Google

geo strategie dag

Unlocking Planetary-Scale Insights

New Era of Geospatial Analytics and AI

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Cloud Geographer / Staff Customer Engineer

goo.gle/geofort25-geocloud

Abstract

The world of geospatial data is undergoing a profound transformation, driven by the convergence of scalable cloud computing, advanced analytics, and the power of artificial intelligence. This talk will explore Google's latest developments designed to empower spatial data scientists and analysts. We will discover how the deeper integration of Google Earth Engine with BigQuery, including the ability to seamlessly read BigQuery data within Earth Engine, is revolutionizing large-scale raster and vector data analysis. This enables unprecedented insights directly within a familiar and powerful analytical environment.

We'll showcase the new Geospatial Analytics announcements for Google Maps Platform, enrich location-based applications by deriving insights from Places, Roads, and Imagery data.

Furthermore, this talk will introduce Google Research's early work in AI for Geospatial Reasoning, demonstrating how new geospatial foundation models can be combined with generative AI capabilities to simplify complex geospatial problem-solving. This powerful synergy allows users to interact with and derive insights from diverse geospatial data sources through natural language queries and intelligent, agentic workflows.

Explore how these innovations are democratizing access to planetary-scale data and sophisticated analytical tools, fostering new opportunities for tackling critical challenges in areas such as environmental monitoring, urban planning, disaster response, and sustainable development.

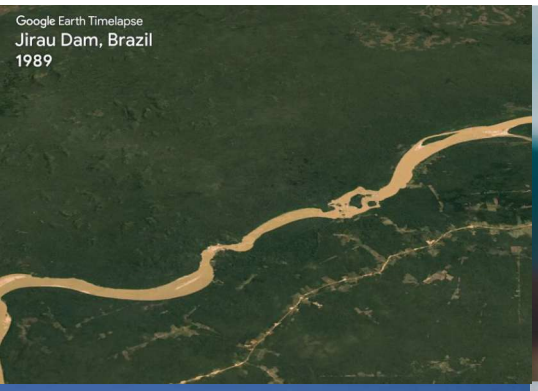
Trends

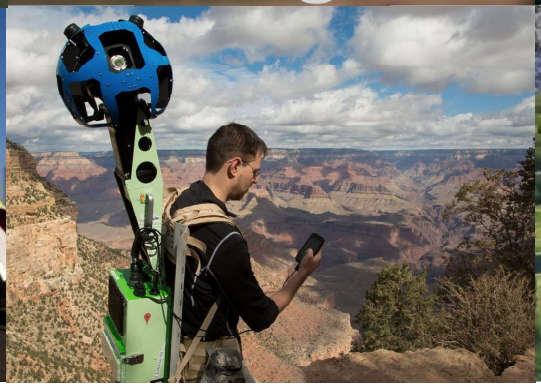
Planetary-scale analysis

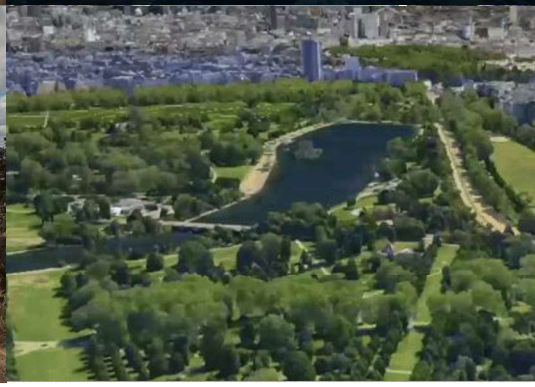
Cloud-native architectures

Real-time datasets

AI for geospatial reasoning







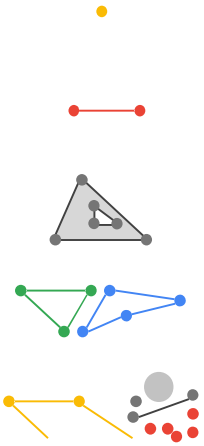
Google Cloud

What is Geospatial?

Vector (Tabular)

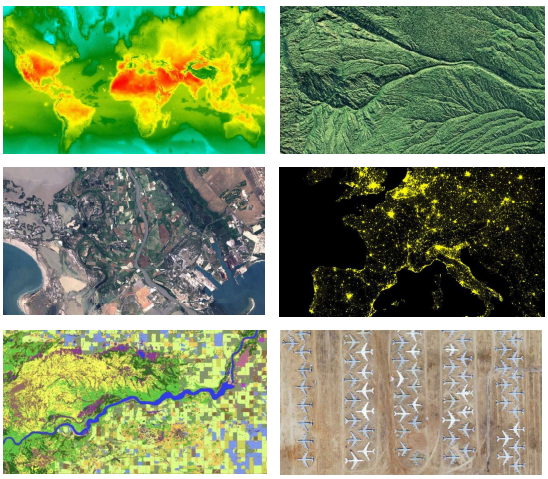
Geography:

- Point
- Linestring
- Polygon
- Multi-polygon
- Collections



Geospatial data includes Vector data such as assets or supplier locations, boundaries and self-attestation survey results.

Raster (Imagery)



Raster data includes historical and near real time information on the assets' actual boundaries and impact by aggregating layers of satellite imagery.

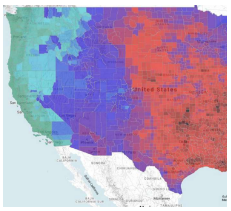
Visualization and Analysis Tools

SQL Analysts

BigQuery GeoViz

Dekart

CARTO



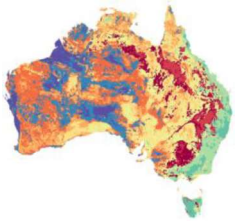
Geospatial Analysts

Google Earth Engine

esri

QGIS

CARTO

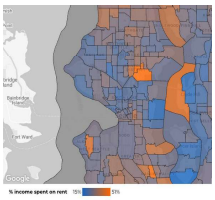


BI Users

Google Data Studio

Looker

tableau

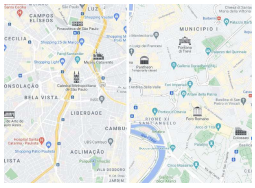


Developers

Google Maps Platform

Google Earth Engine

CARTO

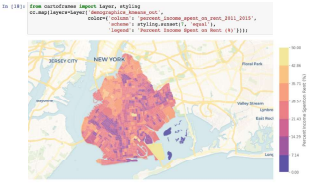


Data scientists

Google Earth Engine

Vertex AI

CARTO

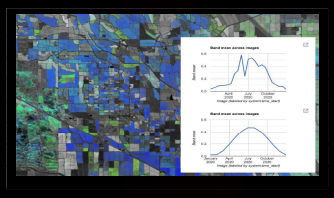


Google Cloud

Geospatial Analytics on Google Cloud

Google Cloud

Analysts | Data Scientists | Decision Makers | Software Engineers | Geospatial Specialists | Data Management



Geospatial Analytics Solutions at any scale

UI | API | IDE | SDK | SQL | OSS | Javascript | Python | SQL

Partner and Industry AI, Analytics, and BI Solutions

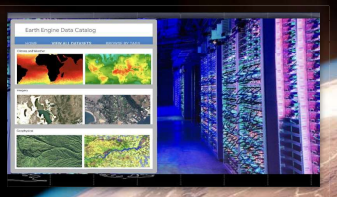
FME by Safe Software

ArcGIS Pro

CARTO

QGIS

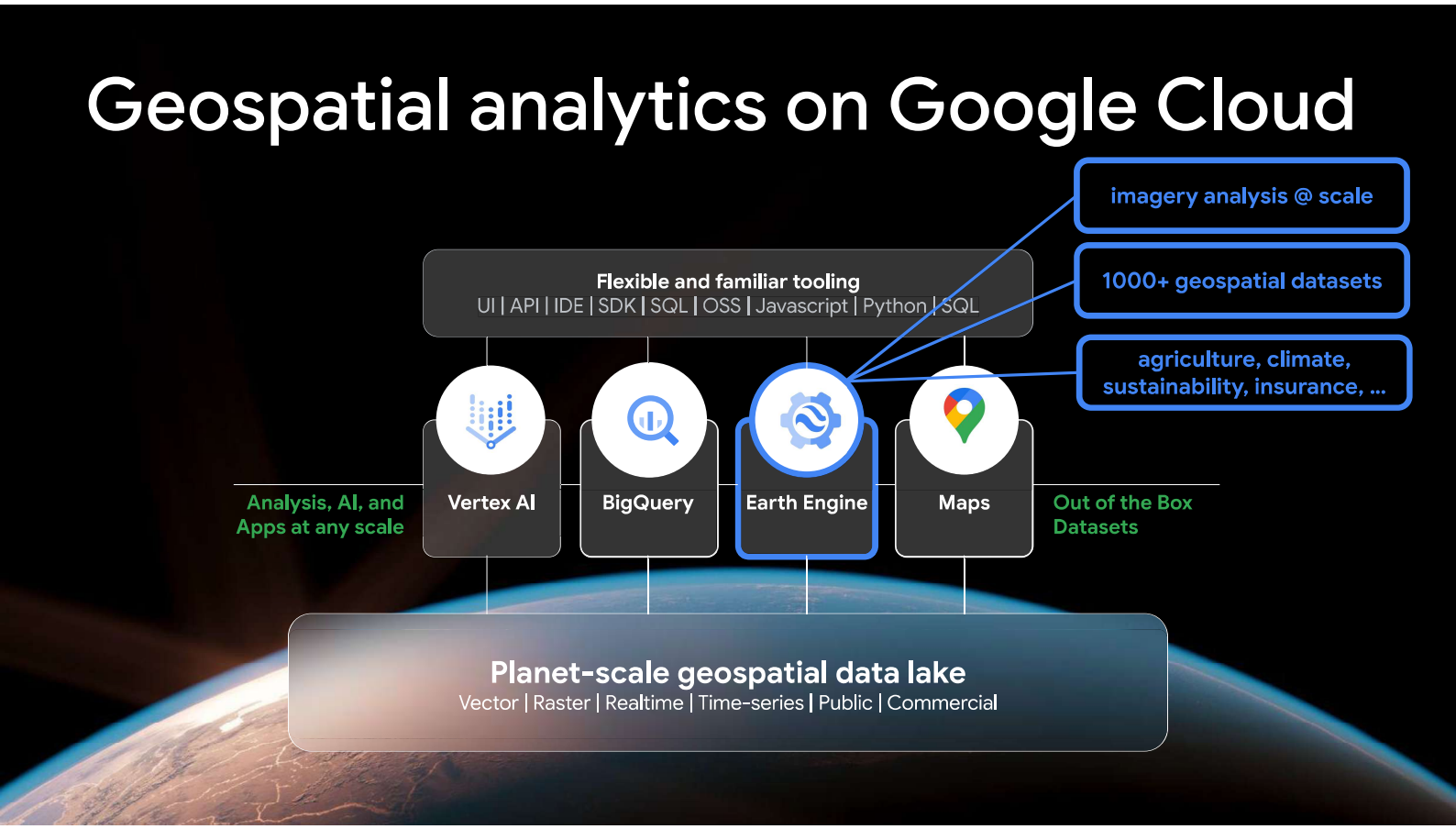
Vertex AI | **BigQuery** | **Earth Engine** | **Maps**



Planet-scale geospatial data lake

Vector | Raster | Realtime | Time-series | Public | Commercial

Geospatial analytics on Google Cloud



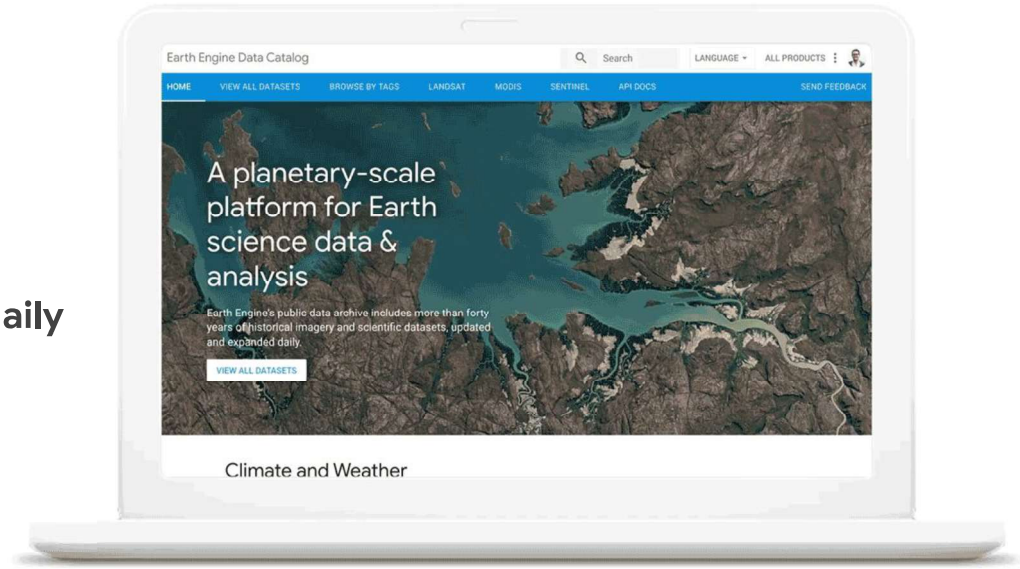
Earth Engine

Data Catalog

90+ Petabytes
Growing daily

1,000+
Curated datasets

Updated and expanded daily



https://developers.google.com/earth-engine/datasets

Google Cloud

Earth Engine

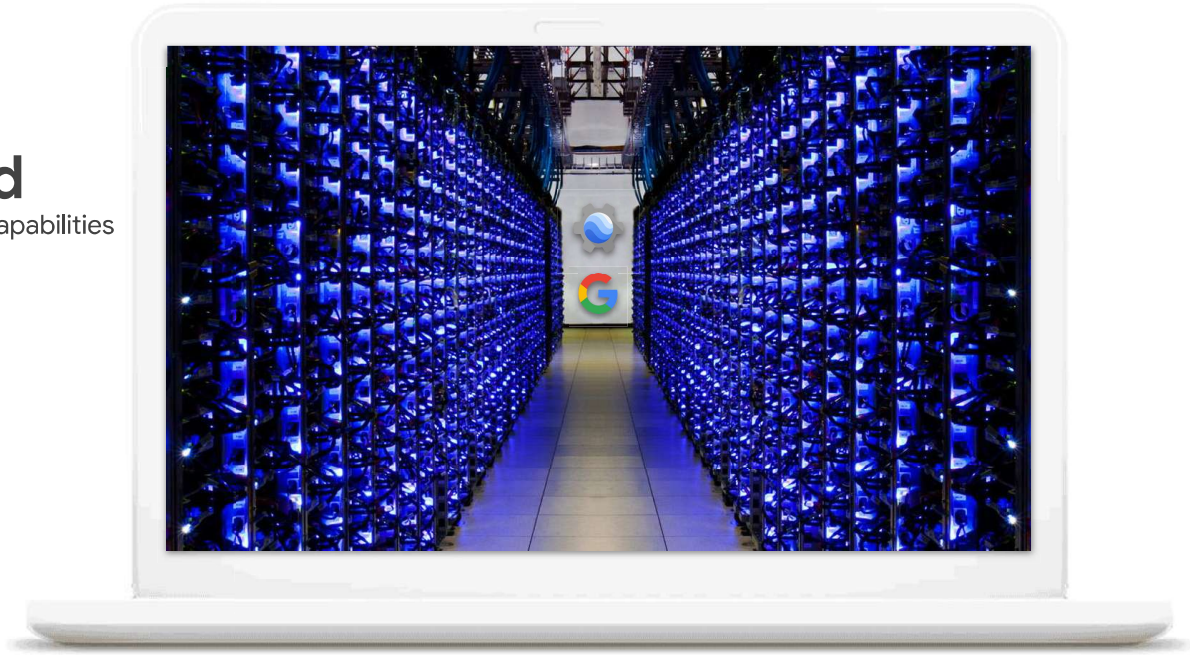
Compute Platform

Compute on-demand

Planetary-scale analysis capabilities

API

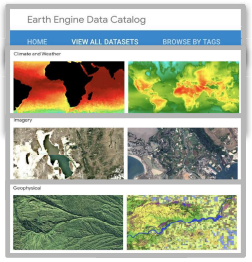
Python and JavaScript



Google Cloud

Earth Engine

Analyze petabyte-size geospatial imagery datasets in a web browser!



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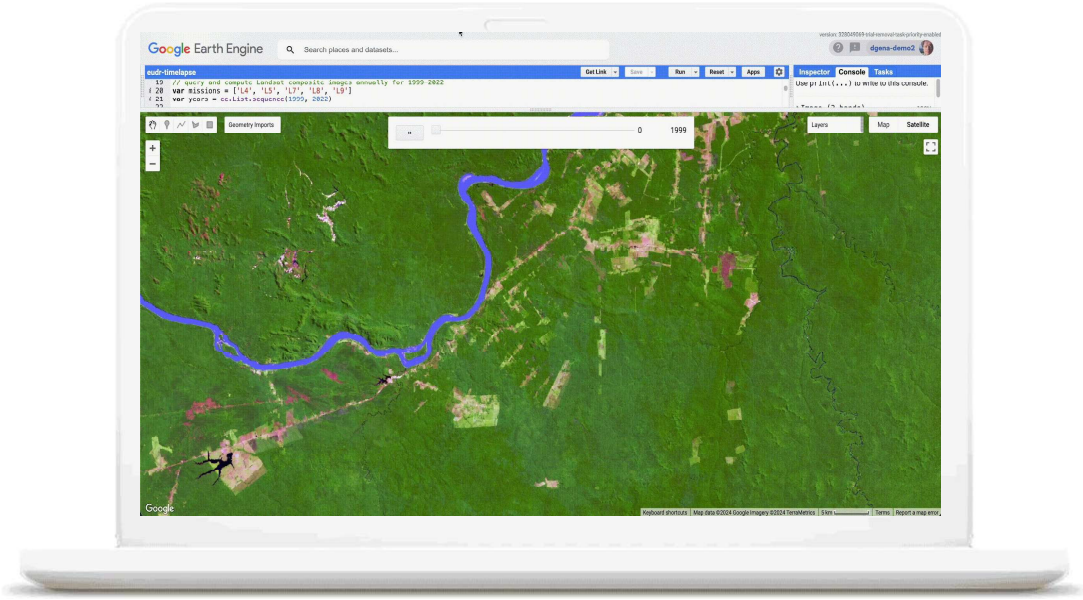
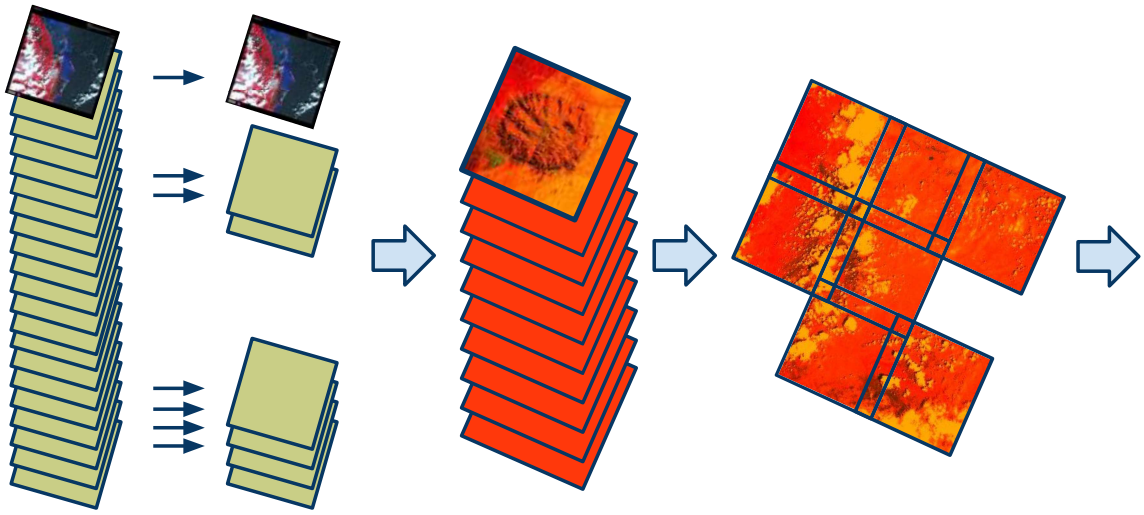


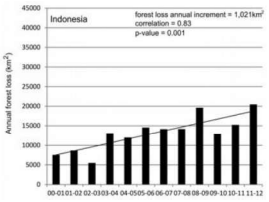
Google Cloud

Build complex image processing pipelines and run them at scale

Slicing & dicing, mapping & reducing, mathematical models, machine learning, statistics, and more!



Gabon	1891	391	11898
Lithuania	1845	1226	40296
Cuba	1725	2271	68008
Mali	1694	0	1247103
Costa Rica	1653	382	11327
Czech Republic	1646	1331	46934
South Sudan	1635	38	460581
North Korea	1605	137	67695
Italy	1603	898	201331



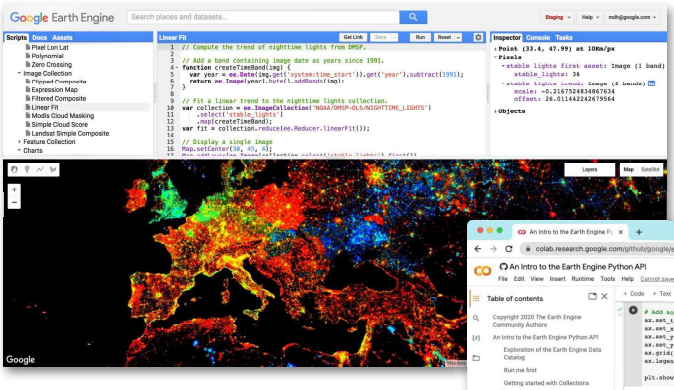
Google Cloud

Interactive Analysis and Visualization

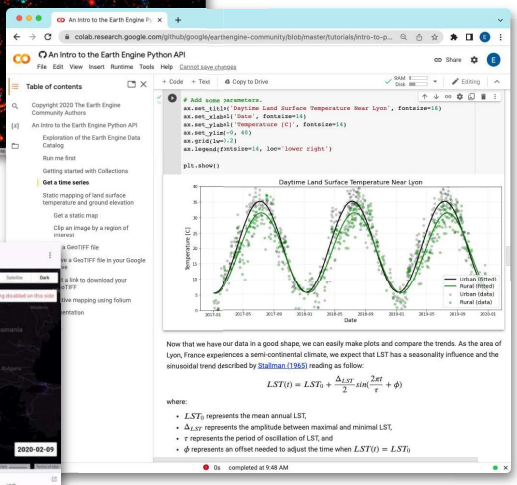
Slice & dice data, train and apply models, and visualize results.

- Client libraries in **JavaScript** & **Python**
- **Code Editor**: Easy interactive experimentation with one-click collaboration
- **Earth Engine Apps**: Wire up and share custom interactive dashboards
- **One Platform API** for direct integration via HTTP

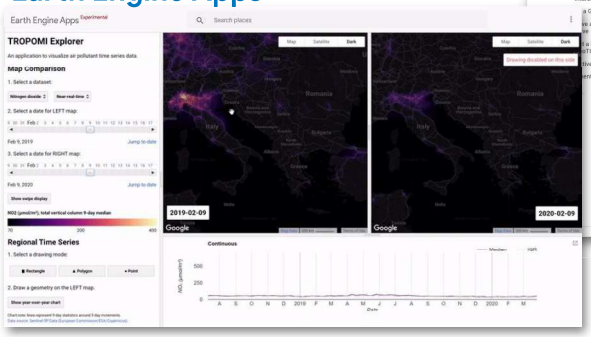
Code Editor (JavaScript)



Colab (Python)



Earth Engine Apps



Google Cloud

Dynamic World

A Global Land Cover map that is

- High-resolution (10m per pixel) - using ESA Sentinel-2
- Regularly-updating, including land cover change over time
- Free, open-source, and easily accessible to all
- Leverages state-of-the-art cloud computing & AI

Help states/provinces/countries have access to better data to protect, manage & restore ecosystems.

https://dynamicworld.app/

https://developers.google.com/earth-engine/datasets/catalog/GOOGLE_DYNAMICWORLD_V1

WORLD RESOURCES INSTITUTE

NATIONAL GEOGRAPHIC

Google

Taxonomy

LEGEND
- water
- trees
- grass
- flooded_vegetation
- crops
- scrub_shrub
- builtup
- bare_ground
- snow_ice


Water


Flooded Vegetation


Built-up Areas


Trees


Crops


Bare Ground

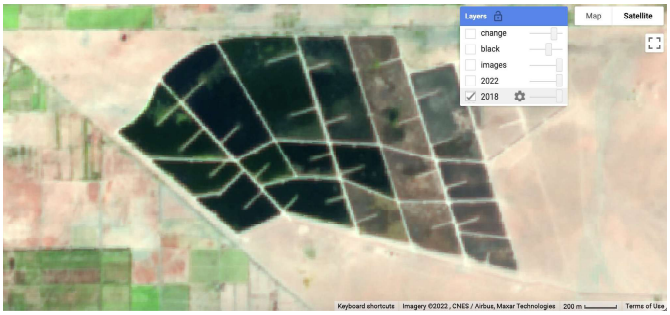

Grass

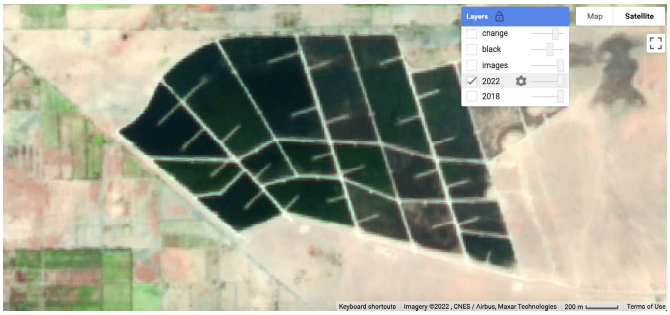

Shrub/Scrub

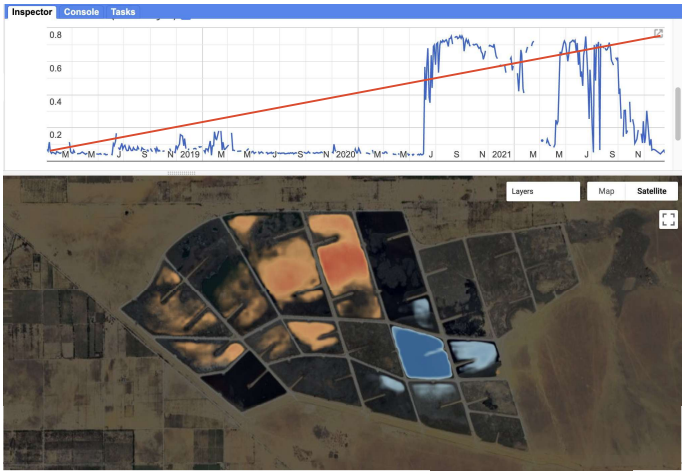

Snow/Ice

WORLD RESOURCES INSTITUTE

Change Detection with Dynamic World







[Code, water]

[Code, trees]

[Code, urban]

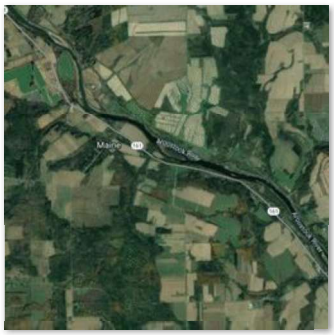
AlphaEarth Foundations

https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/

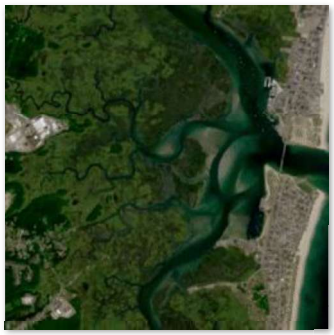
Google

Geospatial Foundation Model at 10m resolution

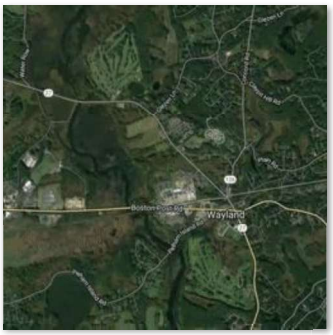
Multimodal input based on Sentinel-2, Sentinel-1, Landsat



Agriculture

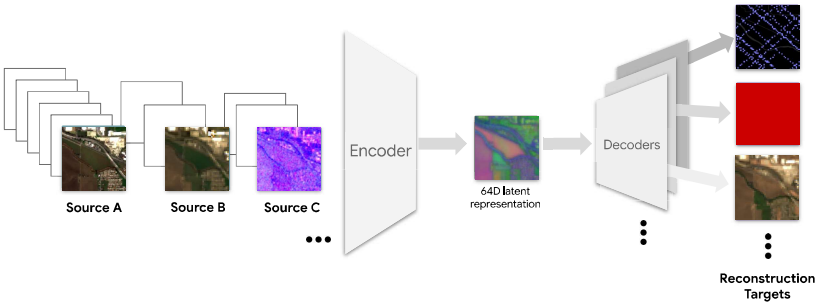


Wetlands

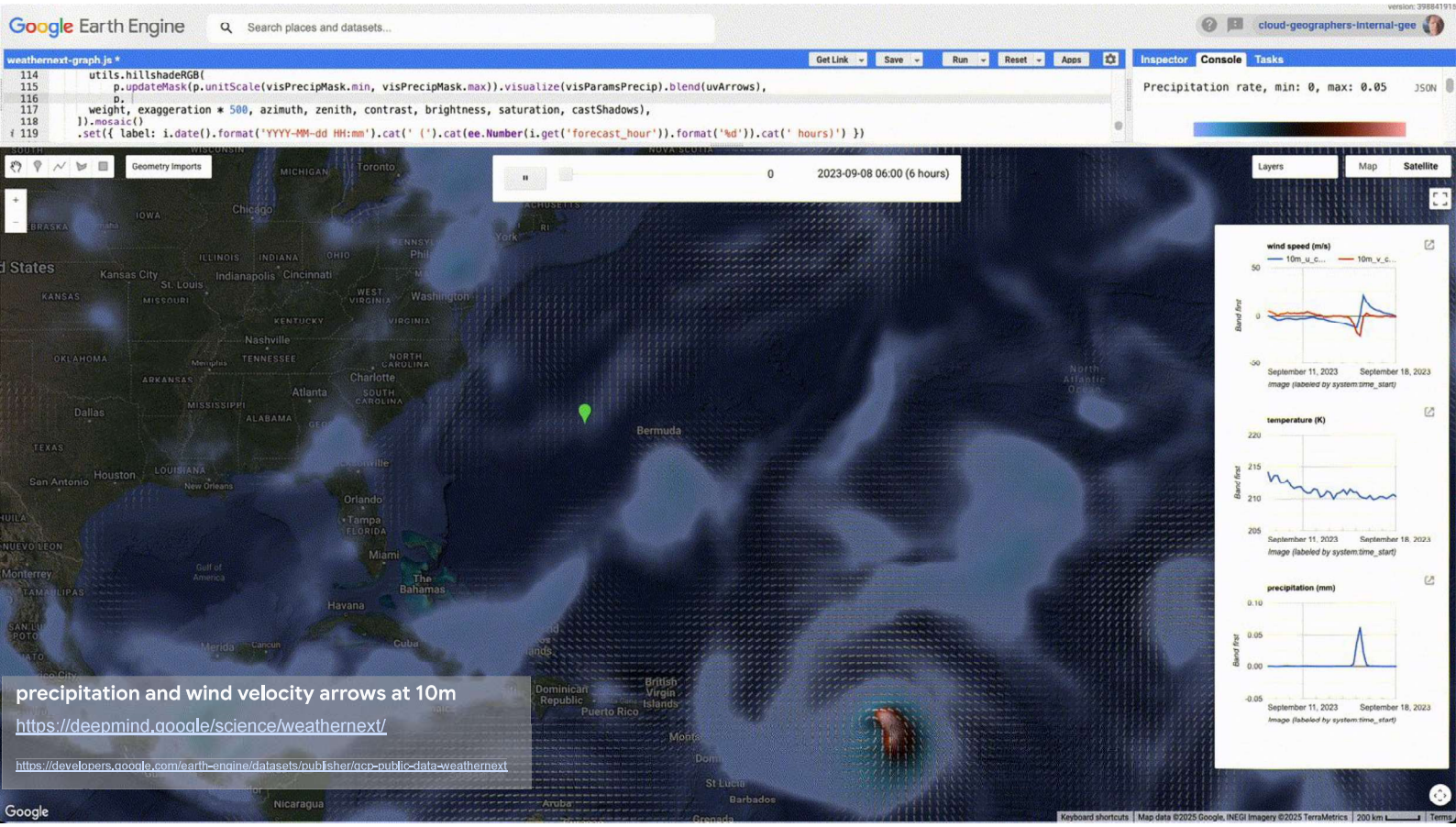


Golf Courses

Built



Google



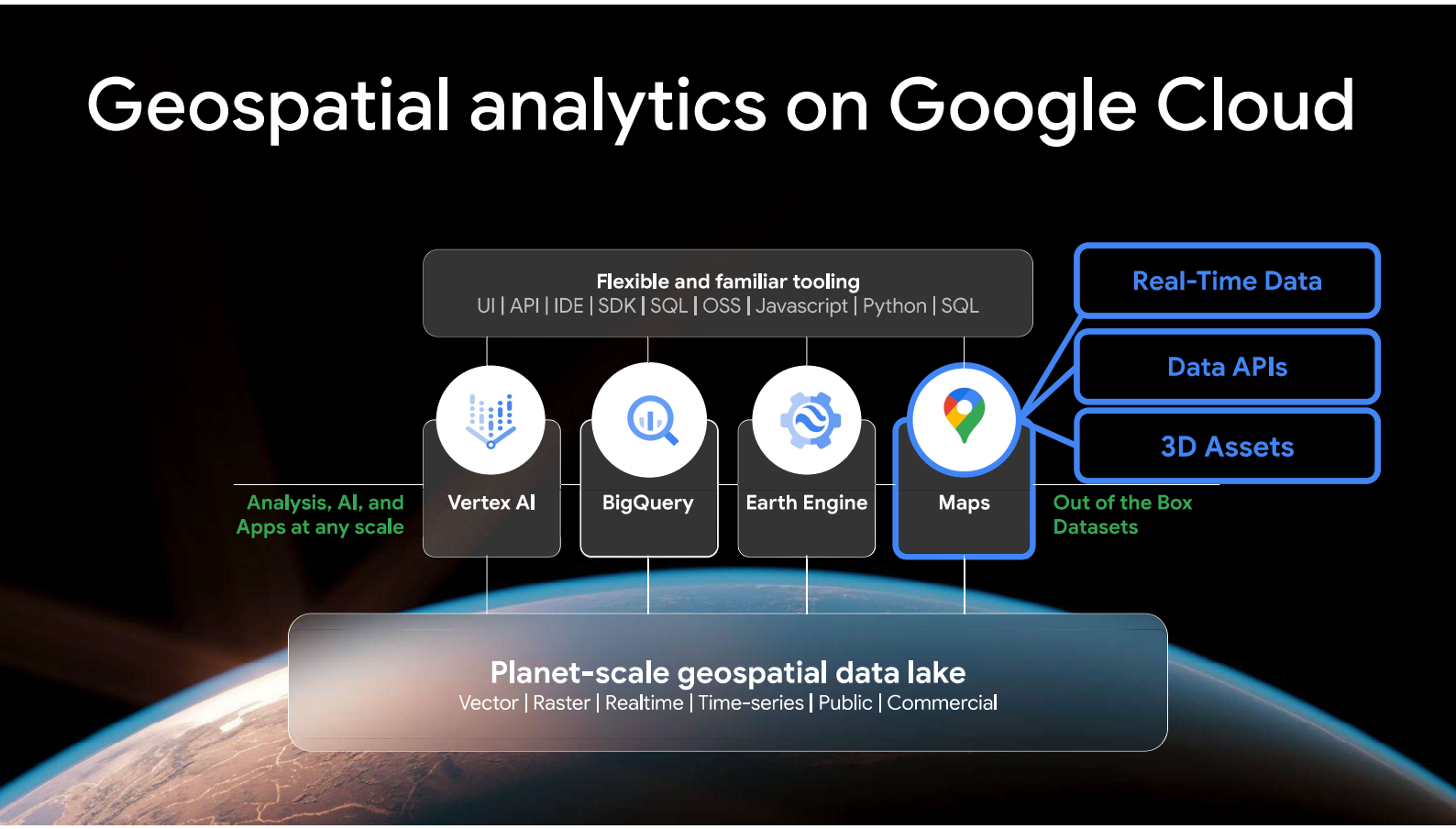

```
    utils.hillshadeRGB(
        p.updateMask(p.unitScale(visPrecipMask.min, visPrecipMask.max)).visualize(visParamsPrecip).blend(uvArrows),
        p.
    weight, exaggeration * 500, azimuth, zenith, contrast, brightness, saturation, castShadows),
}).mosaic()
.set({ label: i.date().format('YYYY-MM-dd HH:mm').cat(' (').cat(ee.Number(i.get('forecast_hour')).format('%d')).cat(' hours)') })
```

precipitation and wind velocity arrows at 10m

https://deepmind.google/science/weathernext/

https://developers.google.com/earth-engine/datasets/publisher/gcp-public-data-weathernext

Geospatial analytics on Google Cloud



What does it take to build world class maps?

Global Scale

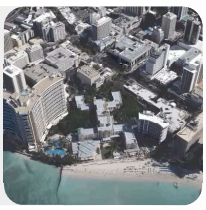
Enable businesses to scale from **prototype** to **production** to **planet-scale**, without having to think about capacity, reliability or performance

Precision and Diversity

The richness of our data comes from diverse data sources including **overhead and Street View imagery, partnerships and user contributions**

Continual Freshness

Relentless commitment to keep our data fresh means you can trust us to have an **up-to-date model of the real world**



Global Infrastructure

Scale from **prototype** to **production** to **planet-scale**, without having to think about capacity, reliability or performance

Global security

Multilayered secure infrastructure, expert engineers, and commitment to transparency.

What does it take to build world class maps?

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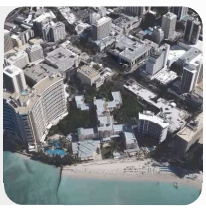

- Overhead Imagery 
- Street View Imagery 
- Anonymized Traffic Data 
- Crowdsourced Edits 
- Authorities 

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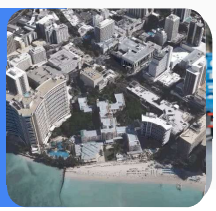
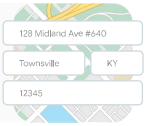


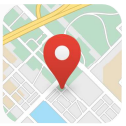
Address updates

Improvements help us keep data fresh and reduce failed queries.



Places of Interest updates

Business information, ratings, reviews and more about over 250 million businesses and places globally.



Hyperlocal Data updates

Coverage and latency improvements drive performance.

Road updates

From the changing layouts of roads themselves to their condition (weather, traffic, and more).

Google Maps APIs

https://mapsplatform.google.com/

Google Maps APIs help improve mobility experiences (e.g., to get from A to Z most efficiently), fleet experience and customer experience.

Maps

3D Maps
API↗

Aerial View ●
API↗

Dynamic Maps ●
JS↗ Android↗ iOS↗

Dynamic Street View ●
JS↗ Android↗ iOS↗

Elevation ●
API↗

Map Tiles* ●●
API↗

Maps Embed ●
API↗

Static Maps ●
API↗

Static Street View ●
API↗

Routes

Compute Routes ●●●
API↗

Compute Routes Matrix ●●●
API↗

Navigation SDK ●
Android↗ iOS↗

Roads ●
API↗

Route Optimization ●●
API↗

Places

Address Validation ●●
API↗

Autocomplete ●●
API↗ JS↗ Android↗ iOS↗

Geocoding ●
JS↗ API↗

Geolocation ●
API↗

Nearby Search ●●
JS↗ API↗

Places Aggregate ●
API↗

Place Details ●●●
JS↗ Android↗ iOS↗ API↗

Place Photos ●
Android↗ iOS↗ API↗

Text Search ●●●
JS↗ API↗

Time Zone ●
API↗

Environment

Air Quality ●
API↗

Pollen ●
API↗

Solar ●●
API↗

Weather ●
API↗

Analytics

DATASETS

Imagery Insights

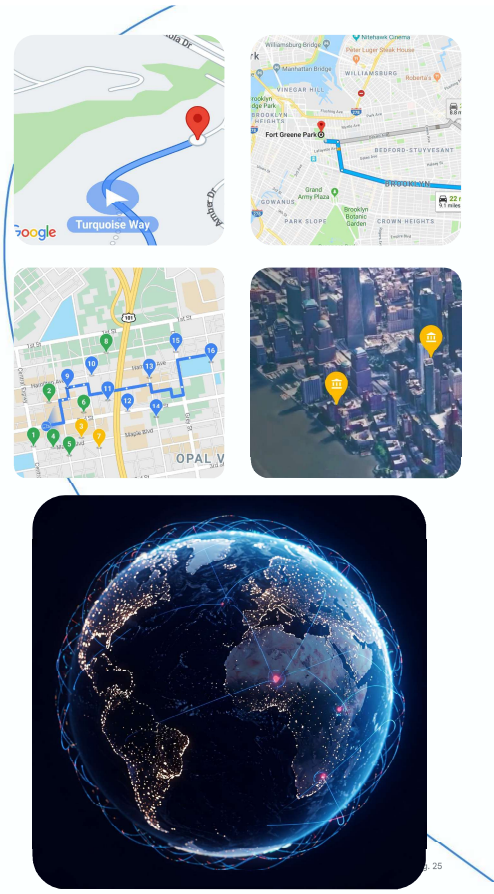
Places Insights

Roads Management Insights

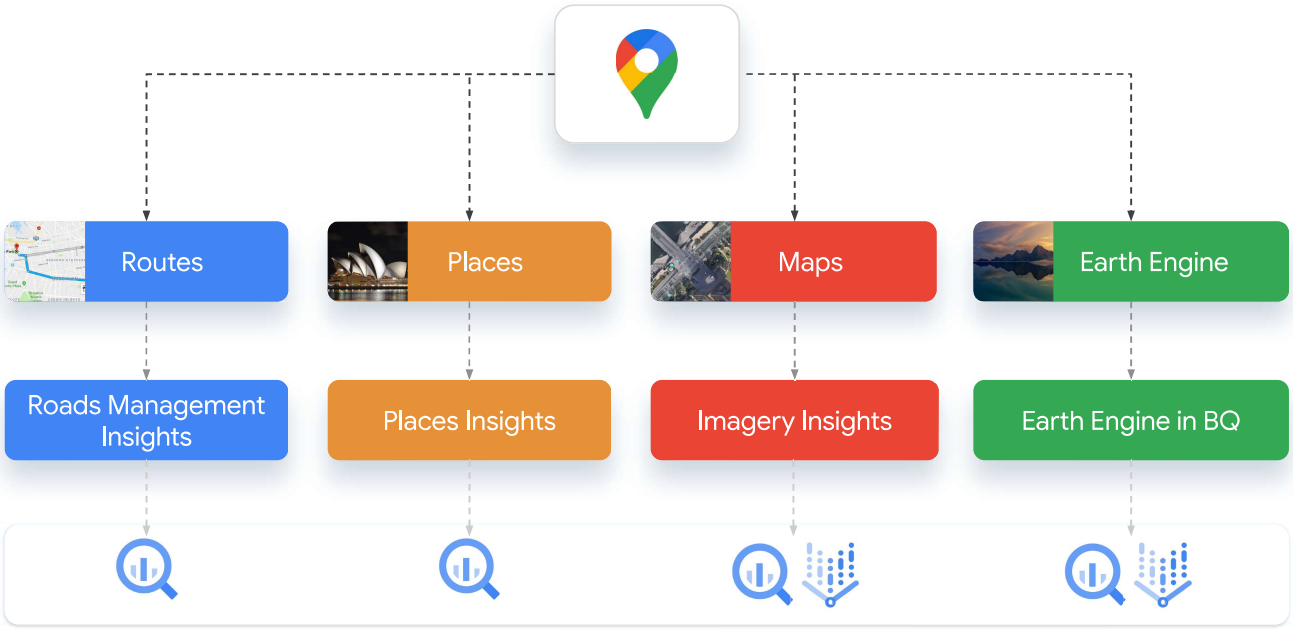
TOOLS

Earth Engine (Google Cloud)
API↗

Google Earth



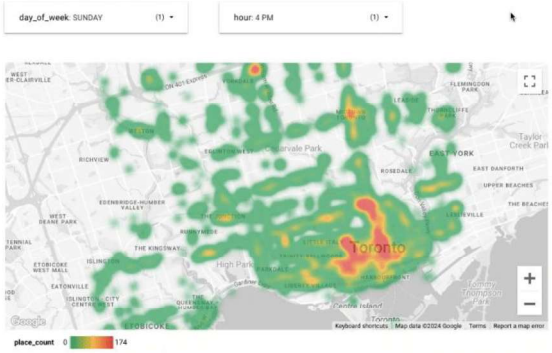
New geospatial datasets and capabilities integrated into BigQuery

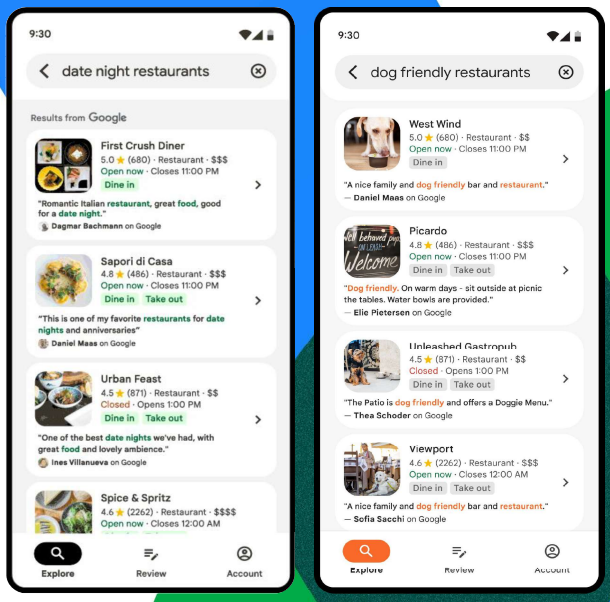


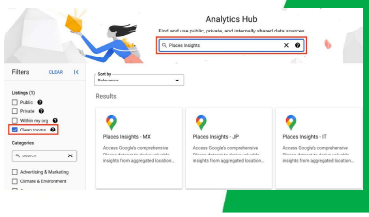
Places Insights

Access Google's comprehensive POI data covering over **250M businesses and places**

Toronto: Open Places by the Hour

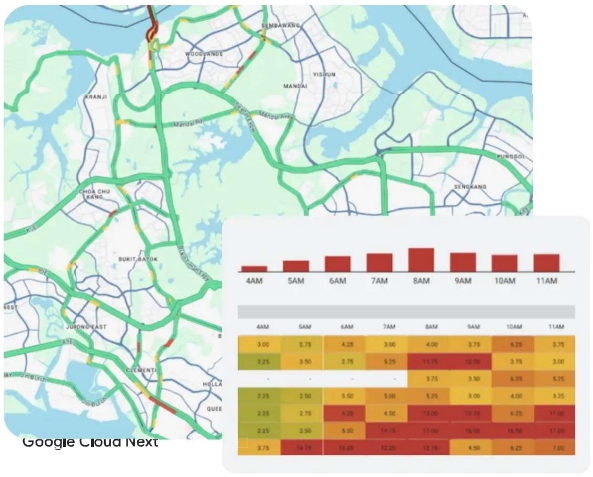


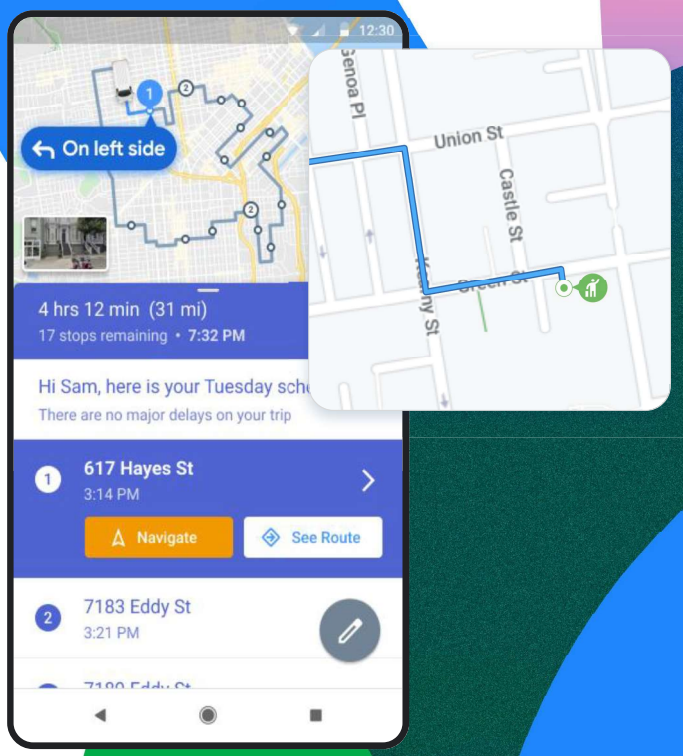




Route Management Insights

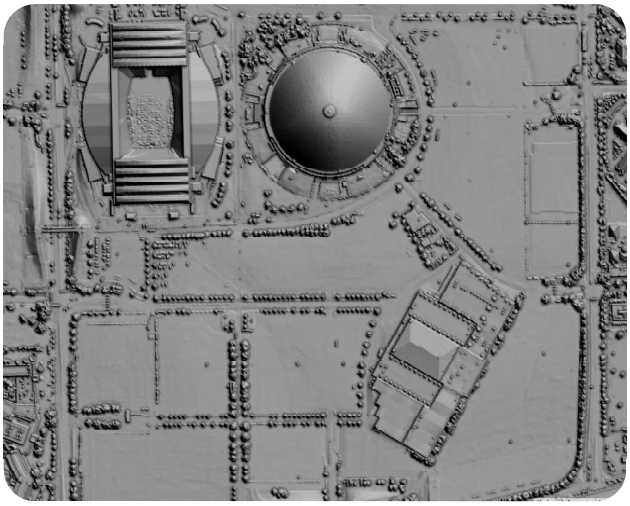
Provide real-time traffic data and comprehensive routes in over 200 countries and territories.





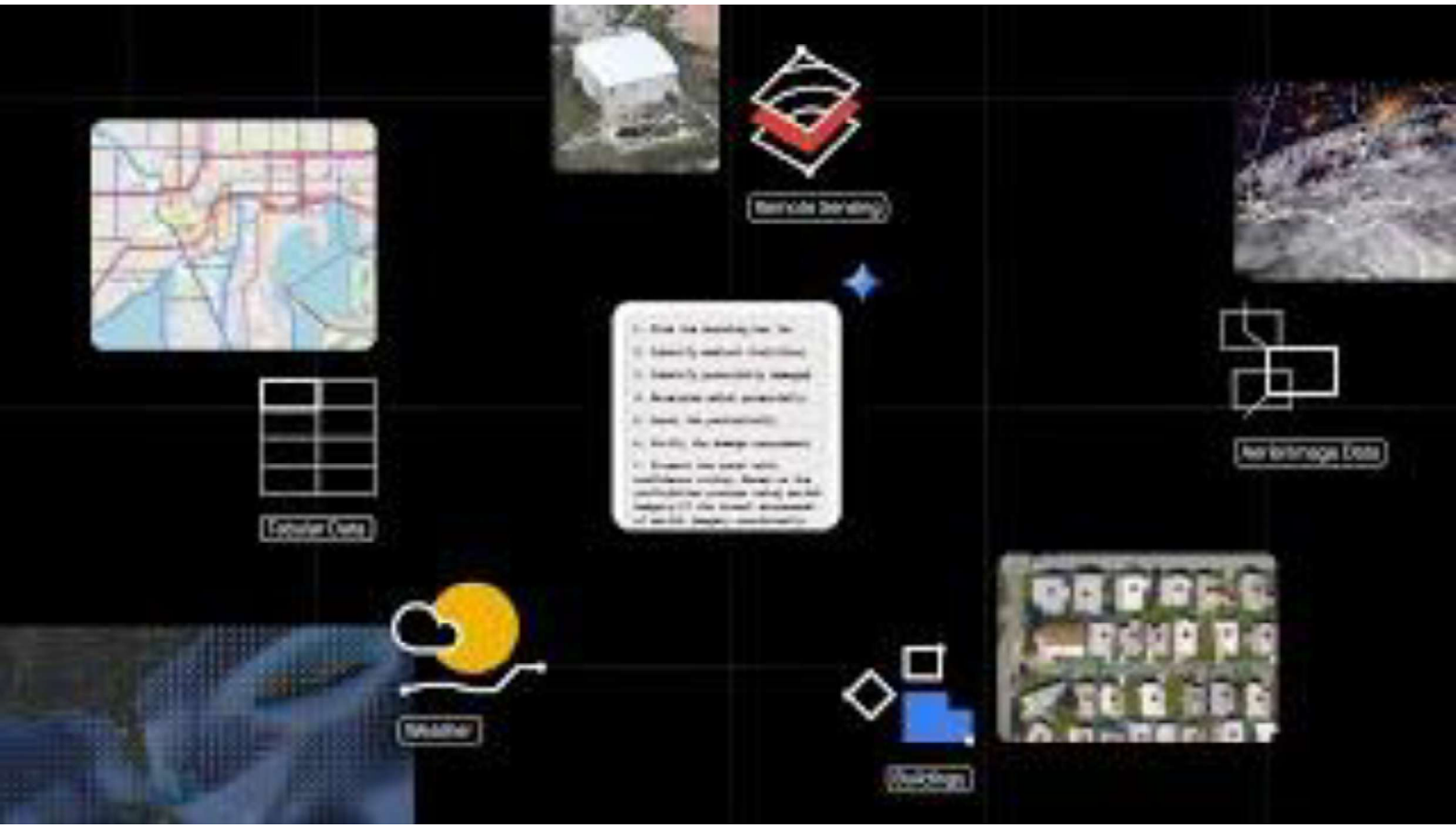
Imagery Insights

Extract insights from StreetView and aerial / satellite imagery



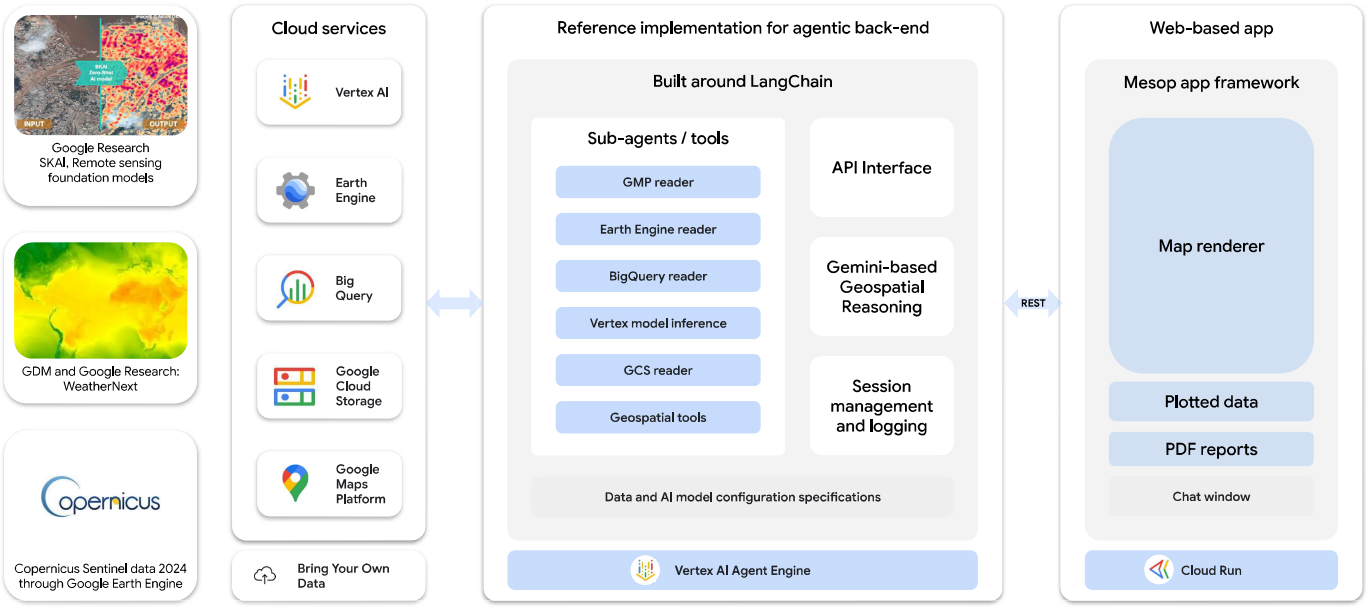
AI for Geospatial Reasoning: Research Focus

- Early work in AI for Geospatial Reasoning
- New geospatial foundation models developed
- Generative AI capabilities for complex problem-solving
- Intelligent, agentic workflows for diverse data sources


Remote Sensing
Aerial Image Data
Tabular Data
Weather

AI Research in Action

Agentic workflow capabilities separated from front-end and deployed using Vertex



https://research.google/blog/geospatial-reasoning-unlocking-insights-with-generative-ai-and-multiple-foundation-models/

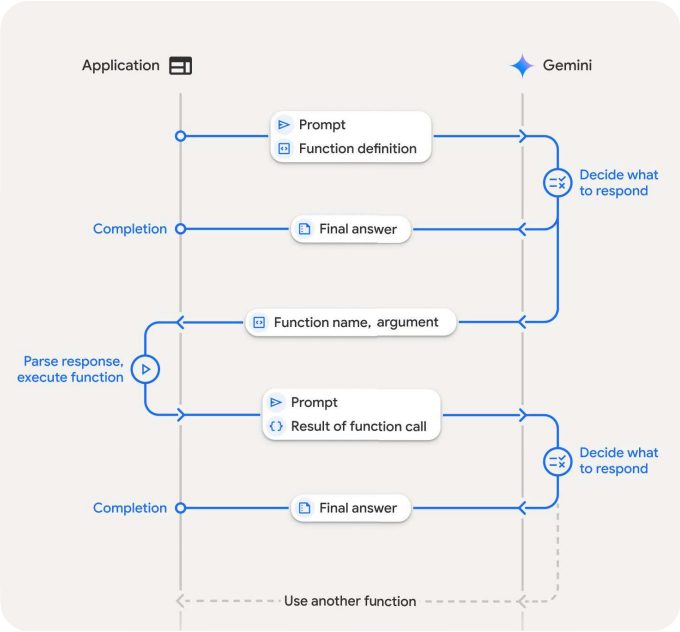
EE Companion

Simon Ilyushchenko

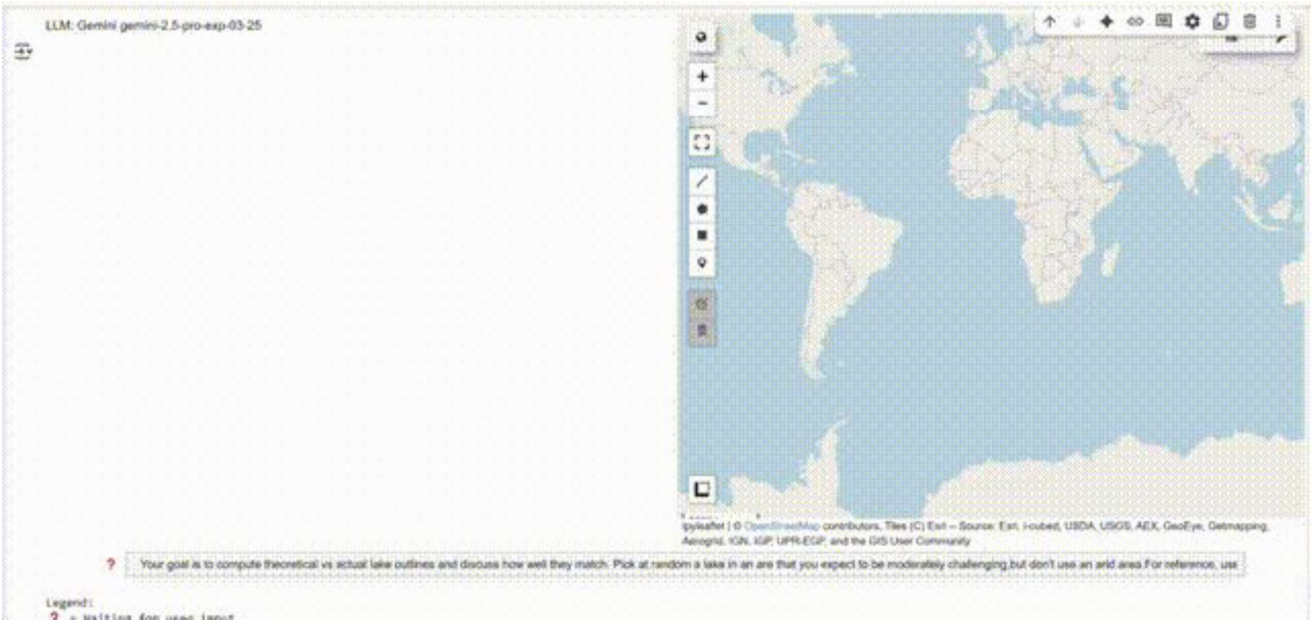
https://www.youtube.com/watch?v=eFJegIAU2II

Gemini Function Calling

https://ai.google.dev/gemini-api/docs/function-calling



Demo time!



Open in Colab

Thank you!