



Deploying Apps and Services using ArcGIS API for Python

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DEVELOPER SUMMIT

Outline of this talk

- **Introduction**
- **Deploying apps**
 - The `arcgis.apps` module
 - Deploying ArcGIS Survey123 and ArcGIS Dashboard apps
- **Deploying services**
 - Services within the ArcGIS Ecosystem (GP service)
 - Services in your own infrastructure
 - Services in cloud infrastructure
- **Deploying scalable services on FAAS infrastructure**
 - Introduction – understanding deployment packages & API gateways
 - Deploying deep learning model inferencing tools
- **Conclusion**

Python in ArcGIS

- Python is the preferred scripting language for ArcGIS
- ArcGIS API for Python & ArcPy – 2 powerful Python libraries
- ArcGIS API for Python – unique features
 - pure Python library
 - OS agnostic
 - light weight & modular
 - free of cost



ArcGIS Python Libraries Python for Spatial Data Science

Build machine and deep learning models

Convert and manage geographic data

Perform advanced analytics

Automate workflows

ArcGIS API for Python
Simple and lightweight library for analyzing spatial data, managing your Web GIS, and performing spatial data science.

ArcPy
Comprehensive and powerful library for spatial analysis, data management, and conversion.

Available across ArcGIS. . .
... In Pro, Enterprise, and Online

ANACONDA



Deploying apps using ArcGIS API for Python

Divyansh Jha

ArcGIS API for Python

Install the API

Version 1.6.1 - May 16, 2019

[Home](#) [Guide](#) [Sample Notebooks](#) [API Reference](#) [Community](#)

A powerful Python library for spatial analysis, mapping and GIS

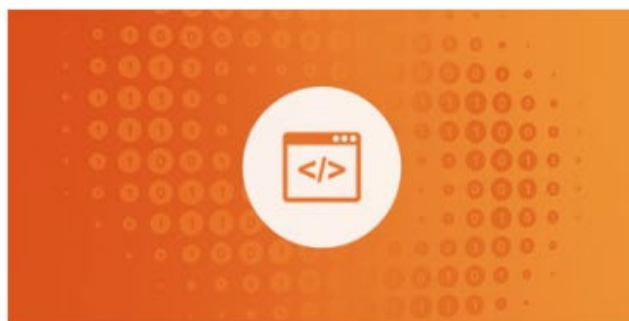
ArcGIS API for Python is a Python library for working with maps and geospatial data, powered by web GIS. It provides simple and efficient tools for sophisticated vector and raster analysis, geocoding, map making, routing and directions, as well as for organizing and managing a GIS with users, groups and information items. In addition to working with your own data, the library enables access to ready to use maps and curated geographic data from Esri and other authoritative sources. It also integrates well with the scientific Python ecosystem and includes rich support for Pandas and [Jupyter notebook](#).

[Install the API](#) | [Get started](#) | [View samples](#)



Understand your GIS

This "hello world" style notebook shows how to get started with the GIS and visualize its contents.



Manage your GIS

The ArcGIS API for Python provides APIs and samples for ArcGIS Online administrators to manage their online



Perform Spatial Analysis

Call sophisticated spatial analysis tools that work with online content, using a few lines of code.

geo
enrichment

widgets

apps

geometry

mapping

geocoding

geo
processing

gis

geo
analytics

realtime

schematics

learn

raster

network

features

env



1.8.4

Search docs

ARCGIS

arcgis.gis module
 arcgis.env module
 arcgis.features module
 arcgis.raster module
 arcgis.network module
 arcgis.geoanalytics module
 arcgis.geocoding module
 arcgis.geoenrichment module
 arcgis.geometry module
 arcgis.geoprocessing module
 arcgis.mapping module
 arcgis.realtime module
 arcgis.schematics module
 arcgis.widgets module
 arcgis.apps module
 arcgis.learn module

API Reference for the ArcGIS API for Python

Contents:

arcgis

- [arcgis.gis module](#)
 - [GIS](#)
 - [Item](#)
 - [User](#)
 - [Group](#)
 - [Datastore](#)
 - [Role](#)
 - [Layer](#)
 - [GroupApplication](#)
 - [CategorySchemaManager](#)
 - [ContentManager](#)
 - [UserManager](#)
 - [GroupManager](#)
 - [GroupMigrationManager](#)
 - [DatastoreManager](#)
 - [RoleManager](#)
 - [ResourceManager](#)
 - [APIKeyManager](#)
 - [APIKey](#)
 - [ProfileManager](#)
 - [InvitationManager](#)
 - [CertificateManager](#)
 - [PortalDataStore](#)
 - [Submodules](#)

▪ [arcgis.gis.admin module](#)

ArcGIS API for Python

- > Power users / Developers
- > Org Administrators
- > GIS analysts and data scientists
- > Content publishers

Samples

Samples presented here demonstrate various features of the ArcGIS API for Python. The samples are categorized by the user profile they are most relevant to. Most samples are in the form of a [Jupyter Notebook](#), that can be viewed online, or downloaded and run interactively. A few samples are provided as stand-alone Python scripts in the accompanying GitHub SDK repository.

Download and run the sample notebooks

Download as an archive Clone the GitHub repository

To run the sample notebooks locally, you need the [ArcGIS API for Python](#) section in the Guide to learn how to download and install the API.

Once the API is installed, you can download the sample notebooks from the [Samples](#) section.

Next, extract the archive if you downloaded as an archive. Then start Jupyter notebook application. For more information, see the [Getting started](#) section.

ArcGIS API for Python

- > Get started
- > API Overview
- > The GIS
- > Working with geometries
- > Feature data and analysis
- > Introduction to Data Engineering in Python
- > Working with the Spatially Enabled DataFrame
- > Enriching GIS data with thematic information
- > Imagery and raster analysis
- > Working with big data
- > Using geoprocessing tools
- > Finding places with geocoding
- > Performing network analyses
- > Mapping and visualization

Guide

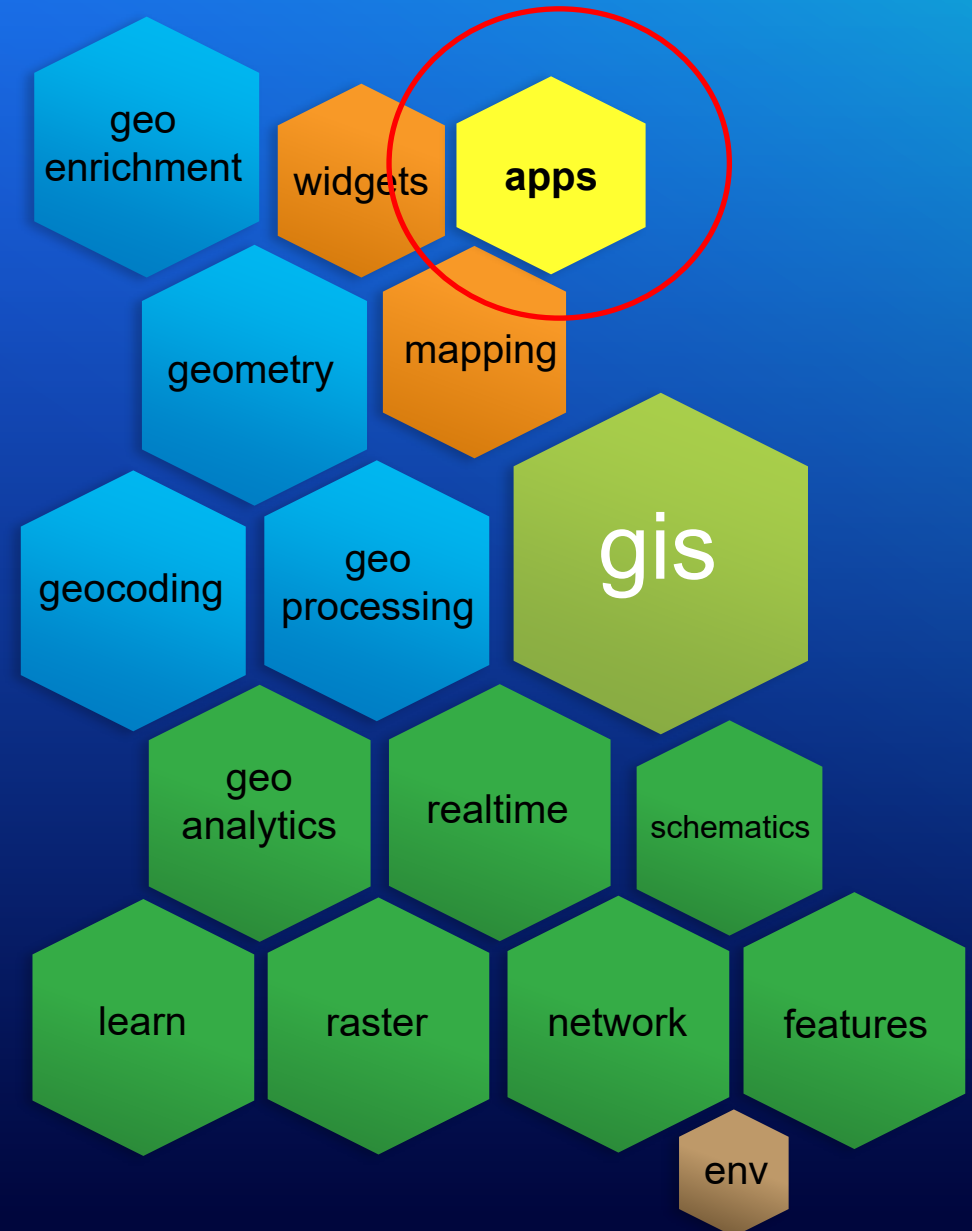
The ArcGIS API for Python is a powerful, modern and easy to use Pythonic library to perform GIS visualization and analysis, spatial data management and GIS system administration tasks that can run both in an interactive fashion, as well as using scripts.

It enables power users, system administrators and developers to leverage the rich SciPy ecosystem for automating their workflows and performing repetitive tasks using scripts. It integrates well with the Jupyter Notebook and enables academics, data scientists, GIS analysts and visualization enthusiasts to share geo-enriched literate programs and reproducible research with others.

This guide describes how to use the ArcGIS API for Python to write Python scripts, incorporating capabilities such as mapping, query, analysis, geocoding, routing, portal administration, and more. A great place to start developing once you've [installed the API](#) is to browse the [sample notebooks](#).

The `arcgis.apps` module

arcgis.apps module
<code>build_collector_url</code>
<code>build_explorer_url</code>
<code>build_field_maps_url</code>
<code>build_navigator_url</code>
<code>build_survey123_url</code>
<code>build_tracker_url</code>
<code>build_workforce_url</code>
Submodules
<code>arcgis.apps.hub module</code>
<code>arcgis.apps.dashboard module</code>
<code>arcgis.apps.workforce module</code>
<code>arcgis.apps.storymap module</code>
<code>arcgis.apps.survey123 module</code>
<code>arcgis.apps.tracker module</code>



Survey123 for ArcGIS

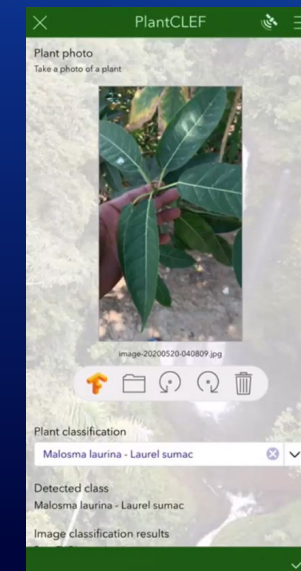
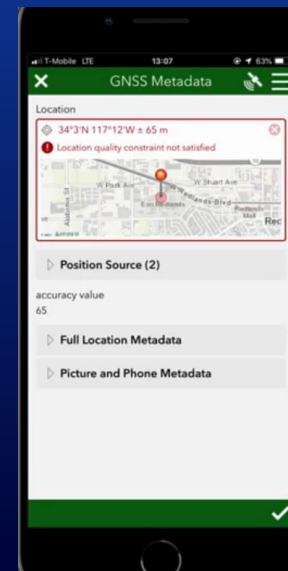
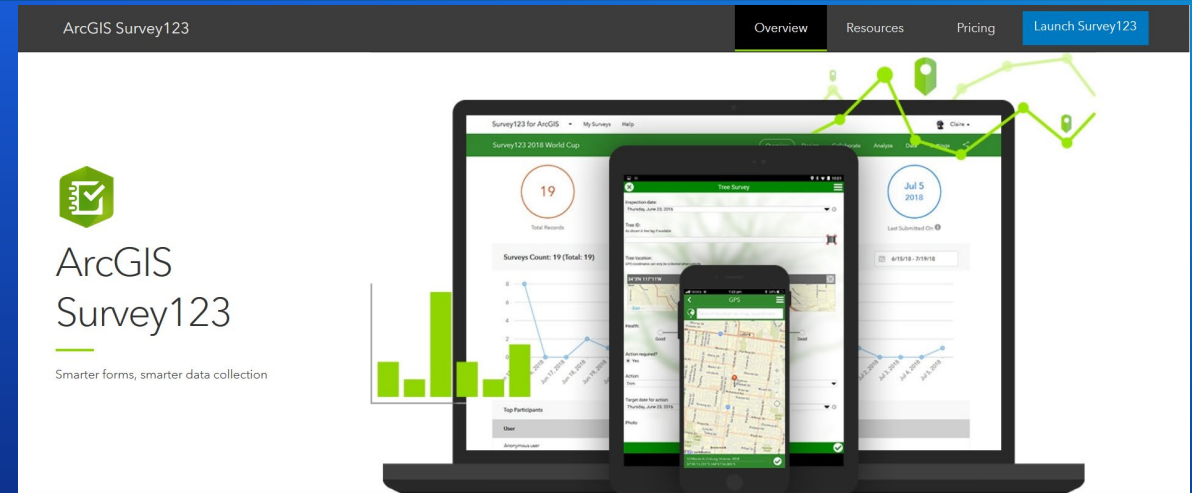
Create surveys for field data collection

Features:

- Form-centric data collection solution.
- Smarter forms – Makes collections process easier.
- Supported on both web (Online) and mobile devices (Offline).
- Integrated with ArcGIS Online and Enterprise

Applications:

- Disaster response e.g. Building damage assessment
- Inspection of utilities e.g. pipes, pumps
- Environmental activities e.g. Survey of water cleaning





Demo: Tree Inventory

Field data collection with Survey123

ArcGIS Dashboards

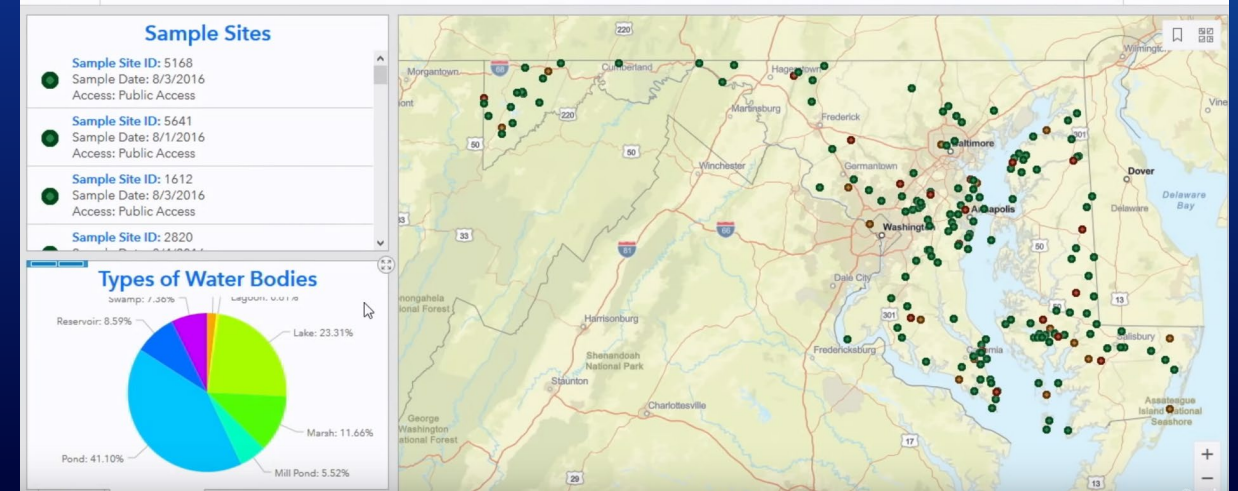
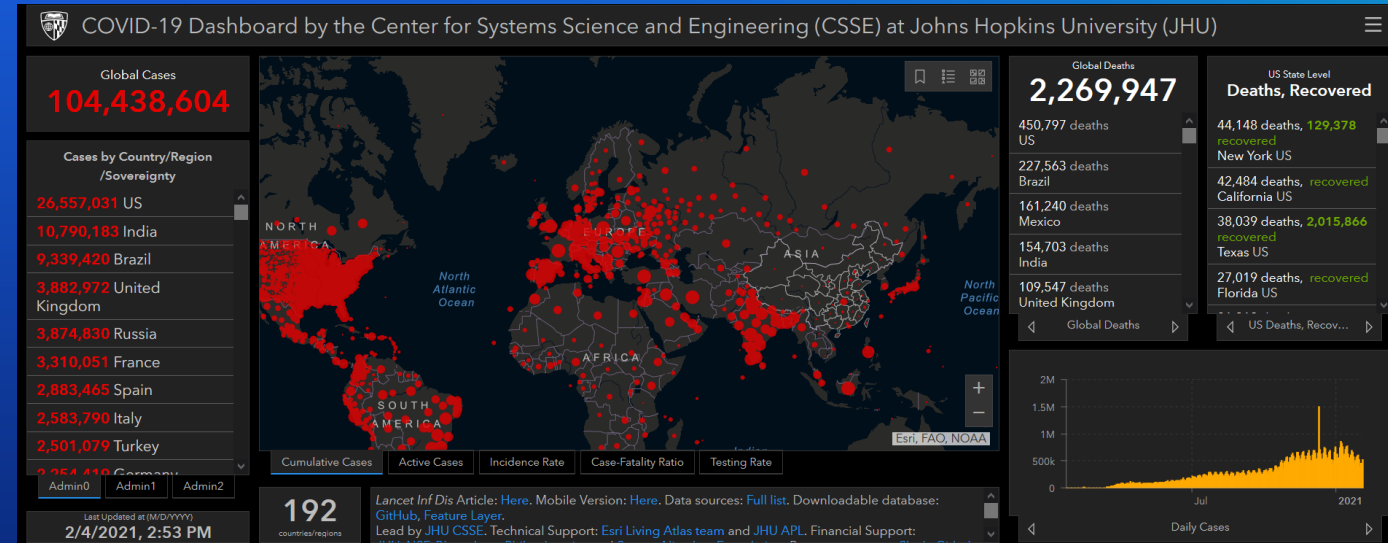
Summarize your data using dashboards.

Features:

- Provides key insights from your data on a single screen
- Provides ready to use data visualization using serial charts, pie charts, maps, embedded content etc.

Applications:

- Monitor and manage operations
- Visualize summaries/performance
- Emergency management



Building change detection

55,387.526

Last update: a few seconds ago

Before Change

After Change



Sources: Esri, MapmyIndia, DeLorme, METI/NASA | E...



Sources: Esri, MapmyIndia, DeLorme, METI/NASA | E...

Demo: Dashboard for Change Detection

ArcGIS StoryMaps

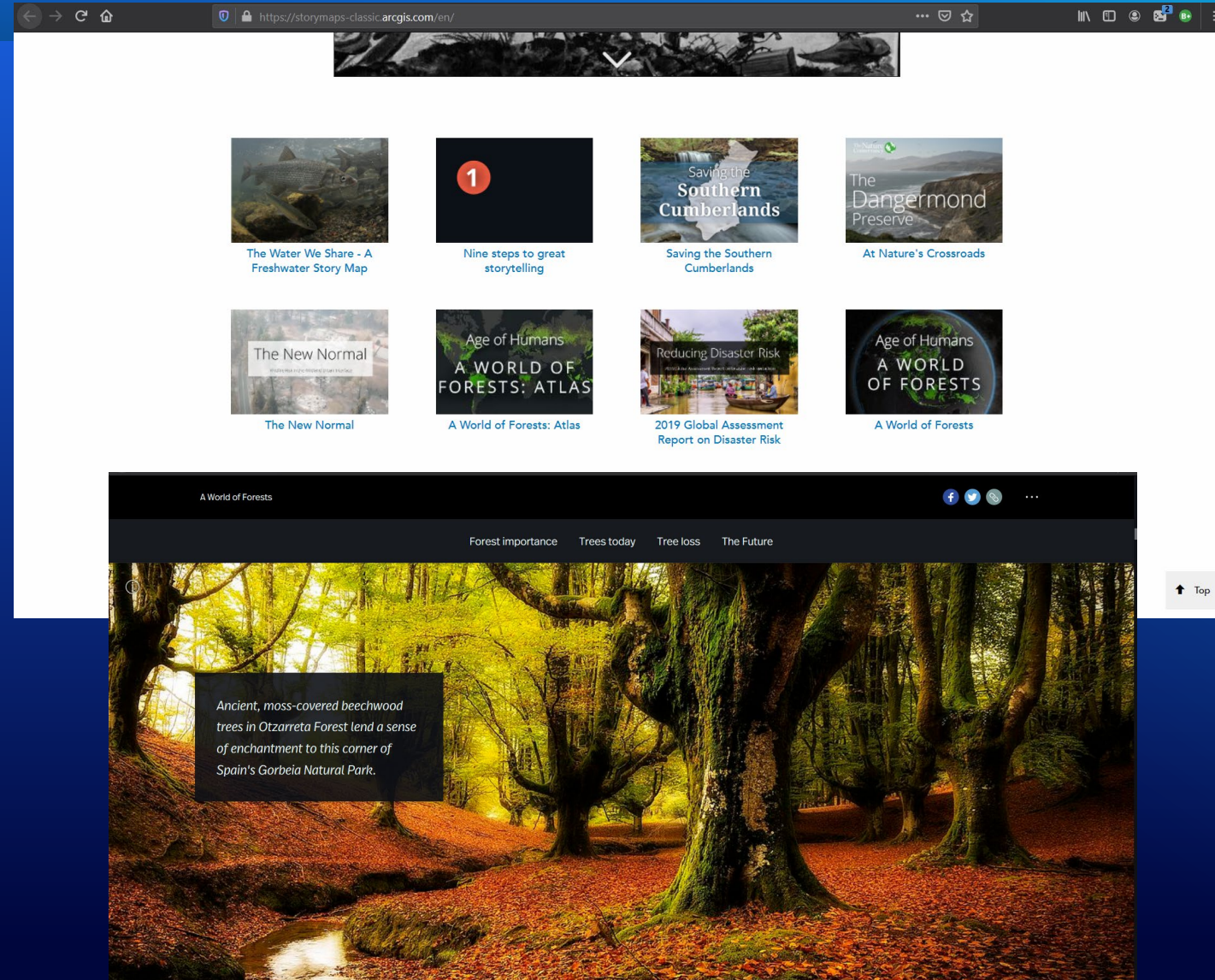
Tell a story using ArcGIS Storymaps

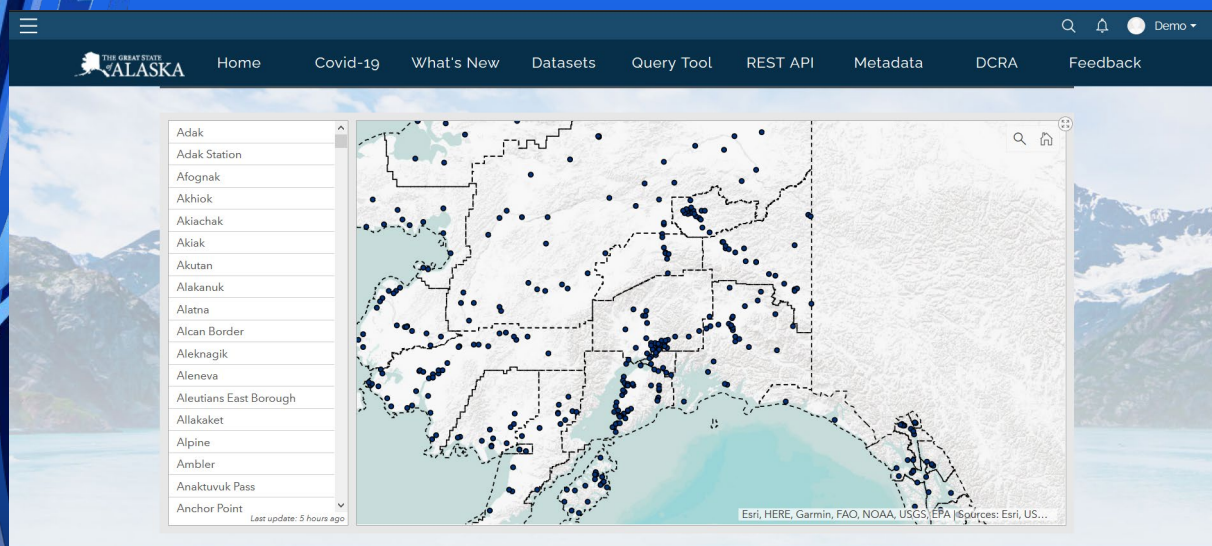
Features:

- Share your analysis in the form of a story.
- Embed dashboards, maps, pictures within the story.

Applications:

- Create convincing stories.
- Bring in multiple dashboards and maps in one place.





Demo:
Iteratively create and
update StoryMaps

Streamlit

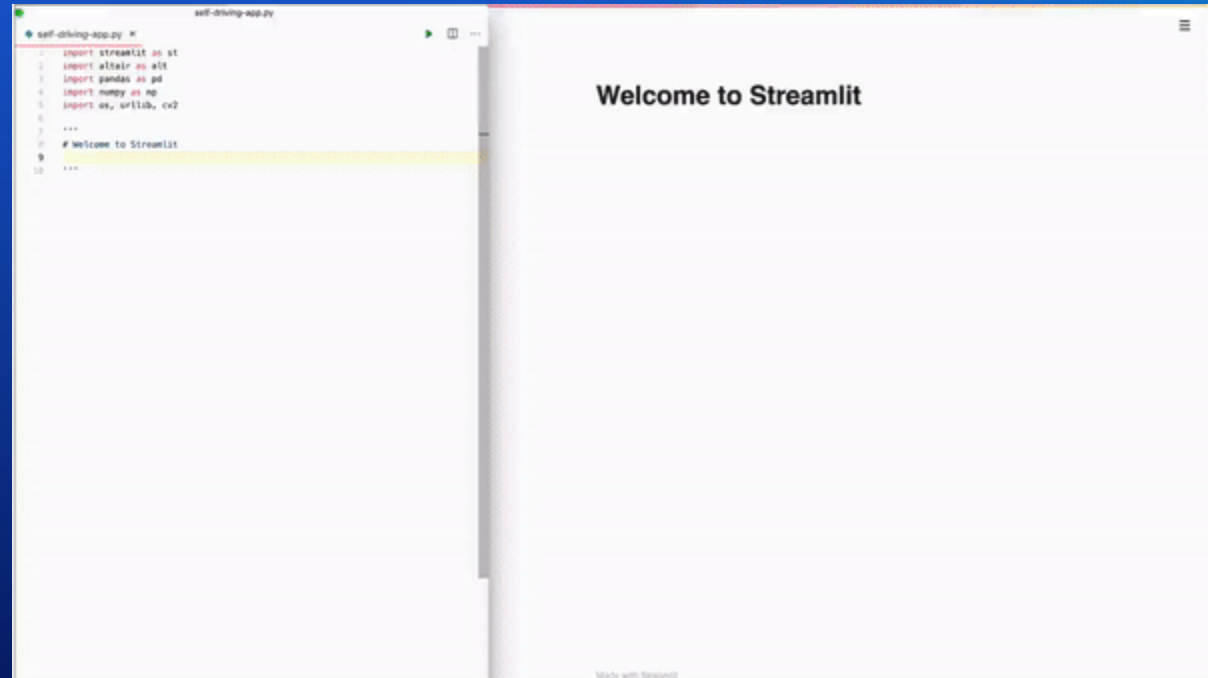
Create data driven webapps in Python. (<https://www.streamlit.io/>)

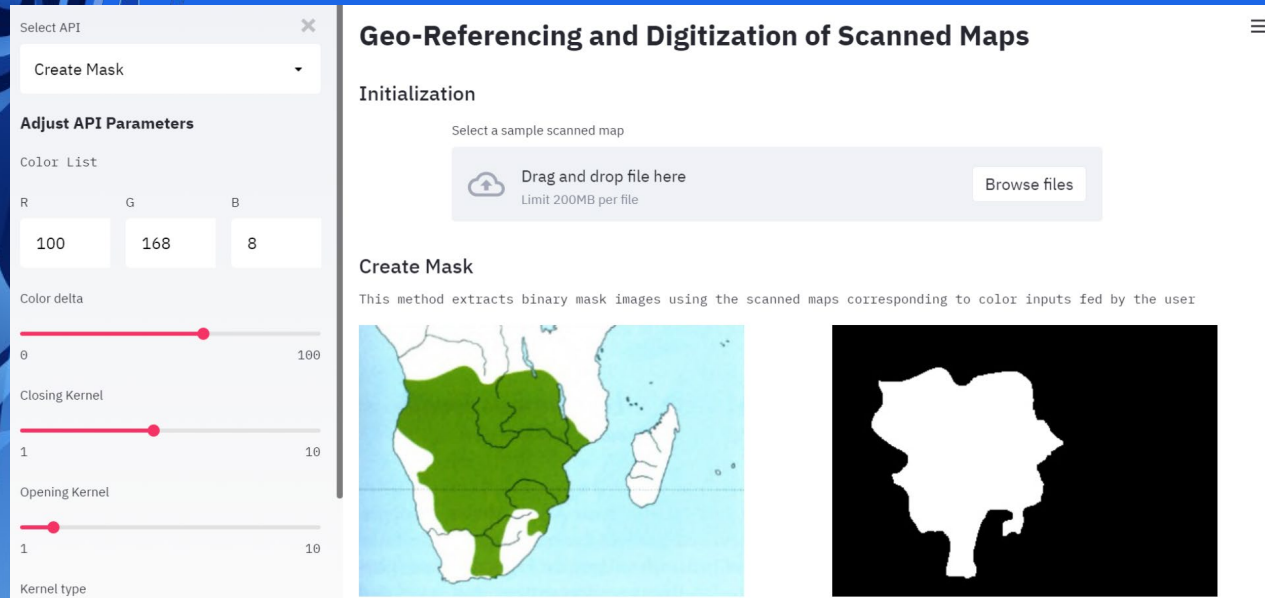
Features:

- Fast way to create webapps in few lines of Python code
- Easy to use API
- Can be deployed instantly

Applications:

- Data annotation
- Deep learning model deployment





Demo:
Integrate Streamlit with
ArcGIS API for Python



Deploying Services

with the ArcGIS API for Python

Atma Mani

Deploying services

- **What is a web service?**

- a pattern of deploying application using a client-server architecture
- communication over the web using HTTP using RESTful APIs

- **How does a web service work?**

- user interacts with the client (typically through a web app)
- client passes web requests to the server
- business logic and computation happen on the server
- user receives the output via the client

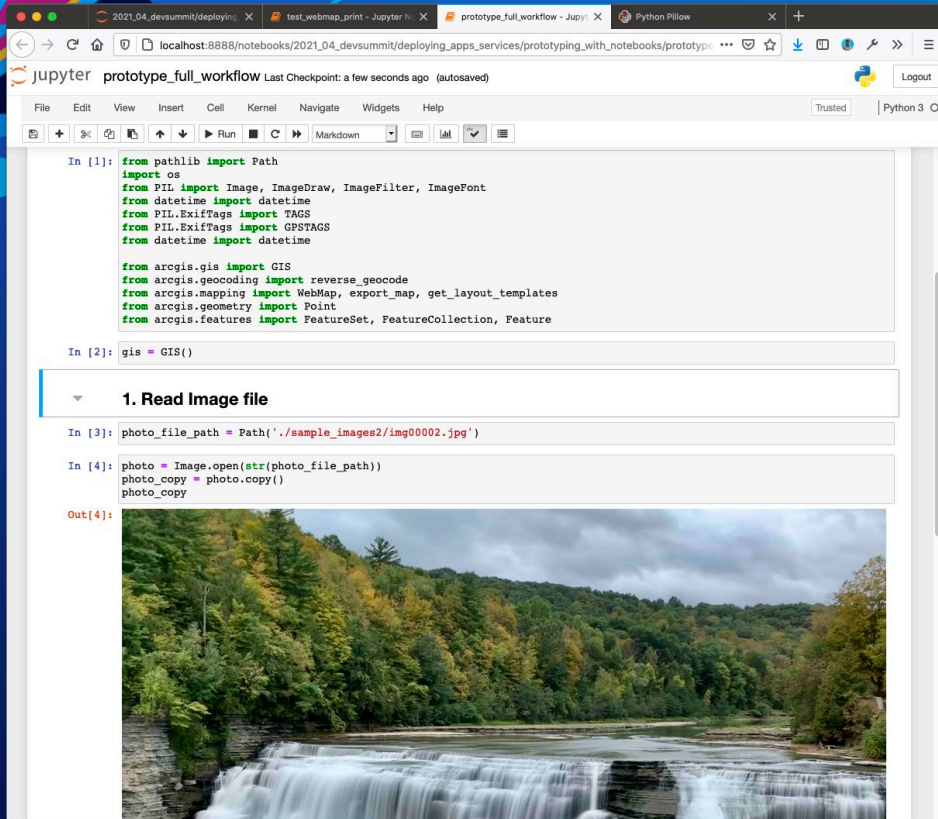
- **What are the advantages?**

- usually no software / app to install
- serve multiple users at the same time
- scale easily by scaling the server side

Where was this photo taken? – Web Service to Embed maps within photos

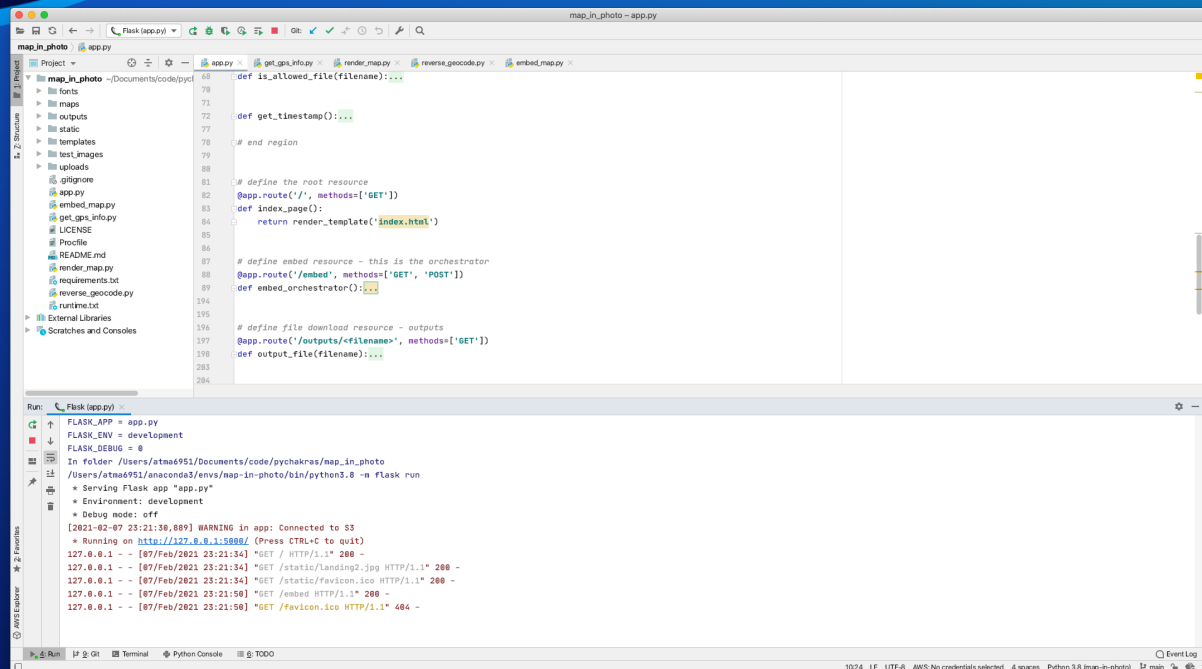
- **Example problem:** Have you ever wondered where a photo was taken?
- **Solution:**
 - Read EXIF tags (metadata) from JPG photos
 - Extract location coordinates
 - Make a map of the location
 - Reverse geocode to get the address / POI labels
 - Embed map and text back into the photo
- **Approaches**
 - Geoprocessing tool within ArcGIS Pro
 - GP service on ArcGIS Enterprise
 - Flask based service on your own infrastructure
 - Flask based service on cloud infrastructure





Deploying a GP Service

Atma Mani



The screenshot displays a VS Code editor window titled 'map_in_photo - app.py'. The editor shows a Python file with the following code:

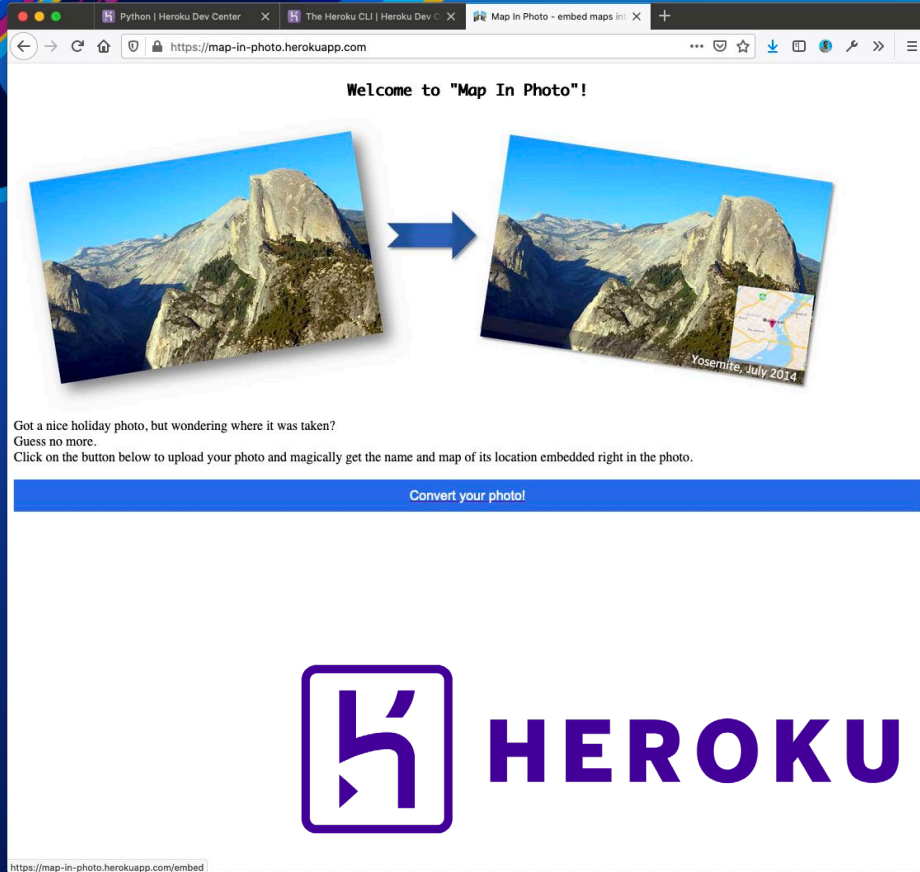
```
def is_allowed_file(filename):...
def get_timestamp():...
# end region
# define the root resource
@app.route('/', methods=['GET'])
def index_page():
    return render_template('index.html')
# define embed resource - this is the orchestrator
@app.route('/embed', methods=['GET', 'POST'])
def embed_orchestrator():...
# define file download resource - outputs
@app.route('/outputs/<filename>', methods=['GET'])
def output_file(filename):...
```

The terminal output at the bottom shows the following:

```
Run: Flask (app.py)
FLASK_APP = app.py
FLASK_ENV = development
FLASK_DEBUG = 0
In folder /Users/atma6951/Documents/code/psychobias/map_in_photo
/Users/atma6951/anaconda3/envs/map-in-photo/bin/python3.8 -m flask run
* Serving Flask app "app.py"
* Environment: development
* Debug mode: off
[2021-02-07 23:21:30,889] WARNING in app: Connected to S3
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [07/Feb/2021 23:21:34] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [07/Feb/2021 23:21:34] "GET /static/landing2.jpg HTTP/1.1" 200 -
127.0.0.1 - - [07/Feb/2021 23:21:34] "GET /static/favicon.ico HTTP/1.1" 200 -
127.0.0.1 - - [07/Feb/2021 23:21:50] "GET /embed HTTP/1.1" 200 -
127.0.0.1 - - [07/Feb/2021 23:21:50] "GET /favicon.ico HTTP/1.1" 404 -
```

Deploying stand-alone services on your own infrastructure

Atma Mani



Deploying stand-alone services on cloud infrastructure

Atma Mani

An abstract graphic on the left side of the slide, featuring a dark blue background with vibrant, flowing lines in red, yellow, and light blue. There are also some geometric shapes and patterns, including a hexagonal grid and a circular motif, integrated into the design.

Deploying scalable services on FAAS infrastructure

with the ArcGIS API for Python

Akhil Negi



Deploying
geocoding function
as a services on
cloud
infrastructure.

Akhil Negi

2120, POCURO, ESTACIONAMIENTO 309, PROVIDENCIA, METROPOLITANA DE SANTIAGO	CL	1.000000
2681, MOSCONI GENERAL AV.	AR	1.000000
237, 백제고분로19길	KR	1.000000
2461, BONNY DR, COCOA, BREVARD, FL, 32926	US	1.000000
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12, Kościelna, Gołubie, kartuski, pomorskie, 83-316	PL	1.000000
12, Werfelstraße, 1170	AT	1.000000
7, SCOTT STREET, MOUNT HOPE, NSW, 2877	AU	1.000000
5422, GROUSSAC, PAUL	AR	0.999999
17, Morelvej, 8920	DK	1.000000
2 1 2 號, 三興路東勢段, 平鎮市, 東勢里	TW	1.000000
48, Częstochowska, Czarny Las, częstochowski, śląskie, 42-233	PL	1.000000
92H, Moste, Moste, Komenda, Osrednjeslovenska, 1218	SI	1.000000
5551, ECHEANDIA	AR	0.999999
16, Rue de la Republique, Amilly, 28300	FR	1.000000
6 號, 東森路 5 5 巷, 楊梅市, 永寧里	TW	1.000000
4A, Serupvej, 8600	DK	1.000000
62, 18 DE JULIO (VILLA GUADALUPE), 15562	UY	1.000000
1 3, HERNER PLACE, NORTH GEE LONG, VIC, 3215	AU	1.000000

Deploying Address classification service on AWS Lambda

Akhil Negi

Recap

- We saw various ways to deploy Python scripts as services:
 - Services within ArcGIS Ecosystem – GP Service
 - Services on your own infrastructure – Flask based service
 - Services on cloud infrastructure – Heroku and AWS Lambda as an example.
- Saw ways to integrate various ArcGIS apps with ArcGIS API for python.
- Went through an example of integrating 3rd party application(Streamlit) with ArcGIS API for Python.

Learning resources

- Doc website: <https://developers.arcgis.com/python>
- SDK Repo: <https://github.com/esri/arcgis-python-api>
- Flask help: <https://flask.palletsprojects.com/>
- Python imaging library: <https://pillow.readthedocs.io/>
- Python API playlist: https://www.youtube.com/playlist?list=PLGZUzt4E4O2JaOMx_XZc85VdMlrqLGaVf
- Change detection sample notebook: <https://developers.arcgis.com/python/sample-notebooks/change-detection-of-buildings-from-satellite-imagery/>
- Address classification sample notebook: <https://developers.arcgis.com/python/sample-notebooks/identifying-country-names-from-incomplete-house-addresses/>
- Container image support for lambda: <https://docs.aws.amazon.com/lambda/latest/dg/images-create.html>



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