



ArcGIS Online Imagery Analysis Using Python

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Introduction

- ArcGIS Online Imagery is a Software as a Service (SaaS) offering for Imagery data hosting, visualization, exploitation and analysis.
- Image is part of ArcGIS Platform
 - 8.2 ~ 8.4 EAP invite only Beta release
 - 9.1 General available (**Dynamic Imagery Layer still in EAP**)
- No maintenance needed for on-premise Enterprise server
- Scalable and perform

ArcGIS Online Imagery Capabilities

ArcGIS Online

Host Imagery

- Upload imagery data
- Create imagery layer
- Manage collection of imagery
- 30 supported raster types

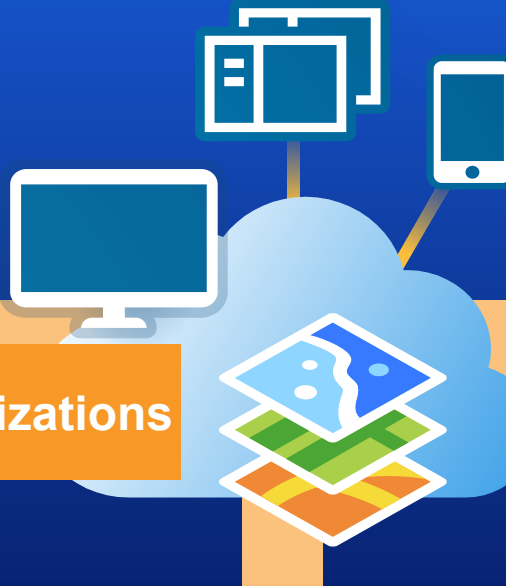
Organizations

Imagery Visualization

- Client-side imagery layer renderer
- Server-side dynamic rendering
- New tiled API for fast rendering

Imagery Analysis

- 160+ raster functions
- 18 analytic tools
- Customize and share raster function modules



Enable Imagery Capabilities for User

- Organization administrator can grant permission by assign privilege to Member Roles
- Privilege requirement
 - Create Imagery Layer
 - Content -> Publish hosted tiled imagery layers
 - Content -> Publish hosted dynamic imagery layers
 - Enable Imagery Analysis
 - Content -> Publish hosted feature layers
 - Premium Content -> Imagery Analysis

✓ Premium Content Enabled: 1/8 [Enable all](#)

Imagery Analysis

Allow member to perform imagery analysis tasks.

Member roles

Manage roles Enabled: 5/9 [Enable all](#)

Create, update, and delete
Allow member to create, edit, and delete t

Publish hosted feature layers
Allow member to publish hosted feature la

Publish hosted tile layers
Allow member to publish hosted tile layers from the packages, features, etc.

Publish hosted scene layers
Allow member to publish hosted scene layers.

Publish hosted tiled imagery layers
Allow member to publish hosted tiles imagery layers from a single image or collection of images.

Publish hosted dynamic imagery layers
Allow member to publish hosted dynamic imagery layers from a single image or collection of images.

Imagery Analysis

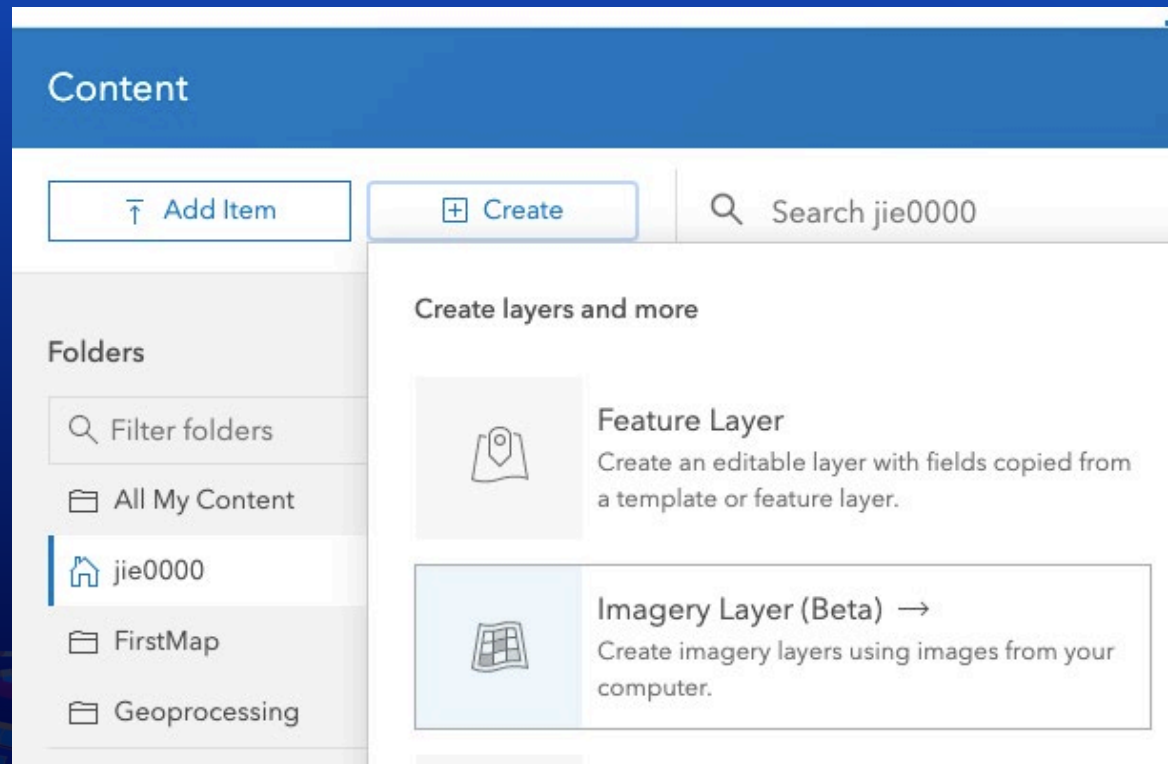
Allow member to perform imagery analysis tasks.

[Create role](#)

Search roles

Create Imagery Layer

- Create imagery layer item by uploading local data
- Launch “Create -> Imagery Layer” from content page
- Only user with required privileges can see the new Imagery Layer option



Create Imagery Layer (cont.)

- Support 2 types of Hosted Imagery Layer
 - Tiled Imagery Layer
 - From single image
 - From a collection – mosaicked & persisted
 - From a collection – multiple layers
 - Dynamic Imagery Layer (EAP Only)
 - From single image
 - From a collection - mosaicked & persisted
 - From a collection – dynamic mosaic
 - From a collection – multiple layers

Create imagery layers

STEP 1 Choose layer type STEP 2 Configure layer STEP 3 Define imagery STEP 4 Set item details

Choose the layer types that best suit your needs

- Tiled Imagery Layer
 - Provides imagery access as static tiles and associated metadata
 - Supports client side processing and rendering
 - Can be used as an input to raster analysis
- Dynamic Imagery Layer
 - Provides versatile dynamic imagery access capabilities
 - Supports on-demand server side processing and dynamic mosaicking
 - Supports managing a collection of images
 - Can be used as an input to raster analysis

Create Imagery Layer (cont.)

- Tiled Layer, Tiled Imagery Layer and Dynamic Imagery Layer difference

Tiled Layer	Tiled Imagery Layer	Dynamic Imagery Layer
No server-side processing	No server-side dynamic processing and image access	Server-side dynamic processing
Static 1 or 3 band JPG/PNG tiles	Static tiles but support full imagery information model	Server-side dynamic mosaicking and image access
Visualize only	Good for visualization and analysis	Good for visualization and analysis

- Do I have to create both Tiled Imagery Layer and Dynamic Imagery Layer?
 - No, create according to your need
 - Existing Tiled Imagery Layer can be republished as Dynamic Imagery Layer, vice versa.

Create Imagery Layer (cont.)

- Imagery data is uploaded and converted to Cloud Raster Format (CRF)
- Image Collection mode create hosted mosaic dataset and reference uploaded data in their original format
- CRF based Imagery Layer (Tiled or Dynamic) - supports tiles API by default
- Support for creation of Dynamic Imagery Layer from existing Tiled Imagery Layers

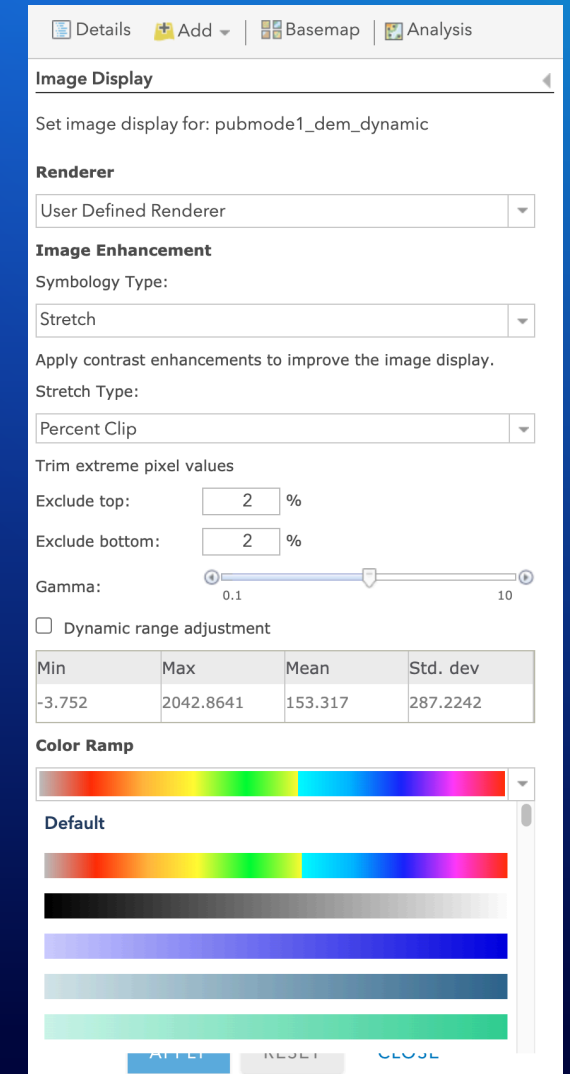
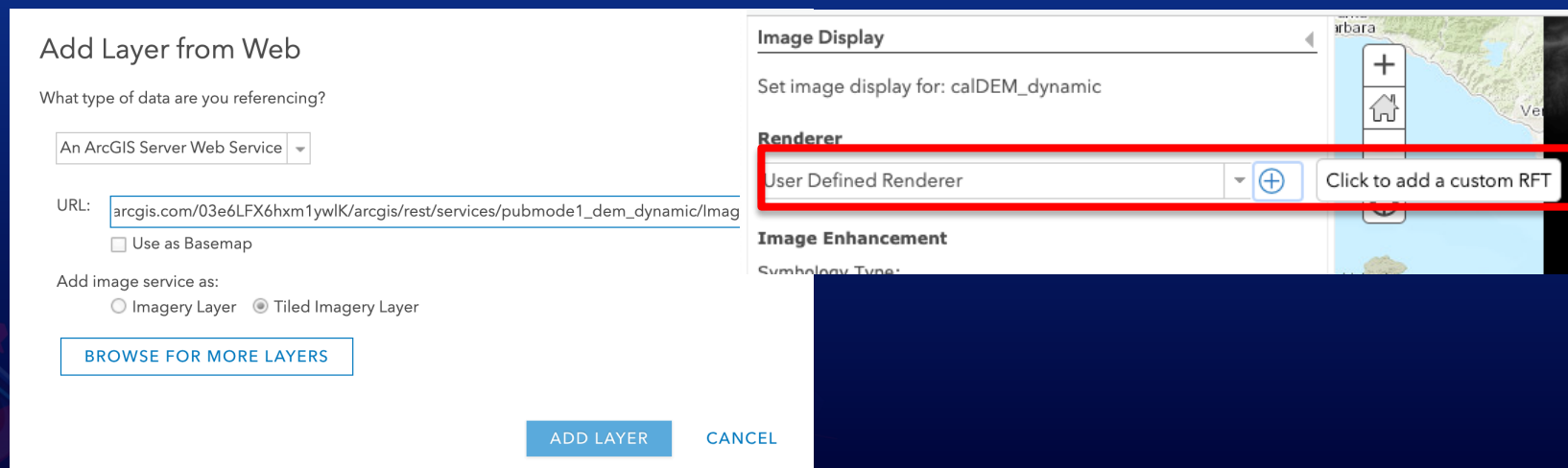


Create Imagery Layer Demo

Nirupam Dey

Visualization

- Both classic and new Map Viewers/Scene Viewers support tiled API for fast imagery rendering
- Client-side rendering support for Tiled Imagery Layer
- Dynamic Imagery Layer support custom rendering rule from the client side
- Additional add layer options



Dynamic Imagery Layer Item

- Support editing of service configuration

pubmode1_dem1 Settings

General Imagery Layer (hosted) Overview

Settings

General

Imagery Layer (hosted)

Capabilities

Image

Maximum columns per request

15000

Maximum rows per request

5100

Maximum samples count

1000

Default resampling method

Bilinear Interpolation (for continuous data)

Allowed compressions

Allow analysis

Allow function

Default template

None

Hillshade.rft.xml

Choose Raster Function Template

- Additional tools for Dynamic Imagery Layers created with Image Collection mode

pubmode3_dem_fromtiled Overview Image Management Usage Settings

Build Footprints

Computes the extent geometry of every raster in the collection. Use this tool to refine footprints and remove low quality edge pixels.

Build Overviews

When you're satisfied with your processing configuration of all images, you can build overview images to speed up display performance.

Compute Seamlines

Refine mosaic boundaries by building seamlines. Use this tool to smooth the blending of overlapping images.

Compute Color Corrections

Balance and correct color variations among images. Use this tool for an improved visual mosaic. It is not recommended for analytical purposes.

Calculate Statistics

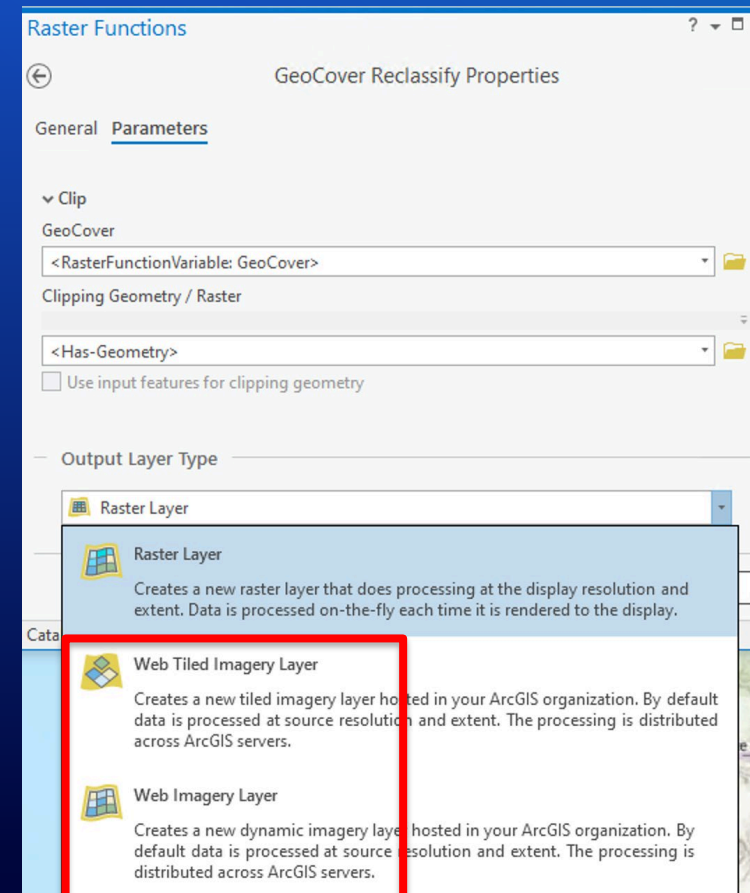
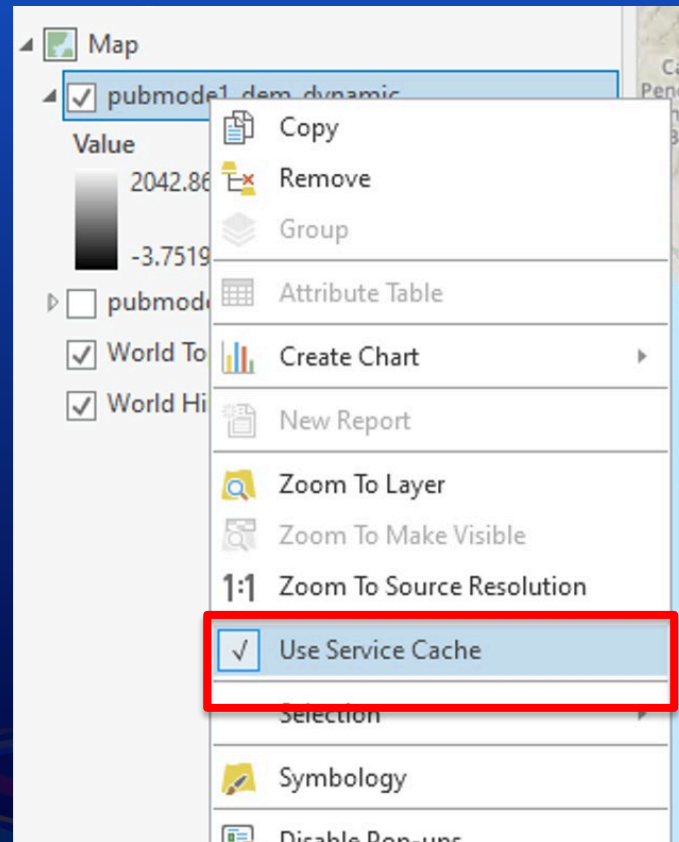
Calculate image statistics and histograms. Statistics are used for rendering and analysis.

Define NoData Pixel Values

If your imagery requires certain values to represent NoData, use this tool to define them.

ArcGIS Pro Support for ArcGIS Online Imagery

- Visualizing and working with both types of Imagery Layers
- Perform Imagery Analysis using Raster function on ArcGIS Online



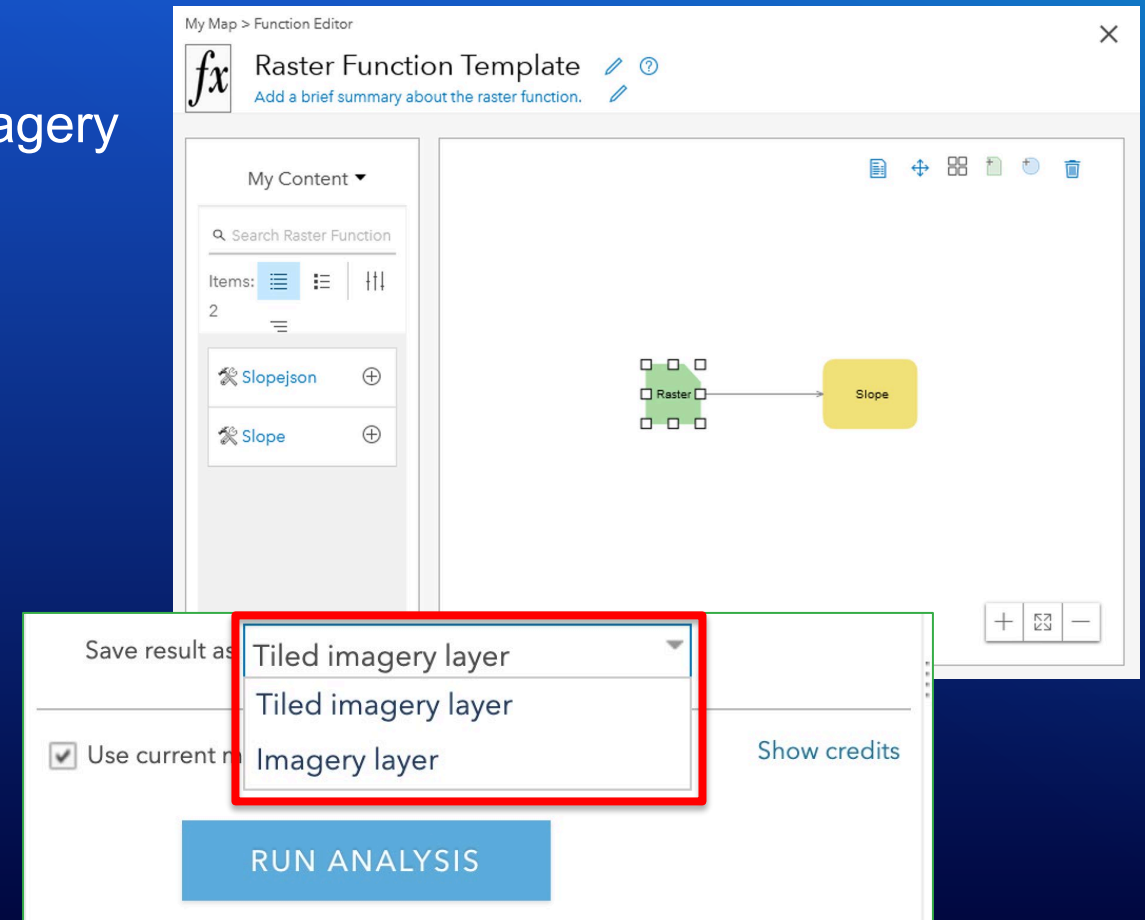
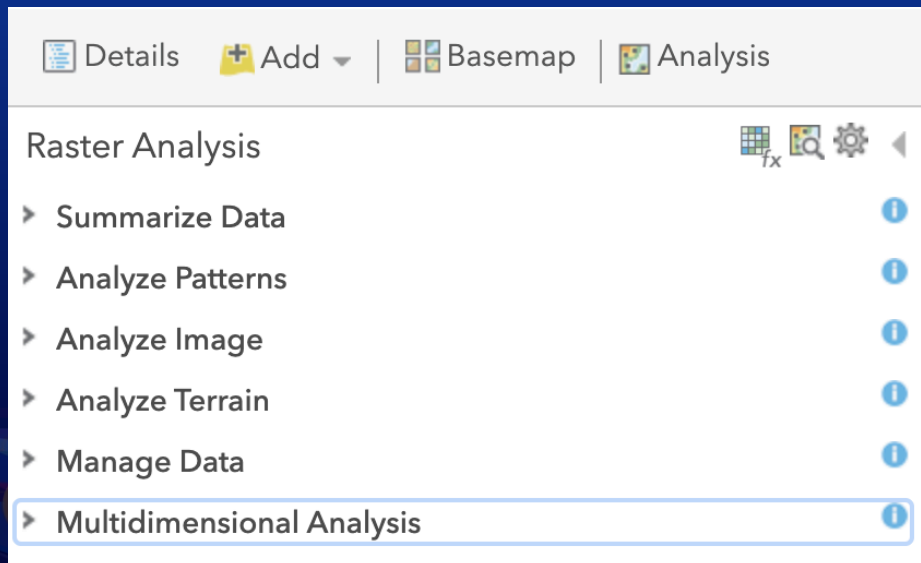


Layer item, Visualization

Jie Zhang

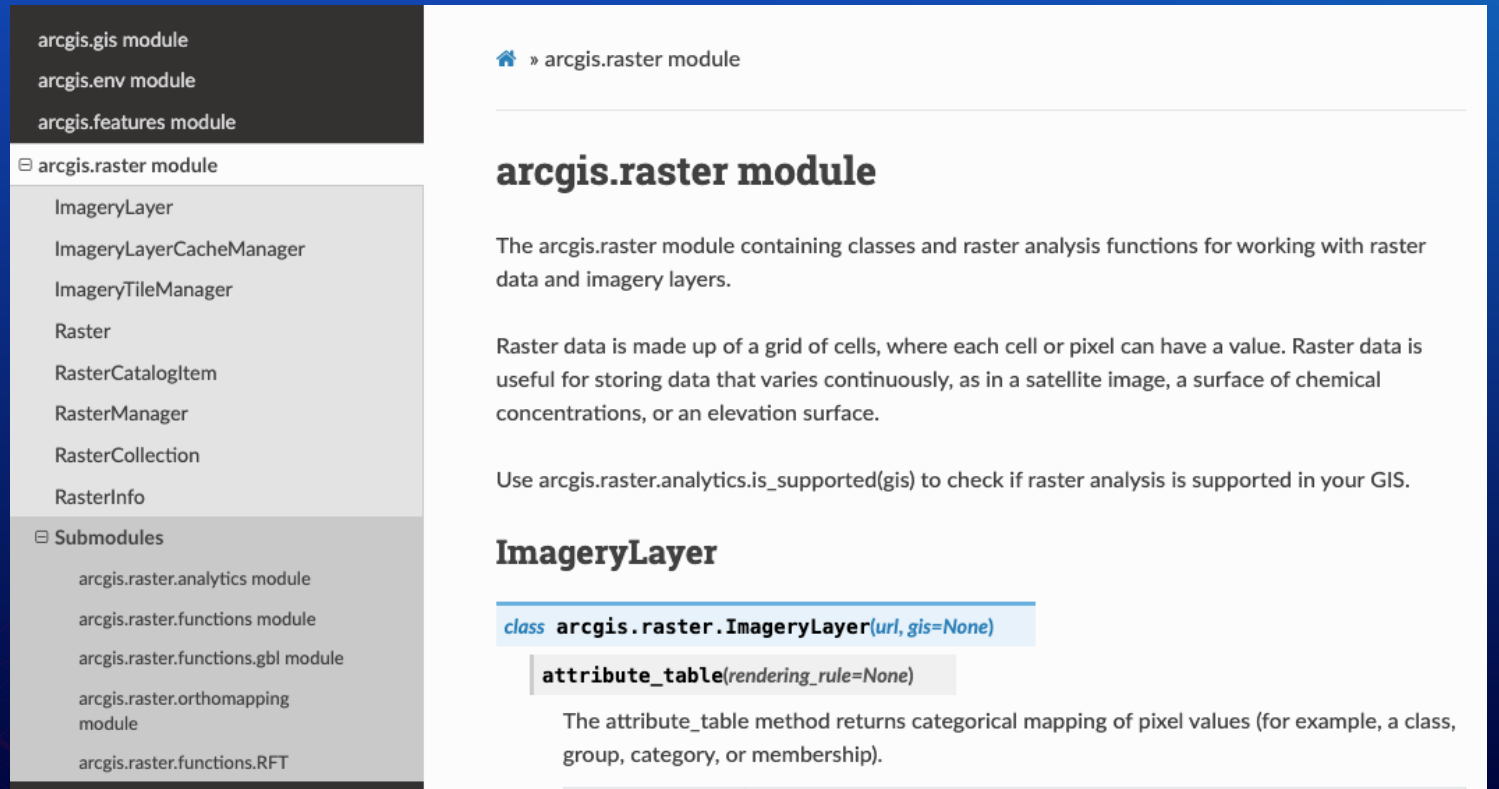
Imagery Analysis

- 18 Ready to use tools under Analysis pane (Including Deep Learning Inferencing)
- 160+ raster functions
- Work with Tiled Imagery Layer and Dynamic Imagery layer
- Output to new Tiled or Dynamic Imagery Layer
- Credit estimation



ArcGIS API for Python Support for ArcGIS Online Imagery

- Create Imagery Layer
- Visualize Imagery Layer in ArcGIS Notebook
- Create and edit Raster Function Template for On-the-fly processing
- Perform Imagery Analysis



The screenshot shows the ArcGIS API for Python documentation for the `arcgis.raster` module. On the left is a navigation sidebar with a tree view. The main content area on the right provides a description of the module and details about the `ImageryLayer` class.

arcgis.gis module
arcgis.env module
arcgis.features module

▾ **arcgis.raster module**

- ImageryLayer
- ImageryLayerCacheManager
- ImageryTileManager
- Raster
- RasterCatalogItem
- RasterManager
- RasterCollection
- RasterInfo

▾ **Submodules**

- arcgis.raster.analytics module
- arcgis.raster.functions module
- arcgis.raster.functions.gbl module
- arcgis.raster.orthomapping module
- arcgis.raster.functions.RFT

» arcgis.raster module

arcgis.raster module

The `arcgis.raster` module containing classes and raster analysis functions for working with raster data and imagery layers.

Raster data is made up of a grid of cells, where each cell or pixel can have a value. Raster data is useful for storing data that varies continuously, as in a satellite image, a surface of chemical concentrations, or an elevation surface.

Use `arcgis.raster.analytics.is_supported(gis)` to check if raster analysis is supported in your GIS.

ImageryLayer

```
class arcgis.raster.ImageryLayer(url, gis=None)
    attribute_table(rendering_rule=None)
```

The `attribute_table` method returns categorical mapping of pixel values (for example, a class, group, category, or membership).

Perform Imagery Analysis in Notebook

- ArcGIS Notebook provides up to date ArcGIS python API for imagery analysis
- Analysis results are shared as hosted feature layer or imagery layer out of the box

Object Detection in ArcGIS Online

With ArcGIS Online Imagery you can perform advanced analysis of your imagery like exporting training data and training your deep learning models, to detecting objects or classifying pixels across a large landscape. In this section, we will show how to perform deep learning - object detection.

```
In [1]: # Importing necessary modules and packages
import arcgis
from arcgis import GIS
from arcgis.raster import analytics
from arcgis import learn
```

```
In [2]: # Prompt user to provide username and password
import getpass
username = input("Enter username: ")
password = getpass.getpass("Enter password: ")

Enter username: ndey_prod
Enter password: .....
```

```
In [3]: # Connect to ArcGIS Online
gis = GIS("https://arcgis.com", username, password)
gis
```

Out[3]: GIS @ <https://esri-rasterweb.maps.arcgis.com>

```
In [4]: deep_learning_package_item = gis.content.search("Coconut Tree DL model", item_type="Deep Learning Package")
deep_learning_package_item
```

Out[4]: [<Item title:"Coconut Tree DL model" type:Deep Learning Package owner:ndey_prod>]

```
In [5]: coconutTrees_item = gis.content.search("Coconut Trees", item_type="Image Service")
coconutTrees_item
```

Out[5]: [<Item title:"Coconut Trees" type:Imagery Layer owner:ndey_prod>, <Item title:"Coconut Trees" type:Imagery Layer owner:ndey_prod>]

```
In [6]: coconutTrees_item[0].layers[0]
```

Out[6]:





ArcGIS API for Python – ArcGIS Online Imagery

Nirupam Dey

Cost Metering – Imagery Storage

- Tiled Imagery Layer
 - Meter Cloud Raster Format image files.
- Dynamic Imagery Layer
 - Meter storage size of the raw uploaded image files, CRF Raster Dataset, as well as number of images count per layer.

Item Information [Learn more](#)

Low High

Top Improvement: [Add a summary](#)

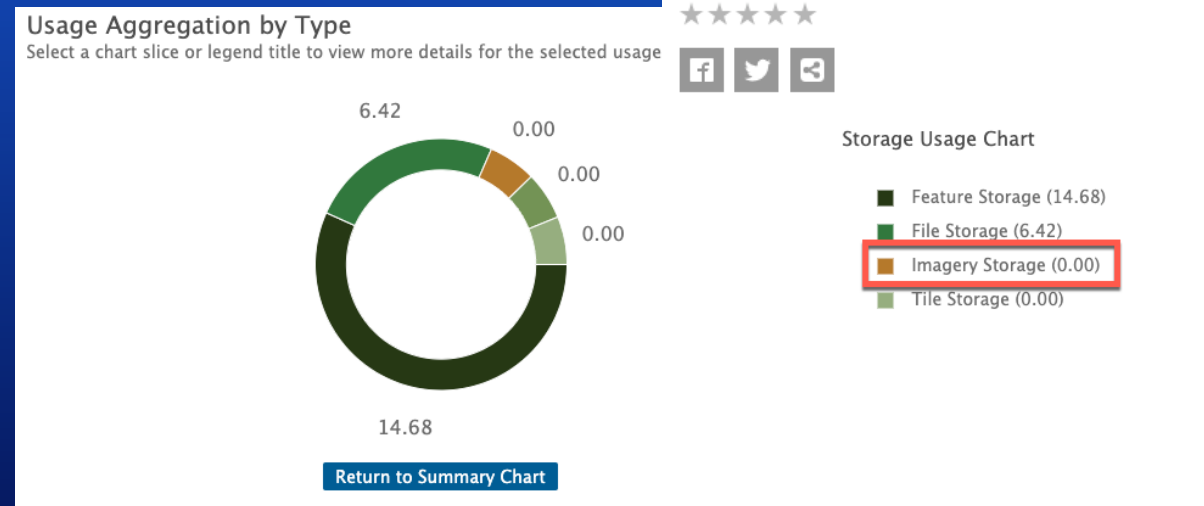
Details

Source: [Image Service](#)

Size: 120 GB

Image Count: 312

★★★★★



Imagery Storage Report | 0.00 Credits | These transactions will consume credits in the future

Member	Layer Type	Images Size	Images Count	Credits
Esri Raster Dev Team	Tiled Imagery Layer	376 GB	7,000	0.00
Esri Raster Dev Team	Dynamic Imagery Layer	487 GB	10,235	0.00

Cost Metering – Imagery Analysis

- Imagery Analysis task credits cost computed based on
 - Number of pixels processed
 - Number of features processed
 - Number of bands, dimension slices
 - Complexity of function template

Usage Aggregation by Type

Select a chart slice or legend title to view more details for the selected usage category



Analytics Usage Chart

■ Imagery Analysis (0.00)

[Return to Summary Chart](#)

Imagery Analysis | 31 Requests | 0.00 Credits | 6.14 credits when imagery analysis is a credit consuming service.

Member	Operation	Requests	Credits
	Custom Raster Function	11	5.54
	Reemap Function	10	0.10
rasterteam	Local Function	7	0.15
	Aggregate Multidimensional Raster	1	0.15
	Generate Trend Raster	1	0.10
rasterteam	Generate Trend Raster	1	0.10

Learn more about ArcGIS Online Imagery

- Current ArcGIS Online Imagery EAP Users have access to EAP site
 - Documentation
 - Forum
 - Issue report
- Stay tune for more information in ArcGIS Online 9.1 release – March 2021

Documentation

1. Enabling ArcGIS Online Imagery capabilities (for org admins)
2. Creating hosted imagery layers in ArcGIS Online
3. Visualizing imagery layers in ArcGIS Online Map Viewer
4. Introduction to raster analysis in ArcGIS Online
5. Use raster functions to customize raster analysis in ArcGIS Online
6. ArcGIS Online Raster Function Editor
7. Credit Metering
8. Whats New in ArcGIS Online Imagery Q3 2020
9. Whats New in ArcGIS Online Imagery Q4 2020
10. Frequently Asked Questions – ArcGIS Online Imagery
11. Known Issues and Limitations – ArcGIS Online Imagery


CREATE NEW DOCUMENTATION

ArcGIS Online Imagery SUMMARY

OVERVIEW RESOURCES MY TO-DO

WELCOME TO THE BETA PROGRAM FOR ARCGIS ONLINE IMAGERY!

NOTICE (Dec 8, 2020): ArcGIS Online Imagery Beta has been updated to include additional imagery privileges in the user role settings. Existing organizations may need to [update custom roles and permissions](#) as described below.



ArcGIS Online Imagery is a capability that lets you host, serve and analyze imagery collections within ArcGIS Online. Make your imagery ready-to-use within your favorite ArcGIS applications, regardless of projection and data type. Simply upload imagery and rasters to ArcGIS Online, then make them accessible as tiled imagery, or as dynamic imagery that provide dynamic mosaicking and on-the-fly processing. Perform analysis to extract information from images such as image classification, change detection and suitability analysis. With all your data and analysis results stored in ArcGIS Online, you are empowered to quickly transition from visualization to interpretation to analysis.

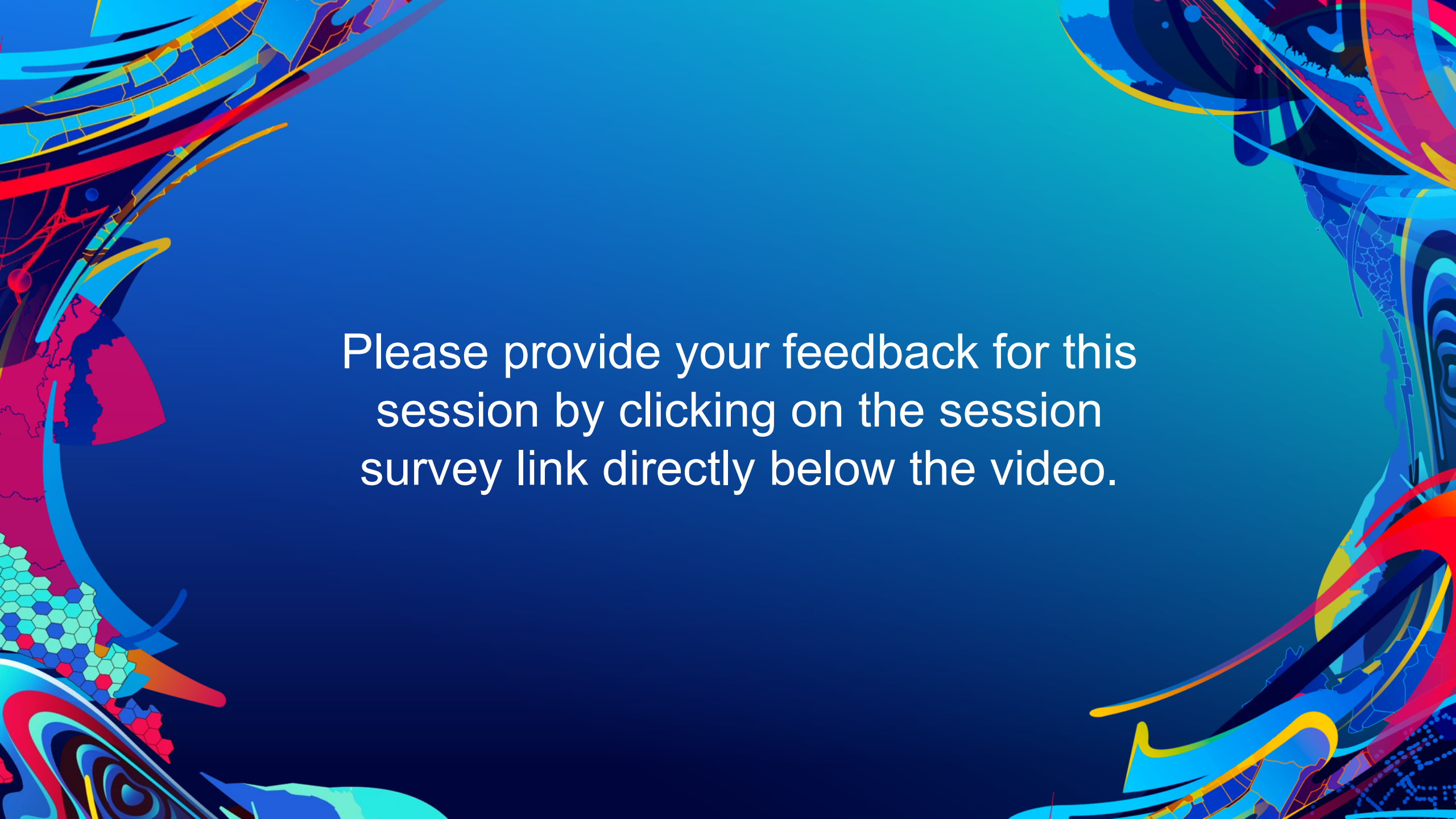
In this beta, all four capabilities of ArcGIS Imagery will be turned on within your ArcGIS Online subscription:

- **Imagery Storage** – Upload imagery into ArcGIS Online where it will be securely stored
- **Tiled Imagery** – Access imagery as tiled imagery layers where servers stream back tiles of imagery that are rendered by the client applications
- **Dynamic Imagery** – Access to imagery with on-the-fly processing and dynamic mosaicking. This enables access to all available content information of overlapping imagery through a wide range of client application.
- **Imagery Analysis** – For the creation of imagery derived products such as persisted vegetation masks or image classification.



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