate | CreationDate | Creator
4 | Water - Lakes, Reservoirs, Channels, Streams, etc | TMorita@dpw.lacounty.gov_lacounty | 8/16/2021 | 8/9/2021 | 9/1/2021 | TMorita@dpw.lacounty.gov_lacounty
5 | Other Paved | MGreninger@dpw.lacounty.gov_lacounty | 8/10/2021 | 8/10/2021 | 9/1/2021 | TMorita@dpw.lacounty.gov_lacounty
2 | Urban Grass/Shrubs | MGreninger@dpw.laco | 8/10/2021 | 8/10/2021 | 9/1/2021 | TMorita@dpw.lacount

Training Polygon Counts



Not included:

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Geoprocessing Tools in ArcGIS Pro

- Export Training Data for Deep Learning to create image chips

Export Training Data For Deep Learning (Image Analyst Tools)

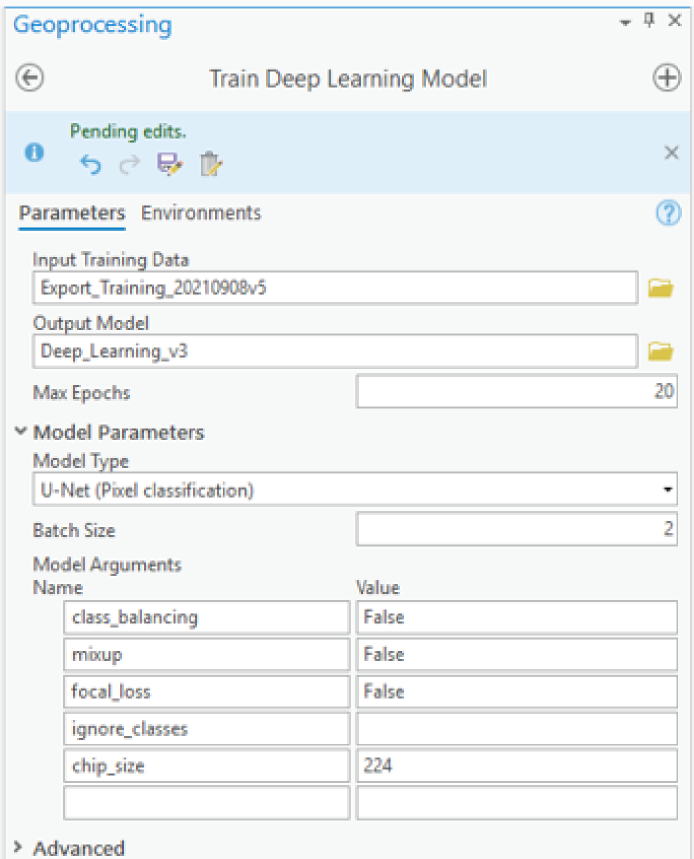
Started: Wednesday, September 8, 2021 at 8:23:45 AM
Completed: Thursday, September 9, 2021 at 11:31:17 PM
Elapsed Time: 1 Day 15 Hours 7 Minutes 32 Seconds

Parameters Environments Messages

Input Raster	Countywide
Output Folder	E:\Land_Cover_Working \Export_Training_20210908v5
Input Feature Class Or Classified Raster Or Table	TrainingSamples_Vin
Image Format	TIFF
Tile Size X	512
Tile Size Y	512
Stride X	256
Stride Y	256
Output No Feature Tiles	ONLY_TILES_WITH_FEATURES
Metadata Format	Classified_Tiles
Start Index	0
Class Value Field	Classvalue
Buffer Radius	0
Input Mask Polygons	
Rotation Angle	0
Reference System	MAP_SPACE
Processing Mode	PROCESS_AS_MOSAICKED_IMAGE
Blacken Around Feature	NO_BLACKEN
Crop Mode	FIXED_SIZE
Additional Input Raster	

Geoprocessing Tools in ArcGIS Pro

- Train Deep Learning Model



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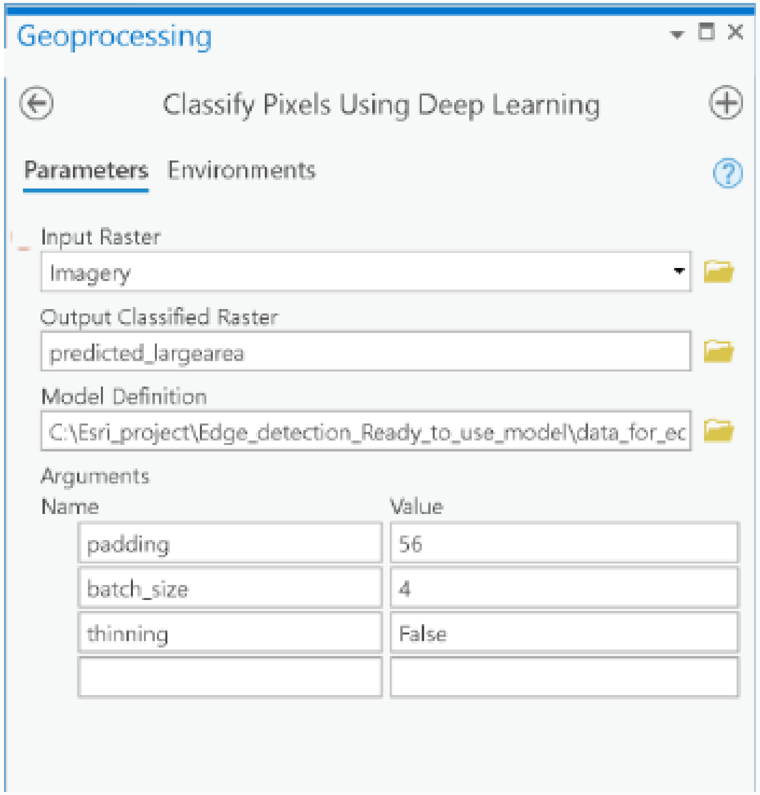
Geoprocessing Tools in ArcGIS Pro

- Classify Pixels Using Deep Learning



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Final Steps

- QA/QC and Accuracy Assessment
  - Manual inspection
  - Accuracy report
- Parcel Fee Change Report
  - All parcels will have a new impervious surface calculation and a difference is calculated for each parcel.
- February 2022 is targeted completion date
- Release to LARIAC6 members

ANY QUESTIONS?

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