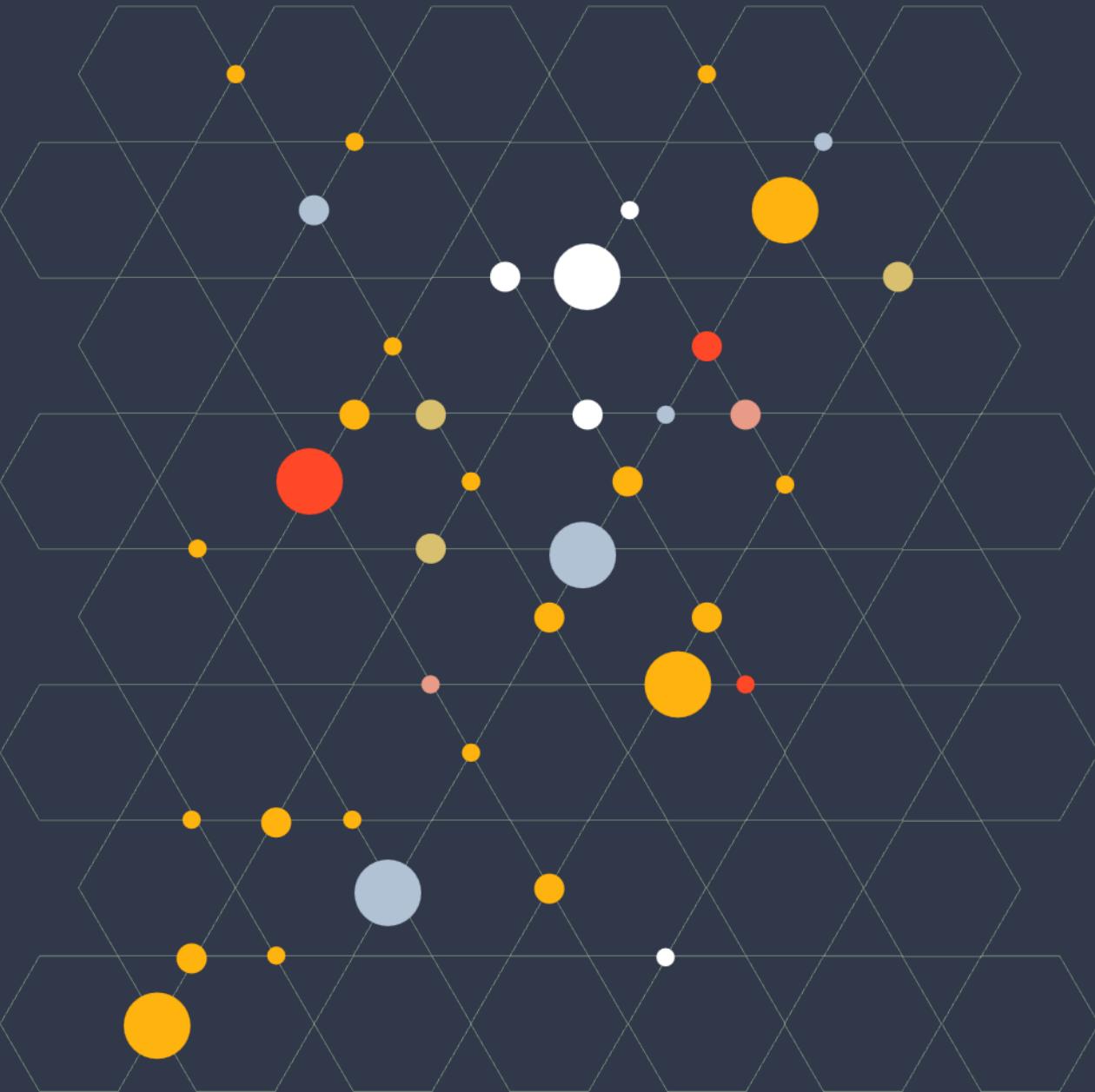


Image geolocation: from beginner to intermediate



Who am I?

Mathieu Gaucheler
Subject Matter Expert

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Location: Barcelona

Position: Subject Matter Expert at Maltego

Joined Maltego in 2021

Mostly focusing on SOCMINT and CTI investigations.

Started to do geolocation exercises as a hobby.

Agenda

What is geolocation and why are we talking about it?

A few methods, ranked by difficulty

How to confirm your findings?

Conclusion

//

Geolocation means finding the real world location of an object, such as the place where a photograph or a video was taken.

Robin Taylor - exposingtheinvisible.org

WHY ARE WE TALKING ABOUT GEOLOCATION?

Why are we talking about geolocation?

[Finding Rundo \(Again\): US White Supremacist Facing Criminal Charges Located in Bulgaria](#)

How Bellingcat found US far-right extremist Rob Rundo starting with these photos



Why are we talking about geolocation?

“Live Universal Awareness Map ([Liveuamap](#)) is a leading independent global news and information site dedicated to factual reporting of a variety of important topics including conflicts, human rights issues, protests, terrorism, weapons deployment, health matters, natural disasters, and weather related stories, among others, from a vast array of sources.”

The screenshot shows a map of the Eastern European region, specifically focusing on Ukraine and surrounding areas. The map is dated 11 May 2025 and includes tabs for Ukraine, Israel-Palestine, Syria, and Kashmir. A 'Select regions' button is also present. The map displays various regions and cities, with several red circular icons containing white symbols representing conflict or strikes. One such icon is labeled '7 hours ago' and 'Source'. A detailed inset map in the top right corner provides a closer look at the conflict area in Ukraine, with text in Russian. Below the map, there are two photographs: one showing a destroyed building with debris and rubble, and another showing thick black smoke billowing from a building against a blue sky.

11 May 2025 Ukraine Israel-Palestine Syria Kashmir Select regions

7 hours ago Source

Several airstrikes were reported in Kostyantynivka of Donetsk region of Ukraine

Why are we talking about geolocation?

Analysis Reveals Damage and Destruction of Cultural Heritage Sites in Gaza

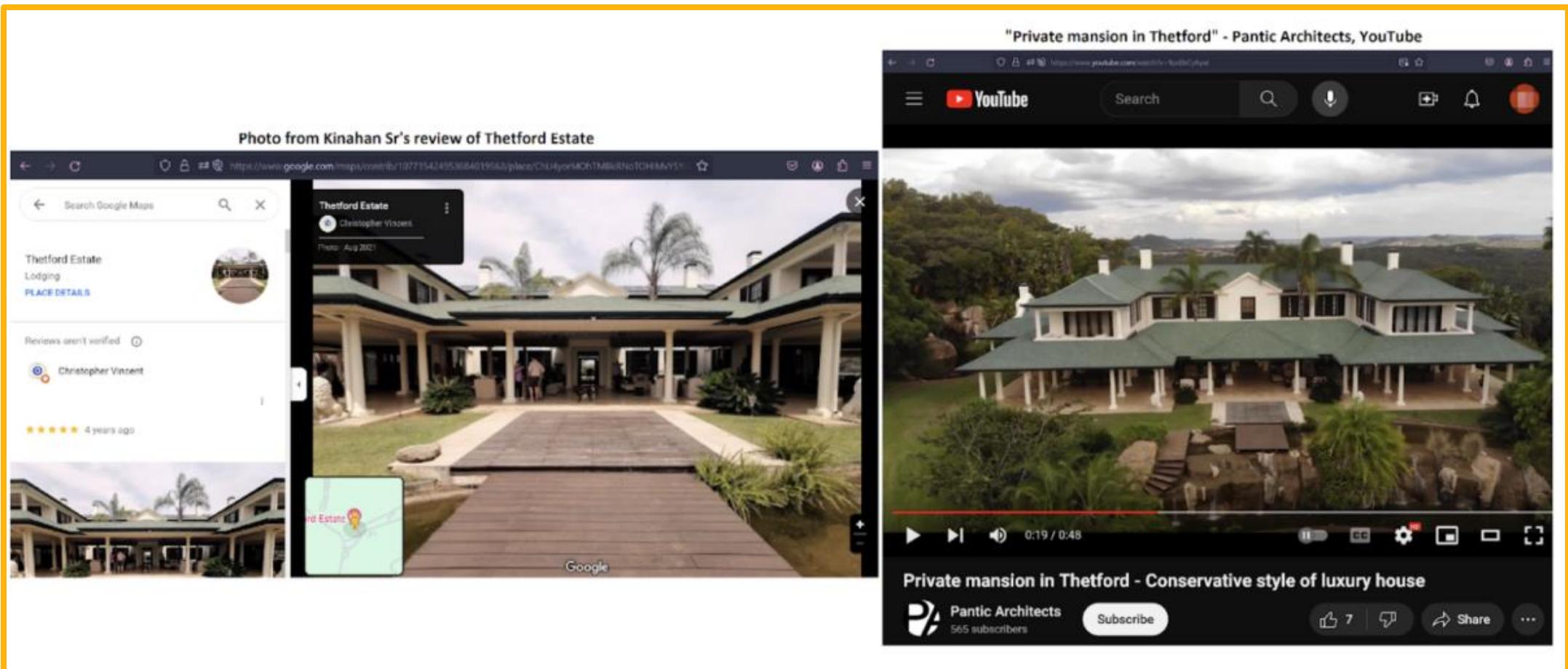
Identifying damage at dozens of religious and cultural heritage sites in Gaza since the Israel-Gaza conflict began in October 2025.



Why are we talking about geolocation?

Cartel King Kinahan's Google Reviews Expose Travel Partners

“Bellingcat was able to geolocate the meeting to this location by comparing a 2019 YouTube video showing drone footage of a “Private mansion in Thetford” with images published by Kinahan Sr, the ICIJ and PIJ Malawi.”



METHODS

From the easiest to the hardest

Metadata – Difficulty: **easy** – Effort: **low**

How does it work?

Digital files can contain information about the data itself: metadata. For pictures or videos, this can include data about camera used, the time the picture was taken and sometimes where the picture was taken

When should you use it?

Always check for metadata but be aware that it is very rarely there. Most platforms remove them by default. Savvy users will know to delete them. They may still be present in platforms like Flickr.

Tools

- Metadata2go
- ExifTool
- EXIF Viewer Pro

```
mg@Mathieu-MacBook-Pro-2 Downloads % exiftool foggy_field-CVCSHQ-A.jpg
zsh: /opt/homebrew/bin/exiftool: bad interpreter: /usr/bin/perl5.30: no such file or directory
ExifTool Version Number      : 12.57
File Name                   : foggy_field-CVCSHQ-A.jpg
Directory                   : .
File Size                   : 420 kB
File Modification Date/Time : 2025:05:11 20:20:43+02:00
File Access Date/Time       : 2025:05:11 20:20:49+02:00
File Inode Change Date/Time: 2025:05:11 20:20:47+02:00
File Permissions            : -rw-r--r--
File Type                   : JPEG
File Type Extension         : jpg
MIME Type                  : image/jpeg
JFIF Version               : 1.01
Exif Byte Order             : Big-endian (Motorola, MM)
X Resolution                : 72
Y Resolution                : 72
Resolution Unit             : inches
YCbCr Positioning          : Centered
GPS Version ID              : 2.3.0.0
GPS Latitude Ref            : North
GPS Longitude Ref           : West
GPS Altitude Ref            : Above Sea Level
Image Width                 : 4032
Image Height                : 3024
Encoding Process            : Baseline DCT, Huffman coding
Bits Per Sample              : 8
Color Components             : 3
YCbCr Sub Sampling          : YCbCr4:2:0 (2 2)
Image Size                  : 4032x3024
Megapixels                  : 12.2
GPS Altitude                : 131 m Above Sea Level
GPS Latitude                : 51 deg 10' 13.08" N
GPS Longitude               : 4 deg 40' 0.12" W
GPS Position                : 51 deg 10' 13.08" N, 4 deg 40' 0.12" W
```

Autonomous AI Tools– Difficulty: **easy** – Effort: **low**

How does it work?

Varies from tool to tool, they might not disclose the way they work.

When should you use it?

When you do not have any privacy concerns surrounding that image. Some of these tools are not free or have a freemium business model. Make sure to verify their answer.

Tools

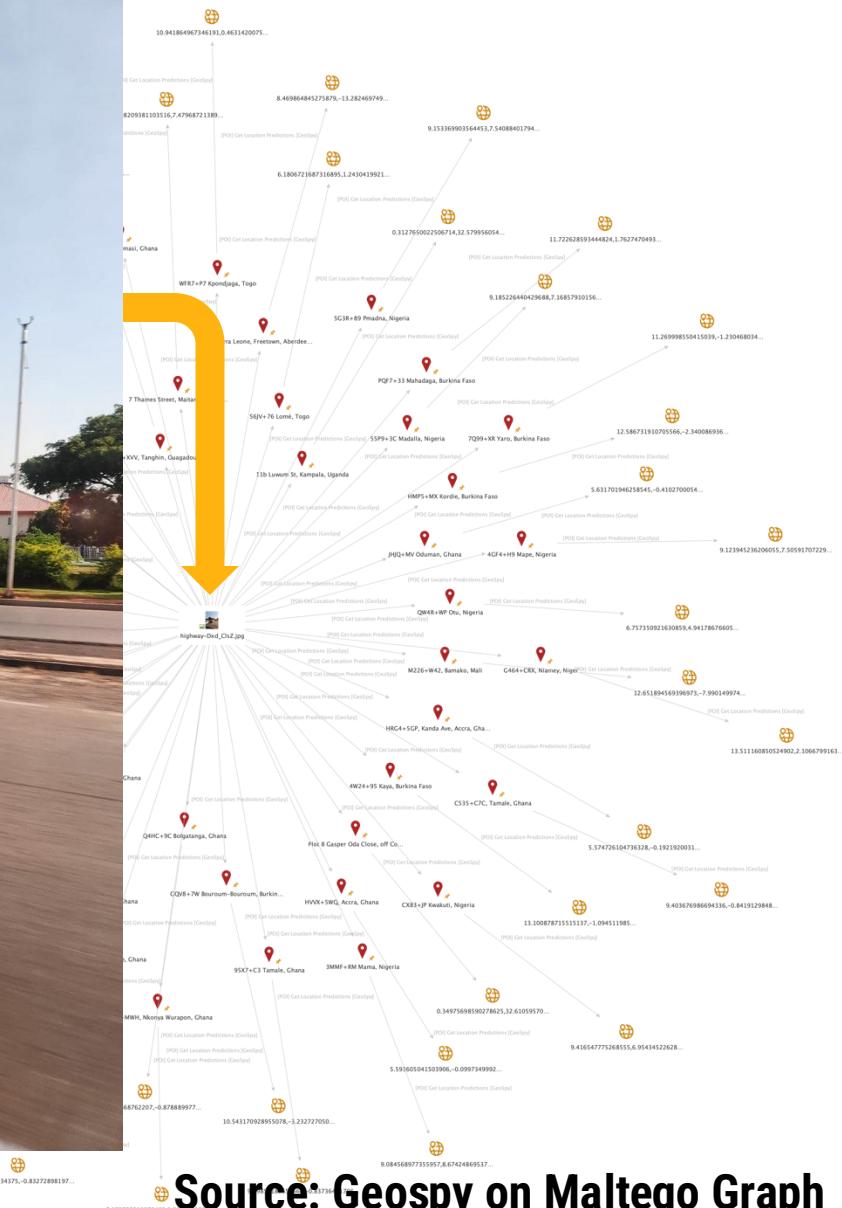
Geospy

Chat GPT

Picarta



Source: Bellingcat



Source: Geospy on Maltego Graph

Reverse Image Search – Difficulty: **easy**– Effort: **medium**

Source: Google Lens

How does it work?

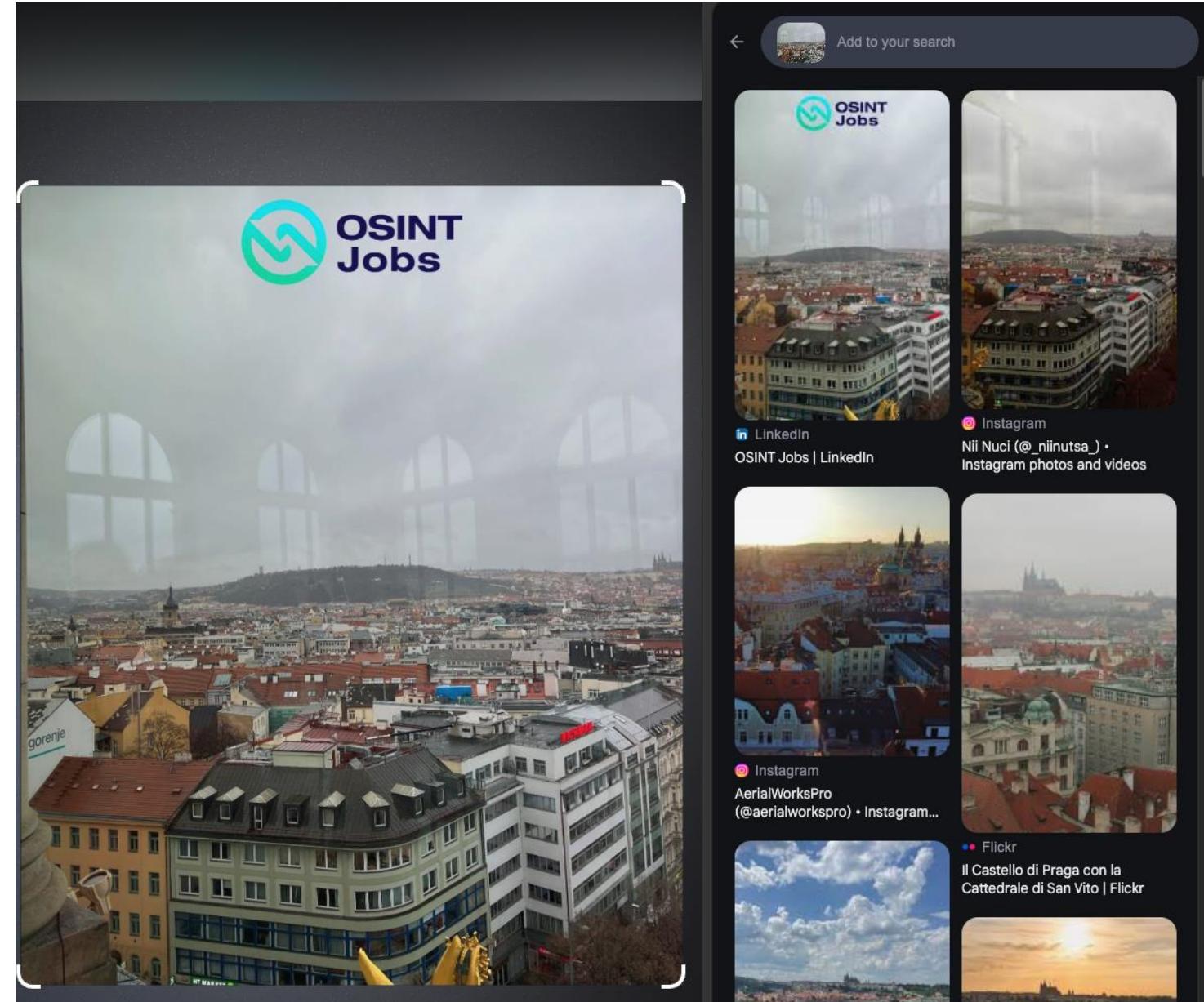
Either search for other places where the image was posted and get access to its context. Or use AI powered solutions to identify features of your image.

When should you use it?

Reverse image search should always be used. The AI powered tools like Google Lens or Lenso.ai can be useful if there is a particular logo or building that you need to identify. You can add keywords to enhance the results.

Tools

- Google Lens
- Lenso.ai
- Tineye
- Any reverse image service from search engines (Bing, Yandex, Google, etc.)



Miscellaneous Clues – Difficulty: medium – Effort: medium

How does it work?

Every photo contains elements that are linked to a specific geographical area: license plates, road markings, fast food franchise, alphabet/script used, flora, fauna, left/right hand traffic, etc. Find the elements that can help narrow down the area.

When should you use it?

Whenever possible, a picture is likely to contain a lot of these elements: prioritize the ones that will reduce the zone to a minimum. Be wary of falling into a rabbit hole.

Tools

geohints.com (general)

plonkit.net (general)

worldlicenseplates.com (license plates)

Wikipedia (general)



Source: Google Street View



Source: Alamy.com



Source: customeuropeanplates.com



Source: Google Street View

Using the sun to orient a picture – Difficulty: medium – Effort: medium

How does it work?

With a rough idea of the location and time a picture was taken, you can use the shadows length and direction to determine the orientation of the picture as well as possible hours it was taken.

When should you use it?

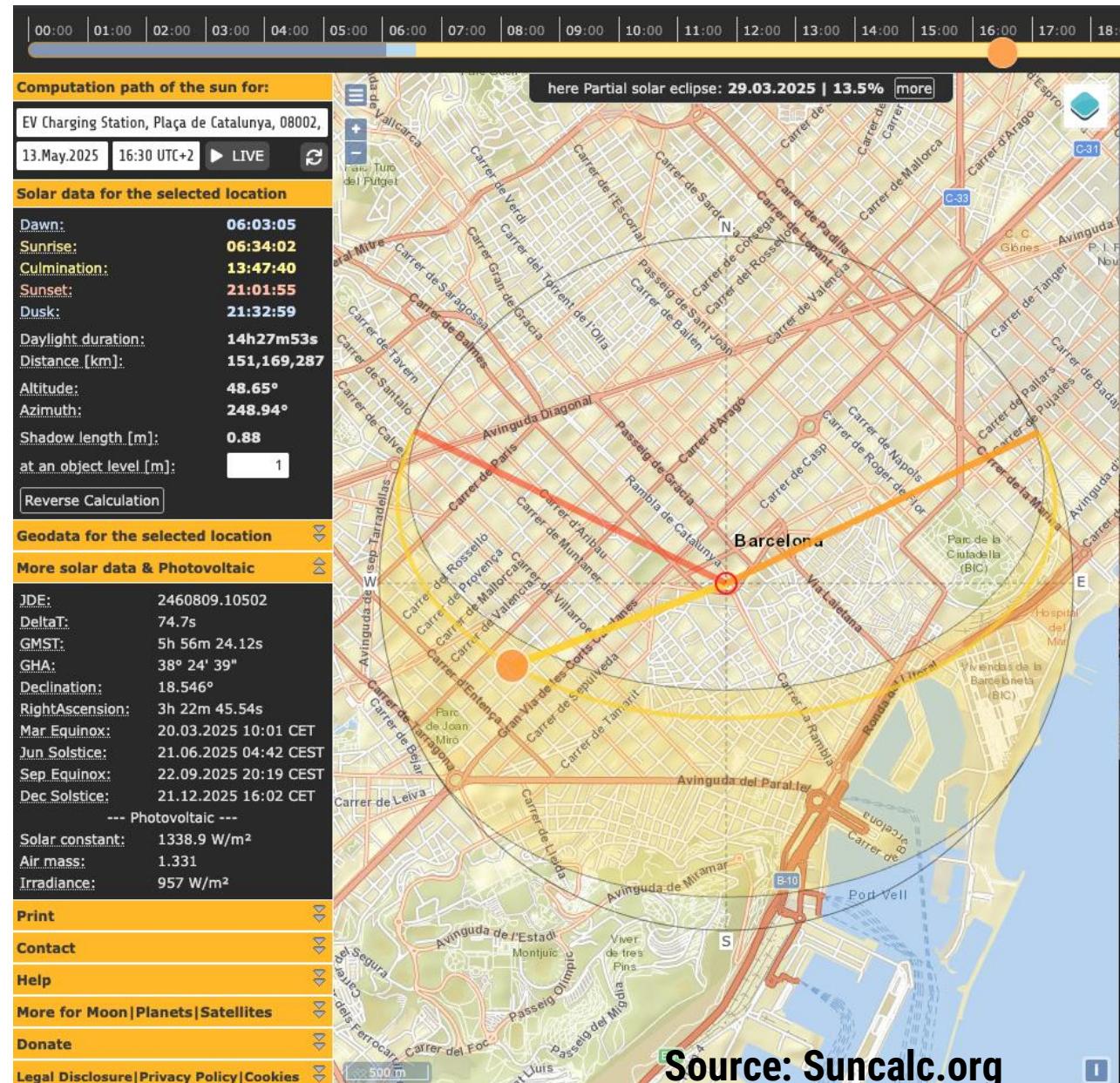
You need to have narrowed down your picture to a reasonably sized area (~country). You also need either shadows or the sun to be visible. This will make your task easier when searching through satellite imagery.

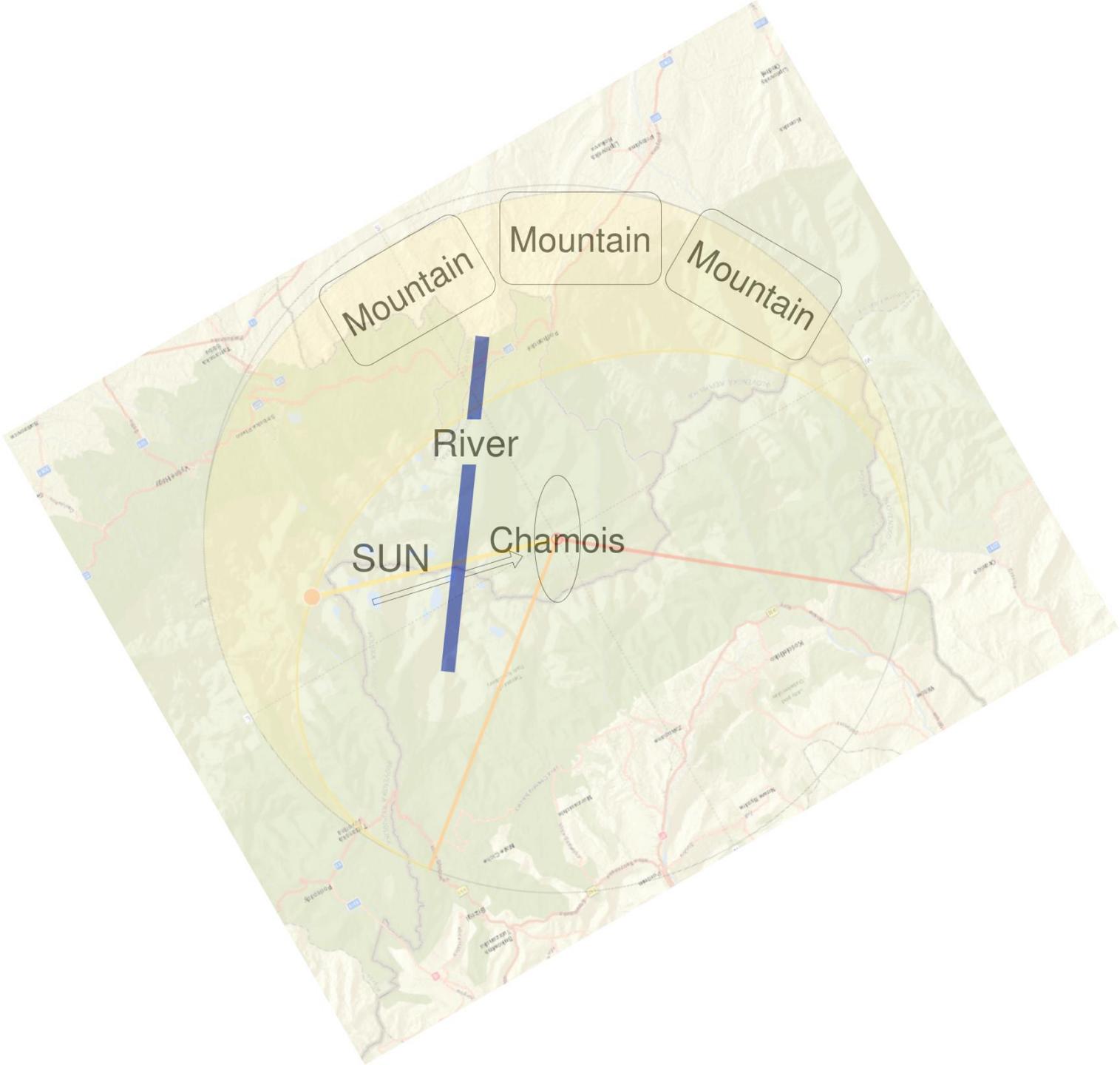
Tools

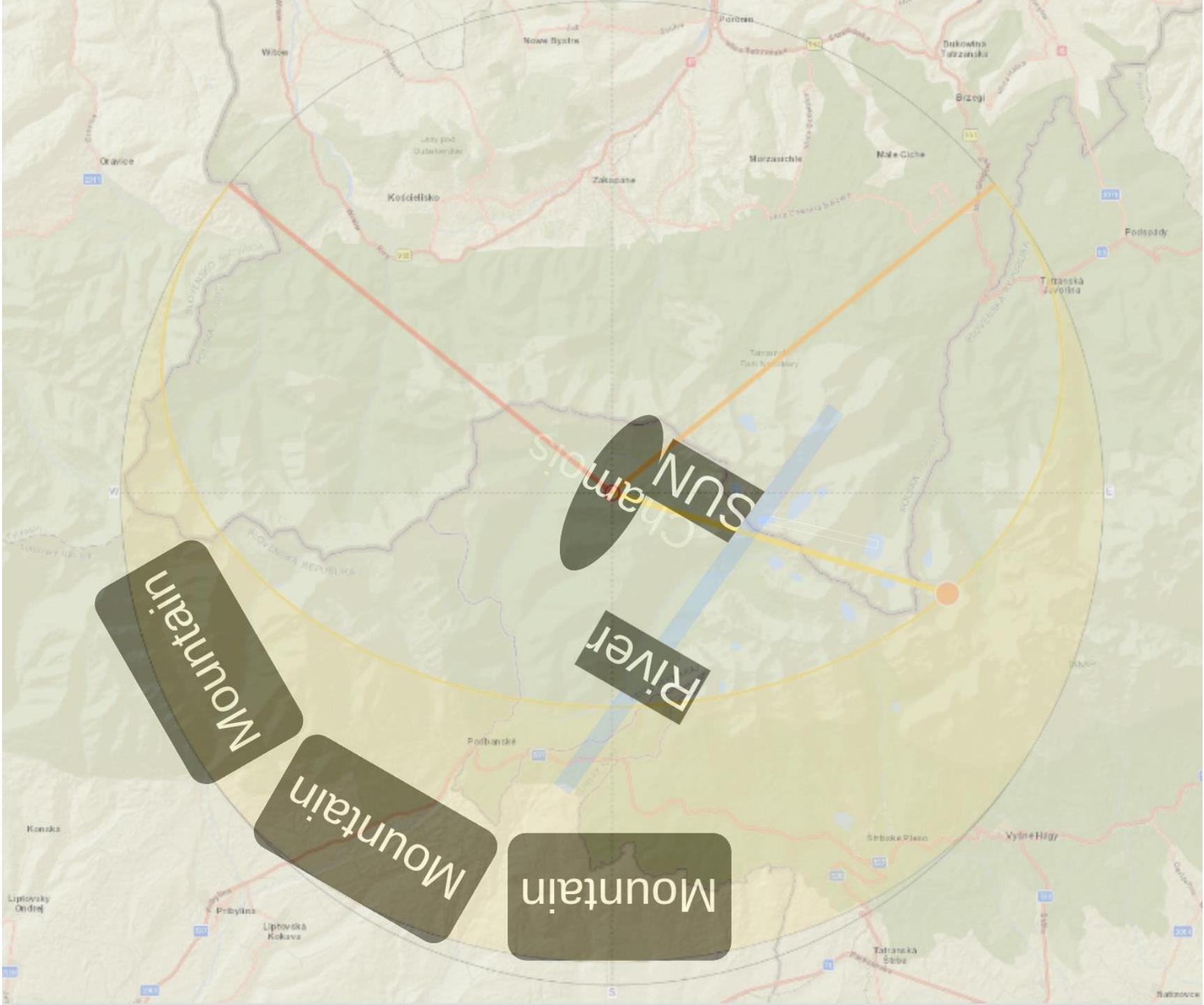
suncalc.org

shademap.app

shadowmap.org







Using the sun to get a broad location

Difficulty: medium – Effort: medium

How does it work?

If you have a shadow as well as the object casting it and you know the exact time the picture was taken, you would be able to reduce your searching area to a given ring around the planet.

When should you use it?

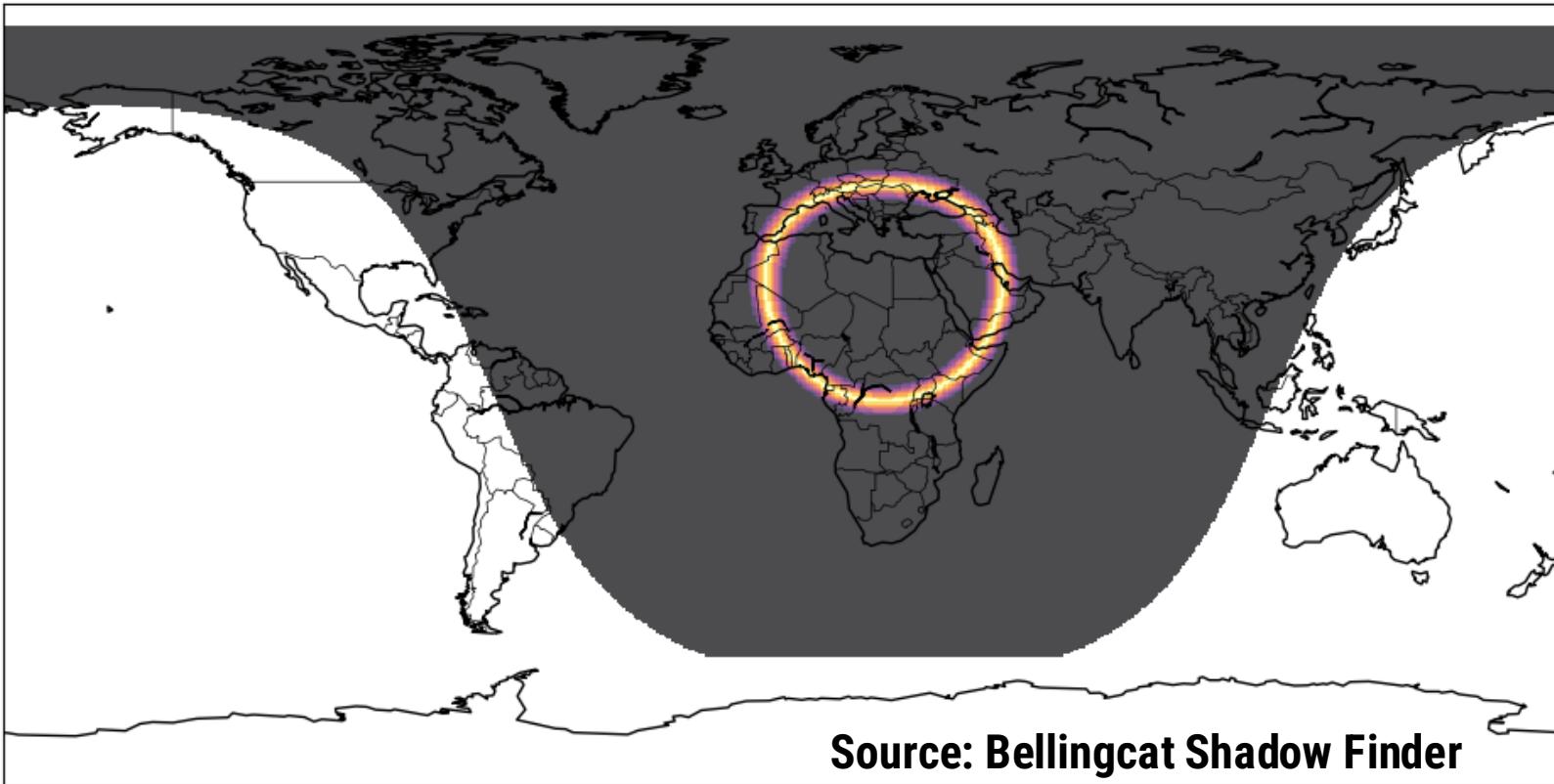
When needing to reduce the area of research. If you have several pictures of the same location at different times, you can look for the intersection of these two points, reducing your area of research even more.

Tools

[Bellingcat Shadow Finder Tool](#)



Possible Locations at 2024-06-22 10:30:41 Utc
(object height: 342, shadow length: 159)



Using Mountains – Difficulty: medium – Effort: high

How does it work?

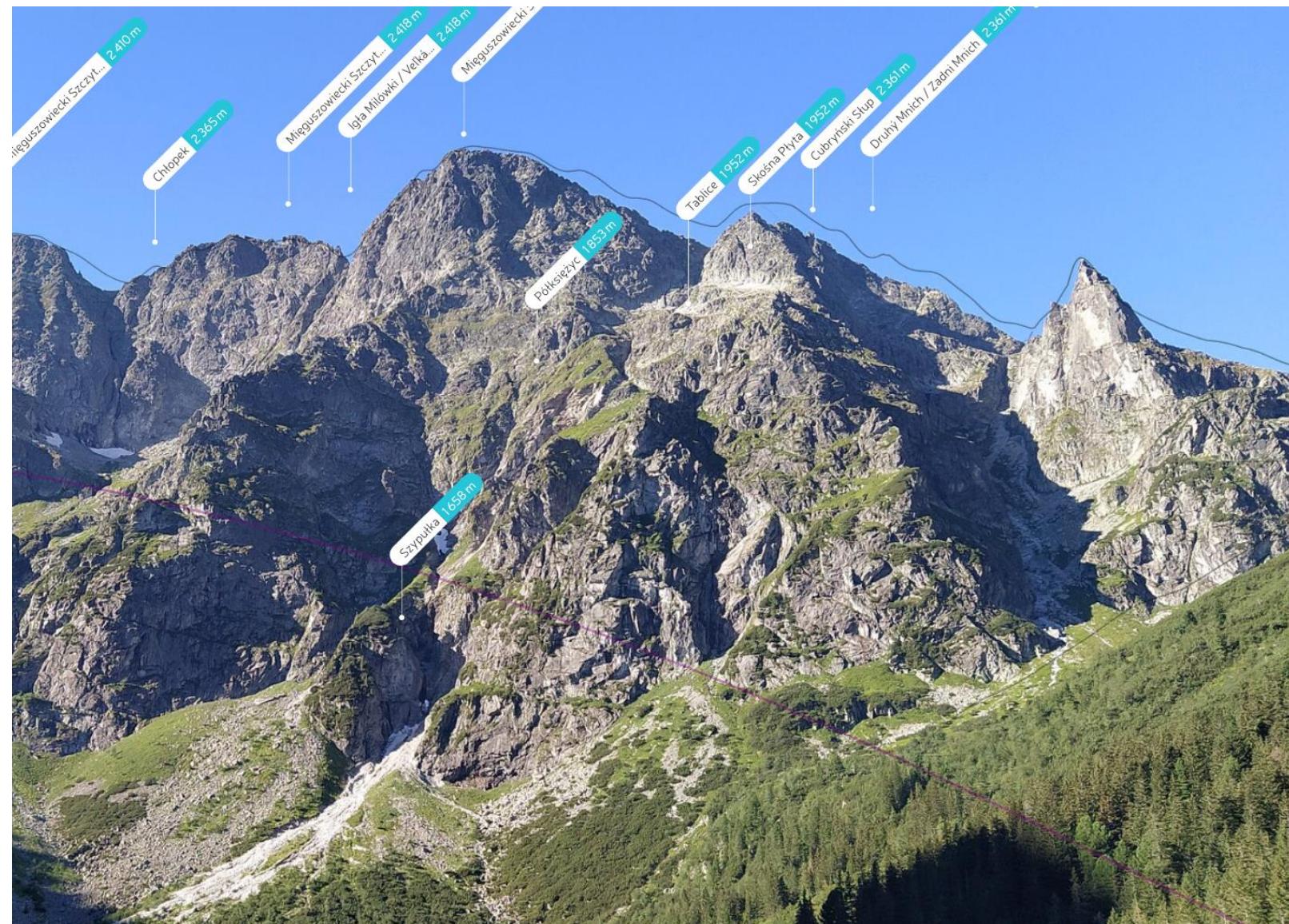
Matching a particular landscape seen in your picture to a 3D model can help you confirm or reject a location. You can also try different points of view on the same mountain range.

When should you use it?

When your picture includes a mountainous landscape, and you have narrowed down the area of research to a finite list of mountains.

Tools

Google Earth Pro
Peakvisor



Using Open Street Map

Difficulty: hard

Effort: medium

How does it work?

Open Street Map is a collaborative effort to develop and maintain a world map with a very high level of detail. We can either use the map directly or query features from it.

When should you use it?

Whenever you see elements in your pictures susceptible to have been mapped on OSM (mostly man-made structures). Understand that this is a collaborative work, and it might be incomplete depending on the area.

Tools

openstreetmap.org (explore the map)
overpass-turbo.eu (query features)

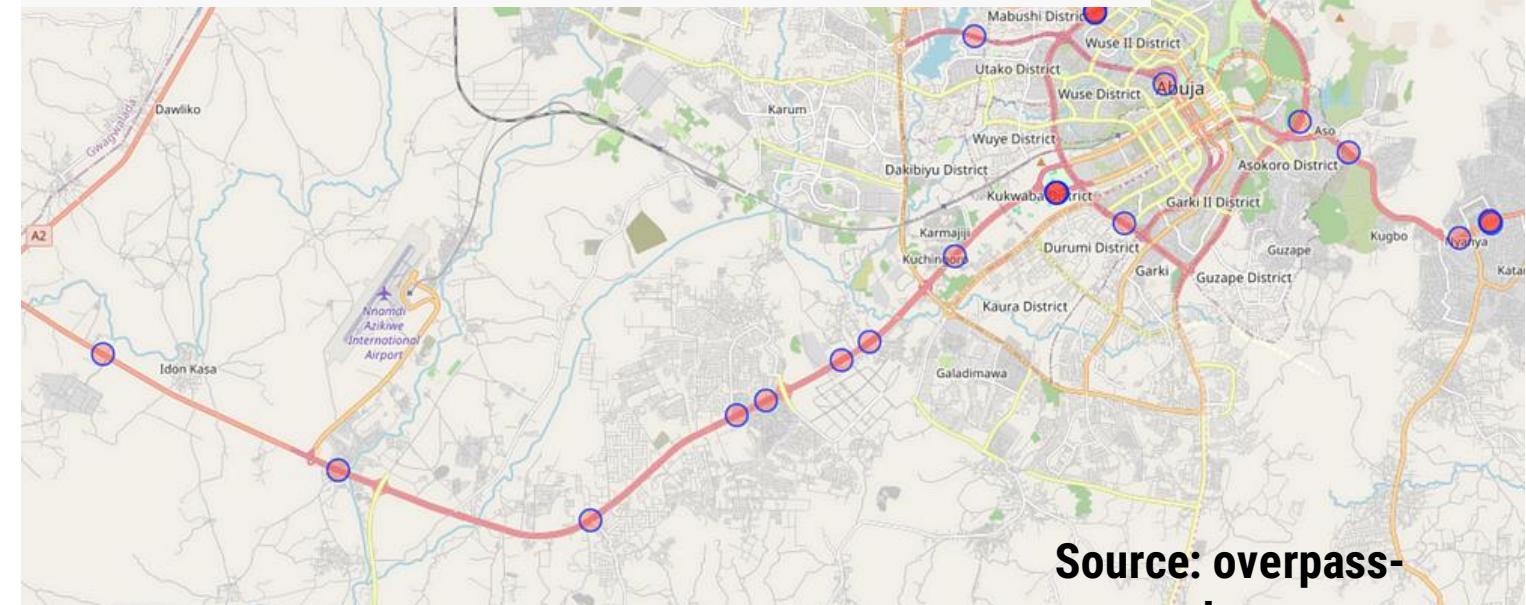
```
[out:json] [timeout:250];
```

```
// get roads matching the picture  
nwr["highway"]="motorway"]({{bbox}});  
nwr["highway"]="trunk"]({{bbox}});  
nwr["highway"]="primary"]({{bbox}});)->.main_highways;
```

```
// get bridges that are also a footway  
nwr["bridge"]["highway"]="footway"]({{bbox}});)  
->.bridges;
```

```
// get bridges that are next to our set of roads  
nwr.bridges(around.main_highways:1);
```

```
out geom;
```



Source: overpass-turbo.eu

HOW TO CONFIRM A GEOLOCATION

Street View Services

How does it work?

A camera, usually carried by a vehicle, continuously captures the surrounding area while being carried along roads. These images are then mapped on an online service.

Advantages

Very easy to use. Offers a high level of details.

Drawbacks

Incomplete coverage. Images are unlikely to be recent.

Tools

Google Street View (via Google Maps)
Mapillary.com
Look Around (via Apple Maps)
Streetside (via Bing Maps)



Current Street View coverage - Source: google.com/streetview/how-it-works/

Satellite Imagery

How does it work?

Satellite imagery is made available through different services. They all have their advantages and drawbacks. An advanced user can play with different layers to highlight specific characteristics of what is on the ground.

Advantages

Complete coverage, possibility to go back in time.

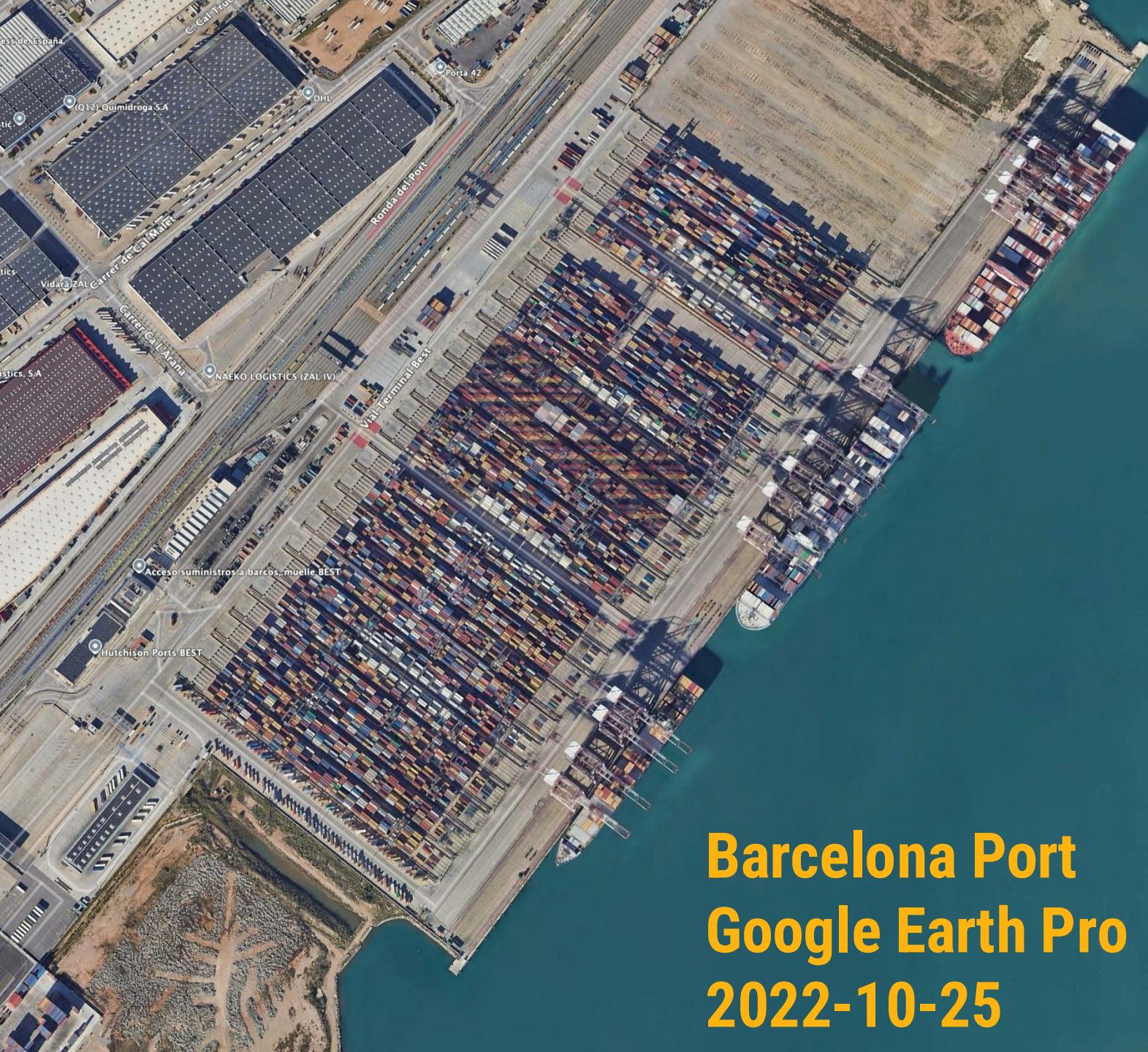
Drawbacks

Pick 2 out of 3: free, often updated and high-resolution pictures.

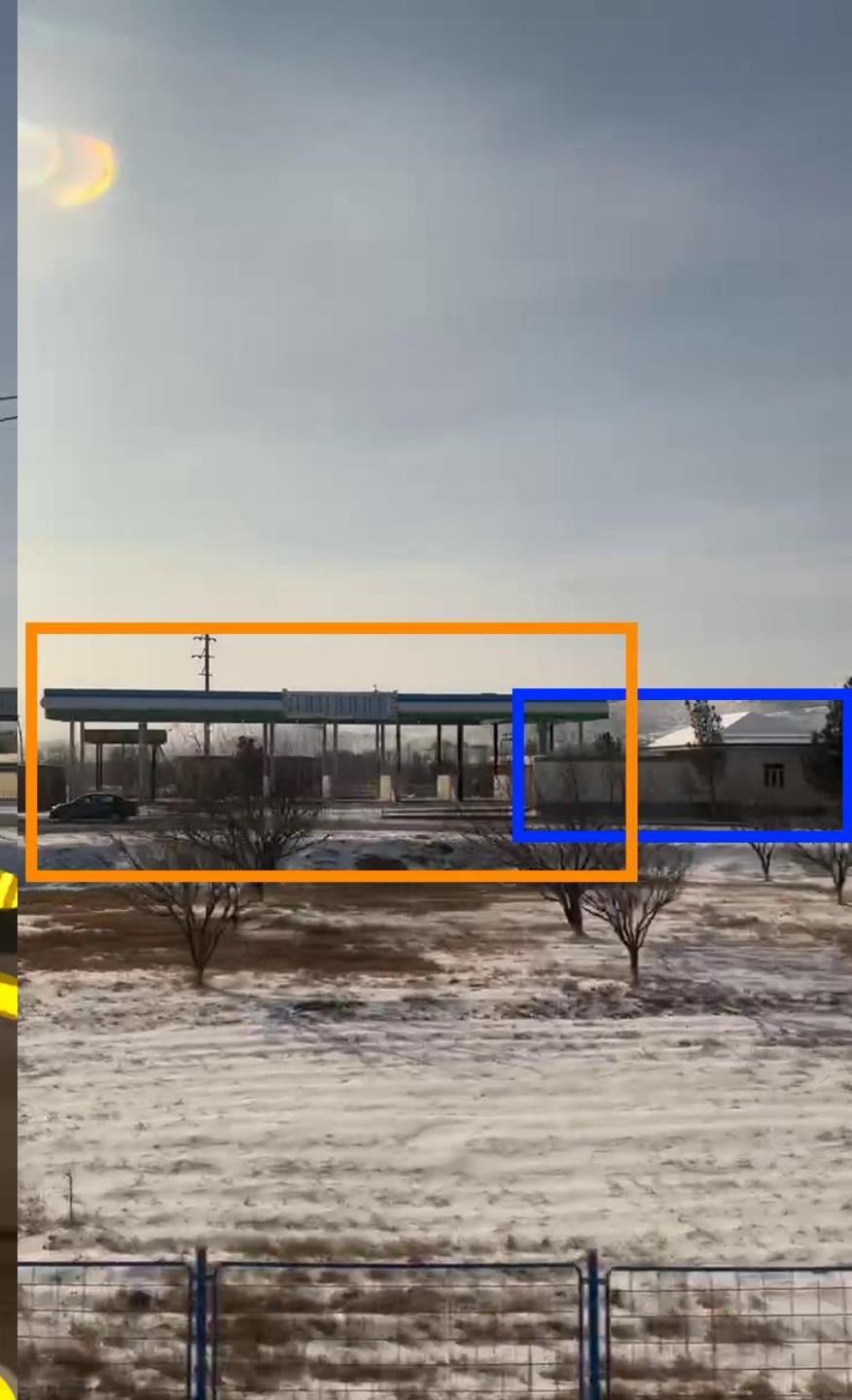
Clouds will become your worst enemies.

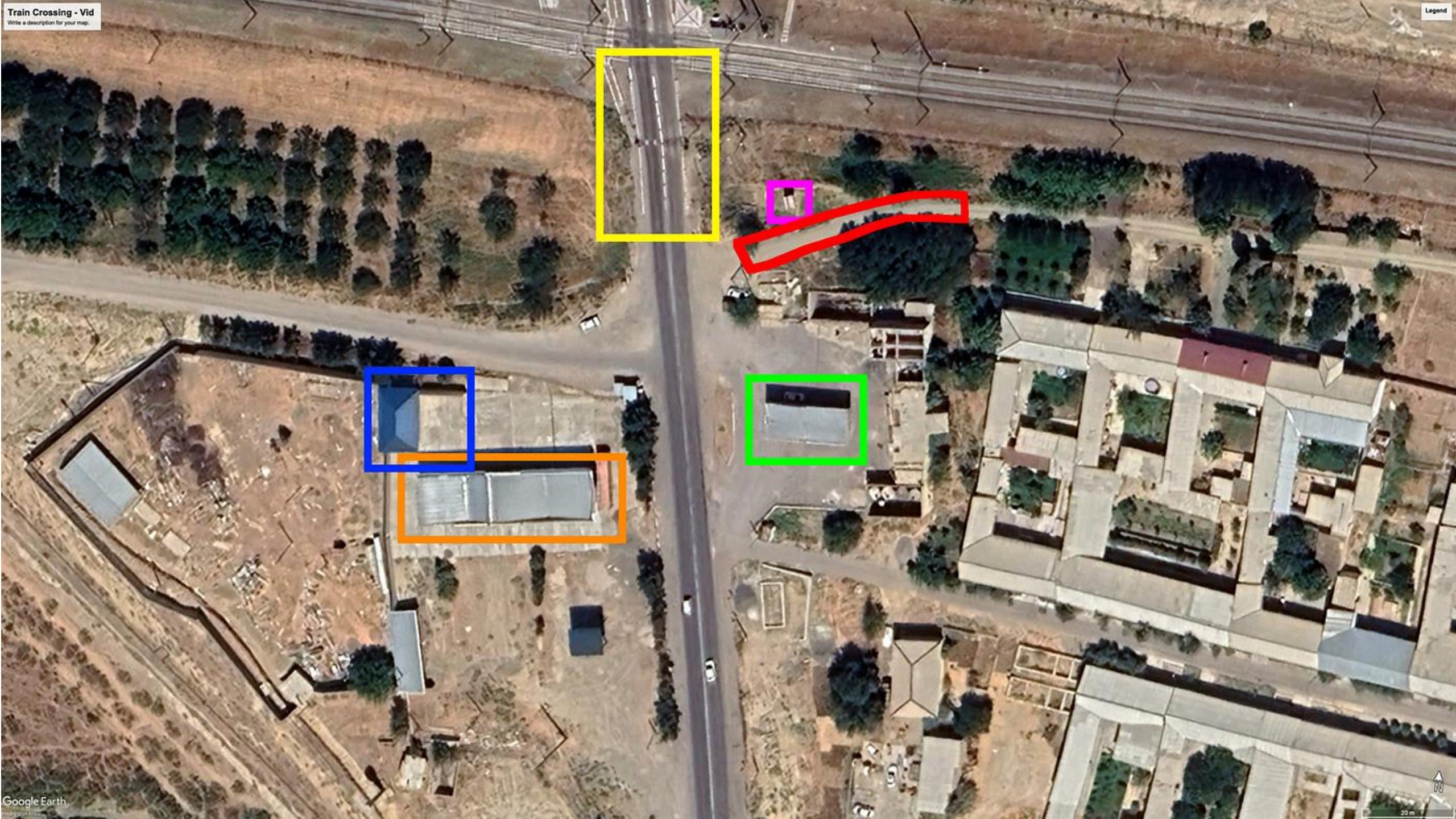
Tools

Google Earth and similar
Copernicus Browser, Sentinel Hub
Maxar, Planet Labs (paid services)



Barcelona Port
Google Earth Pro
2022-10-25





Social Media Posts

How does it work?

Some social media posts might show our picture's location from a point of view inaccessible by the previous two methods (ex: inside a building). These could be posted as vlogs or dumps on Instagram.

Advantages

They are usually well referenced. Some social media will allow you to choose a particular timeframe in which the post has been made.

Drawbacks

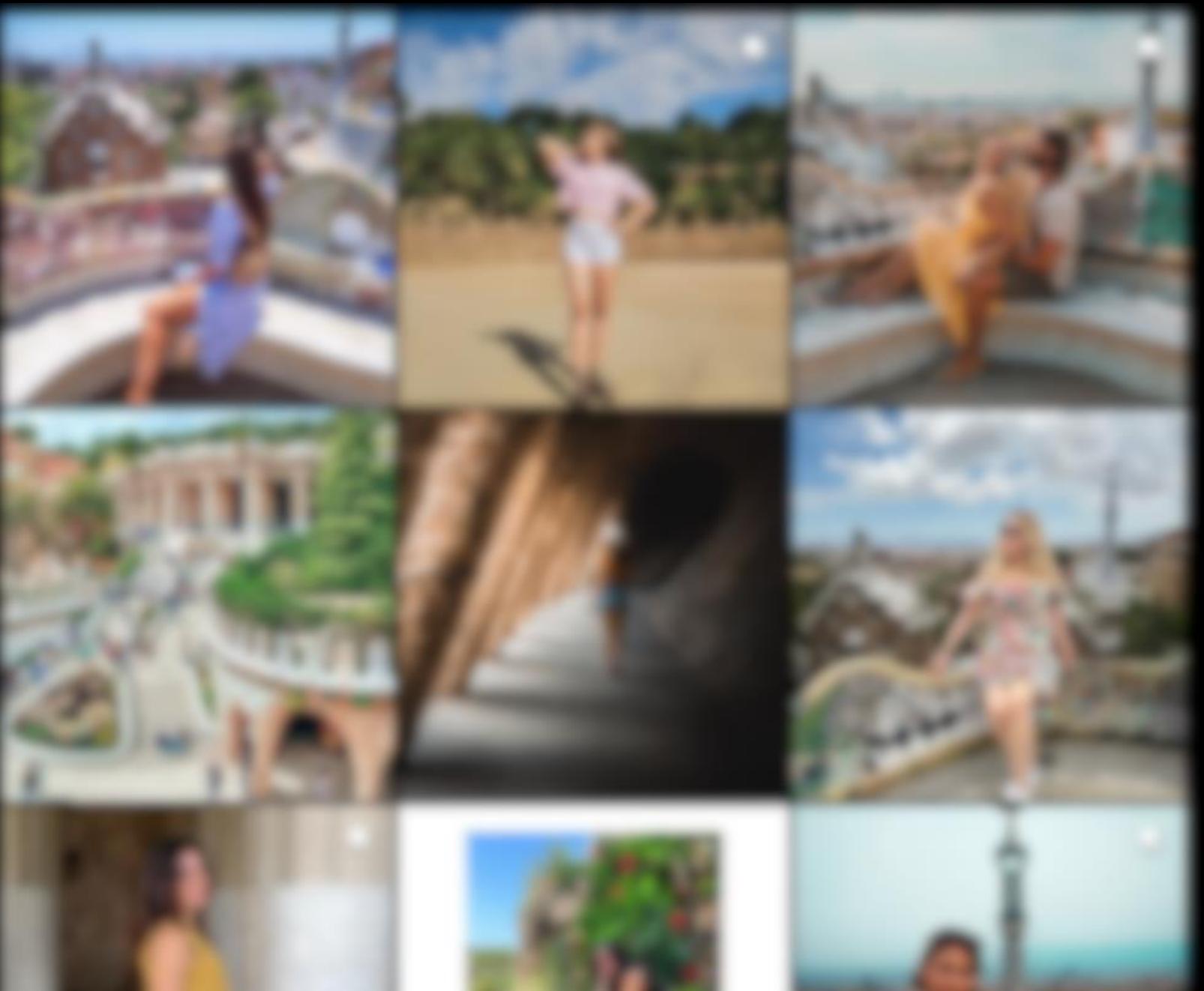
Works better for touristic areas or places often visited by humans.

Tools

Any picture heavy social media: Youtube, Instagram, Twitter, Bluesky, etc.

#parkguell

For you Not personalized



Specialized Photography Websites

How does it work?

Some places will only be documented by a handful of professional photographers (example: refugee camp). These pictures will then be posted on their agency's website or by the organization that commissioned them.

Advantages

Usually numerous and high-resolution pictures.

Drawbacks

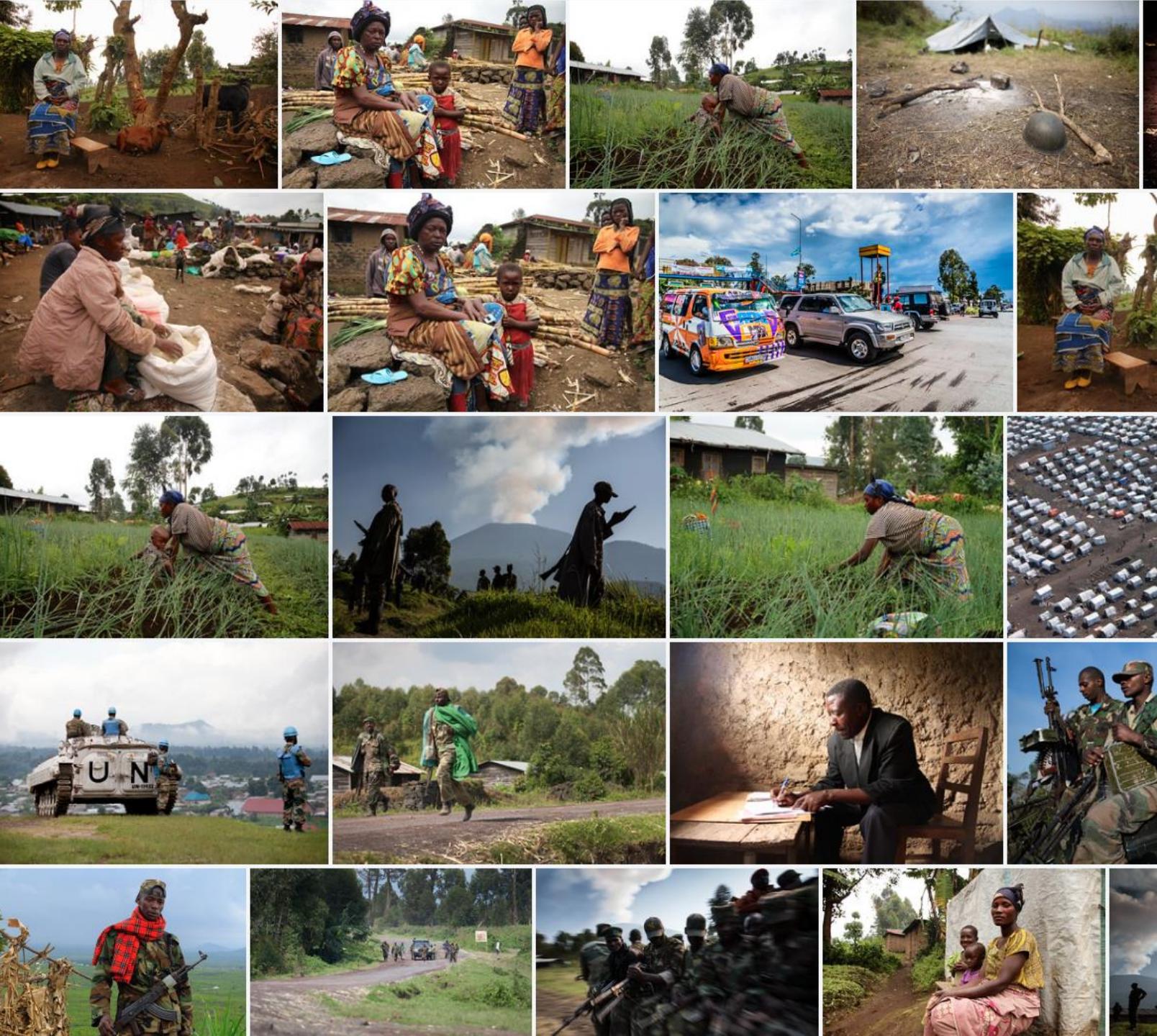
Extremely situational.

Tools

Flickr (search from a map or keywords)

[Getty Images and similar](#)

UN Photo



CONCLUSION

Key Takeaways

1. Practice makes perfect.

Find exercises here:

1. <https://challenge.bellingcat.com/>
2. <https://gralhix.com/list-of-osint-exercises/>
3. https://x.com/bayer_julia

2. Focus on methods, not tools:

Using tools without understanding the method behind them can lead to mistakes. Once a tool stops working, you'll need to find new ones.

3. If you can't crack an image, search for more context:

Sometimes, it's easier to investigate someone's whereabouts or search for more picture of an event.

