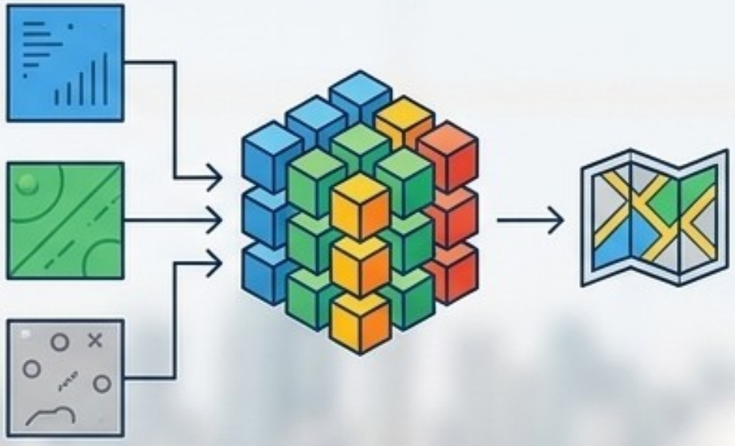
Building the GeoAI Enrichment Pipeline

Transforming unstructured visual data into multi-dimensional geographic intelligence.



Max Kleiner

EKON 30
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Agenda

- Maps with out of the box demos
- Process API Pipeline
- Python4Delphi & Pascal
- Google Directions / Shell / Scripts
- OpenStreetMap OSM mapbox
- https://github.com/maxkleiner/restcountries
- JSON, EdgeView2 and Geocoding
- This session shows you various ways of using Maps and components in your application.

GEO API Pipe

1) Object Detection API & Similarity
2) Image to Text API
3) Language Translator
4) Country, Capital API
5) Image Random Generator (to train & test data)

Download 1473_Geo_Intelligence_API1_4.txt (maXbox5)

https://sourceforge.net/projects/maxbox5/files/EKON30/1473_Geo_Intelligence_API1_51.txt/download

https://sourceforge.net/projects/maxbox5/files/EKON30/1473_JSON_BoundingBox_API1_51.txt/download

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The Core Workflow: 1–5 GEO API Pipe APIs

- Object Detection API — identifies objects, labels, confidence scores, bounding boxes.
- Image to Text API (OCR) — extracts text from images, including signs, labels, handwriting.
- Language Translator — translates extracted text into a target language.
- Country & Capital API — retrieves geographic and demographic data for verification.
- Image Random Generator — produces synthetic images for training/testing.

1) GeoAI has expanded from niche uses (railway imagery, aerial detection) to broader applications like environmental time-series analysis and anomaly detection.

2) GEOINT is evolving rapidly and requires understanding of both AI and geospatial reasoning.

https://sourceforge.net/projects/maxbox5/files/EKON30/1473_Geo_Intelligence_API1_51.txt/download

https://sourceforge.net/projects/maxbox5/files/EKON30/1473_JSON_BoundingBox_API1_51.txt/download

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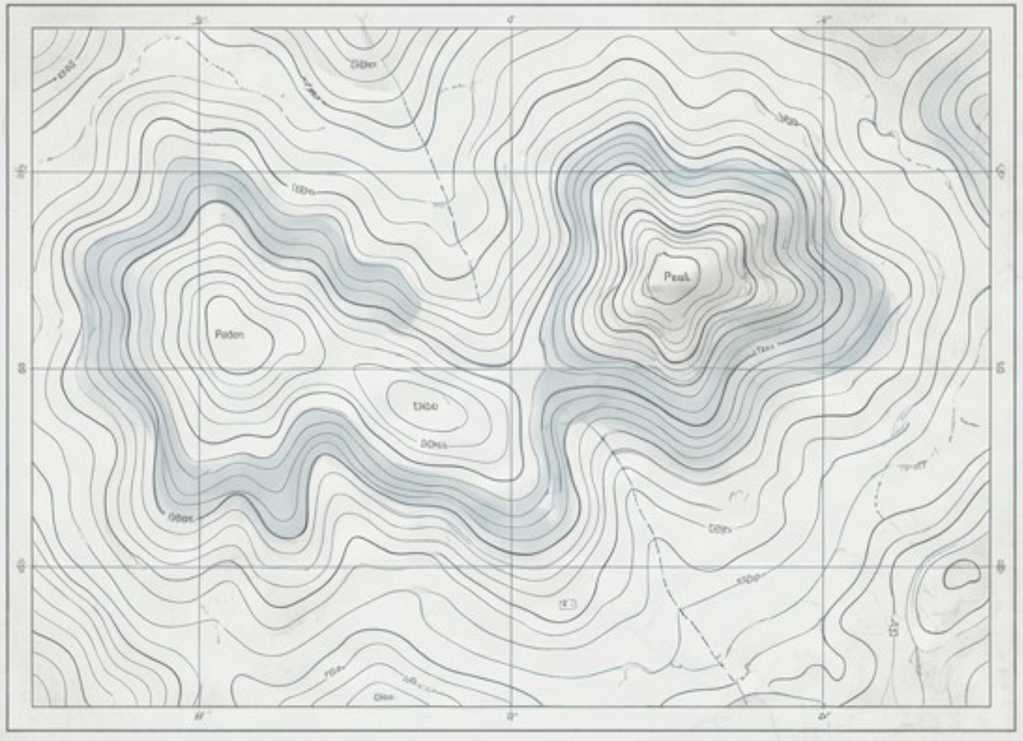
Components

1) TMS FNC Maps: Best all-round choice for maps, geocoding, directions, time zones, and multiple providers such as Google Maps, Bing, Mapbox, Here, OpenLayers, and Leaflet.[tmssoftware]
2) TatukGIS DK: Best for a serious native GIS SDK in Delphi for desktop GIS applications and richer spatial workflows.[stackoverflow]
3) CartoVCL: Good Delphi VCL GIS SDK for a dedicated mapping component set with a more classic Delphi feel.[cartovcl]

4) GISlib: Useful for a lighter Delphi GIS library and you are comfortable assembling some pieces yourself.[github]
5) PostGIS: Essential on the backend for spatial queries, geometry/geography storage, and advanced analysis.[osgeo]
6) TeeChart series class for GIS map web servers. (“Pro” version only). All charting features available (scroll, zoom, adding more series on top, custom painting, annotations, multiple maps, etc etc)

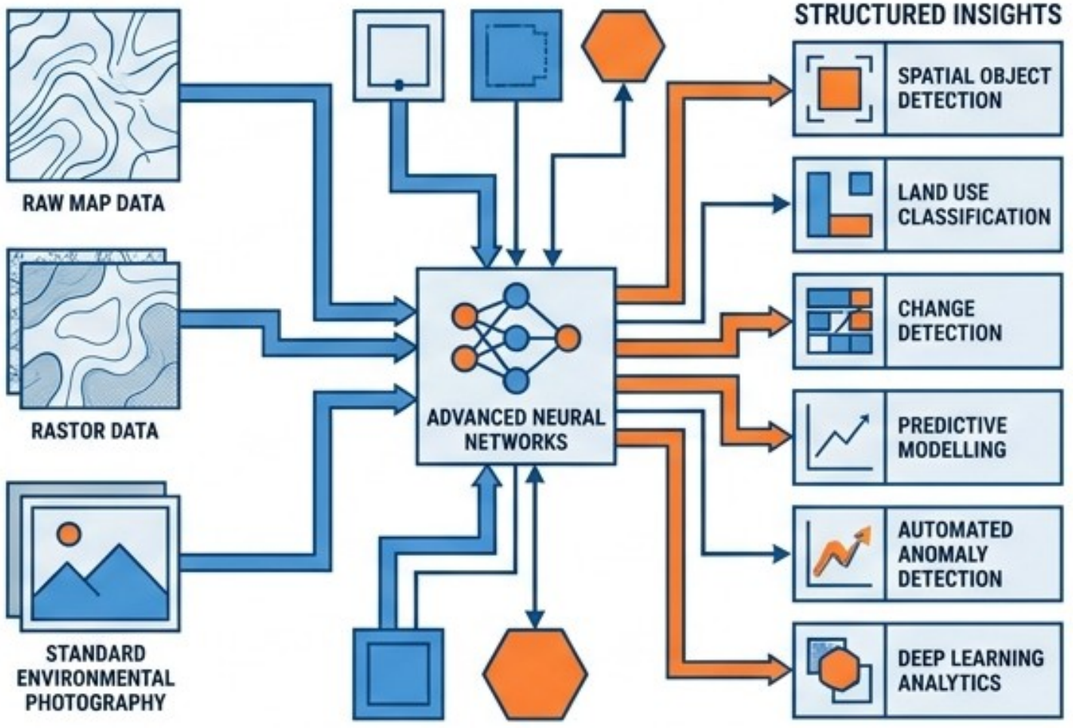
GeoAI is rapidly redefining spatial data science and geography.

The Past: Traditional GEOINT



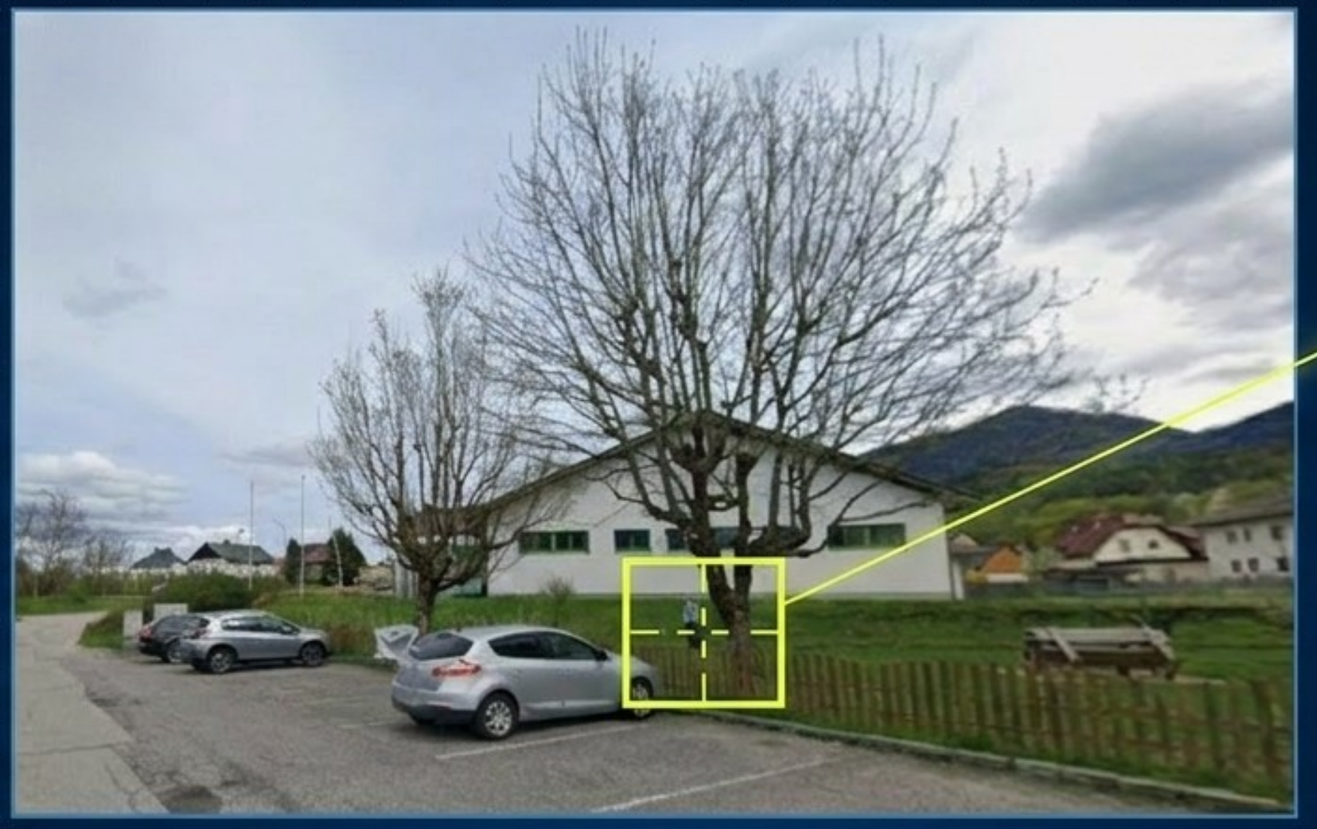
Geospatial Intelligence traditionally relied on manual analysis to understand objects and events across space and time. It was limited by human processing speed and surface-level correlations.

The Future: Automated GeoAI



The integration of advanced neural networks into spatial studies automatically extracts deep, structured insights from raw map data and standard environmental photography.

The unstructured challenge of a standard normalized scene.



Unidentified Object:
Meaning and location context required.

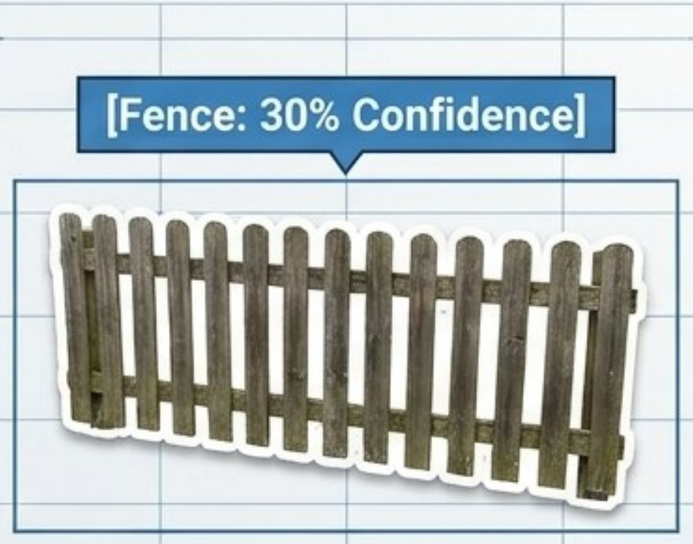
Raw Pixels
AI sees a flat collection of pixels representing familiar shapes.

Similarity Fails
Simple object detection struggles with ambiguous or overlapping items.

The Goal
Extracting the functional meaning and macro-location context of the entire environment.

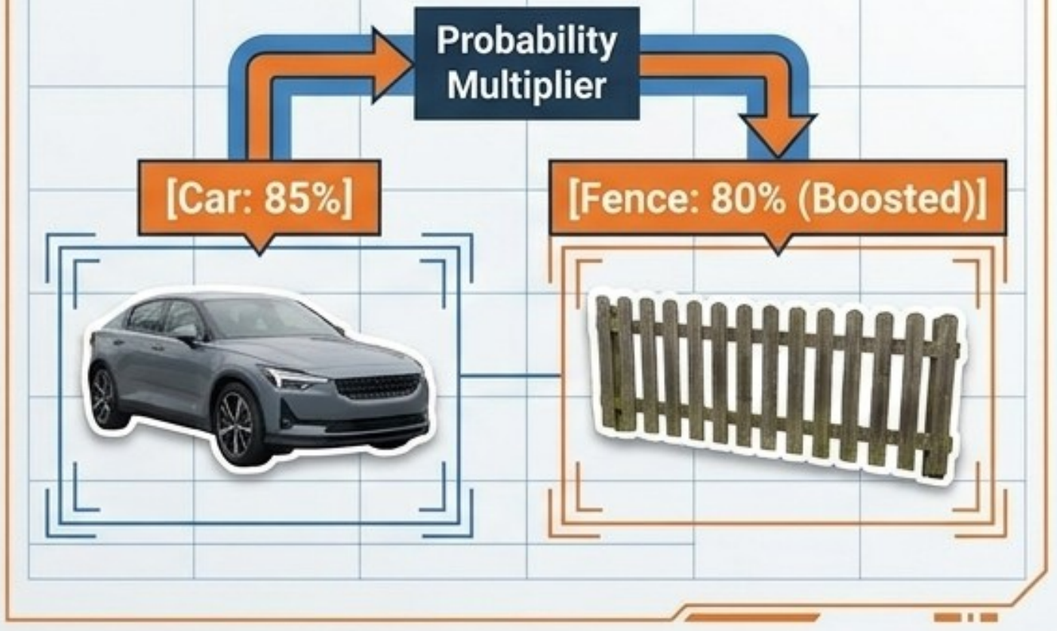
True intelligence relies on contextual probability multipliers.

Standard Detection



Standard object detection struggles with ambiguous shapes, treating every object in isolation.

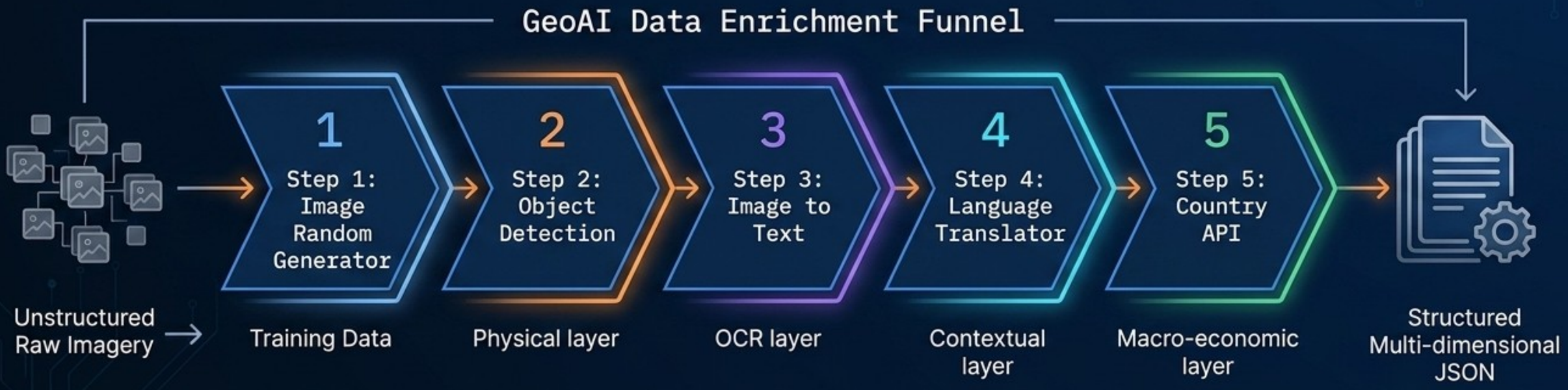
Correlated Detection



GeoAI recognizes that cars are typically parked in front of fences, dramatically boosting the probability score of a low-confidence object based on spatial proximity to high-confidence objects.

The sequential extraction of layered geographic knowledge.

By linking 5 distinct API endpoints into a cohesive architecture, we transform raw imagery into deeply enriched multi-dimensional data.



Stage 1: Isolating high-confidence physical entities.

Data Card

```
{'label': 'car',
 'confidence': '0.78',
 'bounding_box': {
  {'x1': '253',
   'y1': '455', ...}}
 }}
```

Architecture Callout

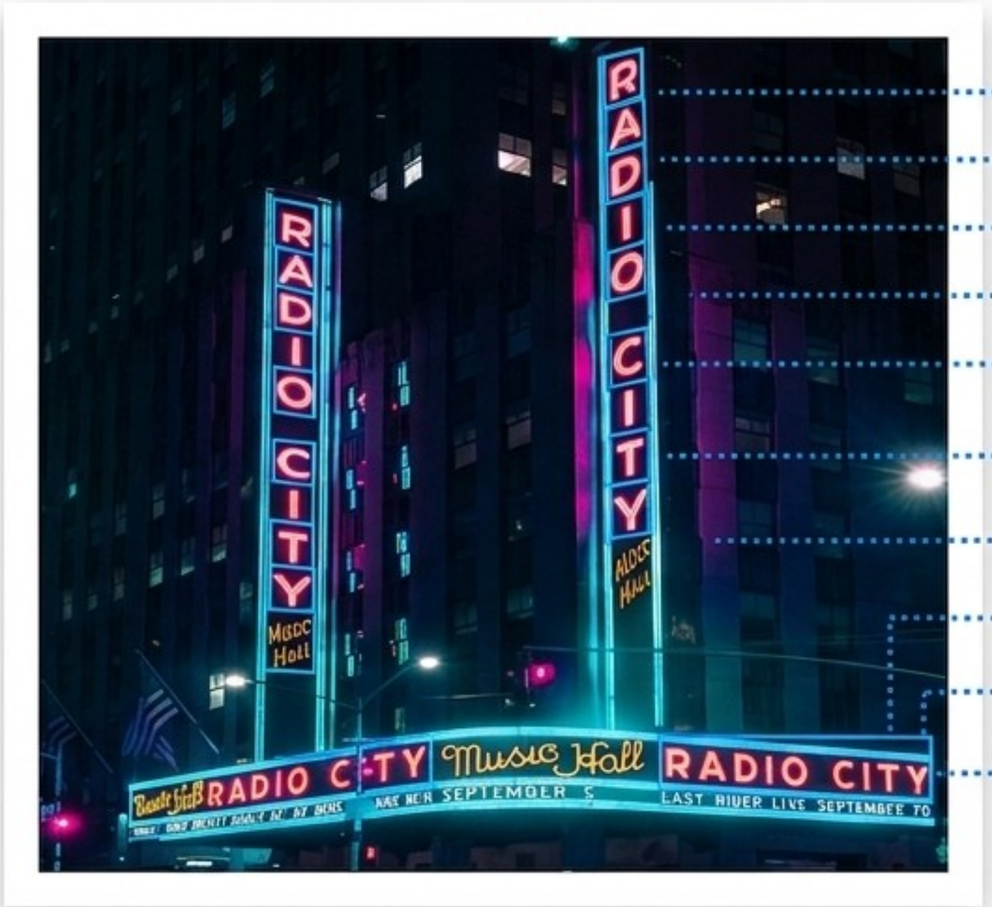
Logical Trigger:

```
requests.post(api_url,
  files=files,
  headers={'X-Api-Key'})
```

Filters objects < 0.30 confidence to ensure baseline data integrity.

Stage 2: Extracting state-of-the-art optical characters.

The pipeline shifts from shapes to syntax. The API deploys advanced OCR to extract strings from complex lighting, varying font scales, and handwriting.




```
[
  {
    'text': 'RADIO CITY',
    'bounding_box': {
      'x1': 148,
      'y1': 26,
      'x2': 262,
      'y2': 46
    }
  }
]
```

Stage 3: Resolving localized context via translation.

Extracted text is useless without comprehension. The pipeline routes native strings through translation endpoints, standardizing data for the geographic query.

Input


```
OCR Output:
[{'text': '偶数'...}]
```

The Engine

Architectural Callout

Endpoint Routine:

```
clients5.google.com/translate_
a/t?client=dict-chrome-
ex&sl=%s&tl=%s&q=%s
```

Output

Data Card

Translated String:

'Even Number' (English)

Stage 4: Attaching macro-economic and demographic payloads

The Country API pulls key statistics based on the translated context, permanently linking the raw visual scene to macro-level global intelligence.

Raw Output

Terminal


```
{
  "gdp": 4971323.0,
  "sex_ratio": 95.4,
  "surface_area": 377930.0,
  "life_expectancy_male": 81.3,
  "unemployment": 2.3,
  "imports": 720895.0,
  "homicide_rate": 0.3,
  "currency": {
    "code": "JPY",
    "name": "Japanese Yen",
    "symbol": "¥"
  }
}
```


Structured Intelligence

Target Location

Japan (Code: JPY)

GDP

4,971,323.0

Life Expectancy (Male)

81.3

Unemployment

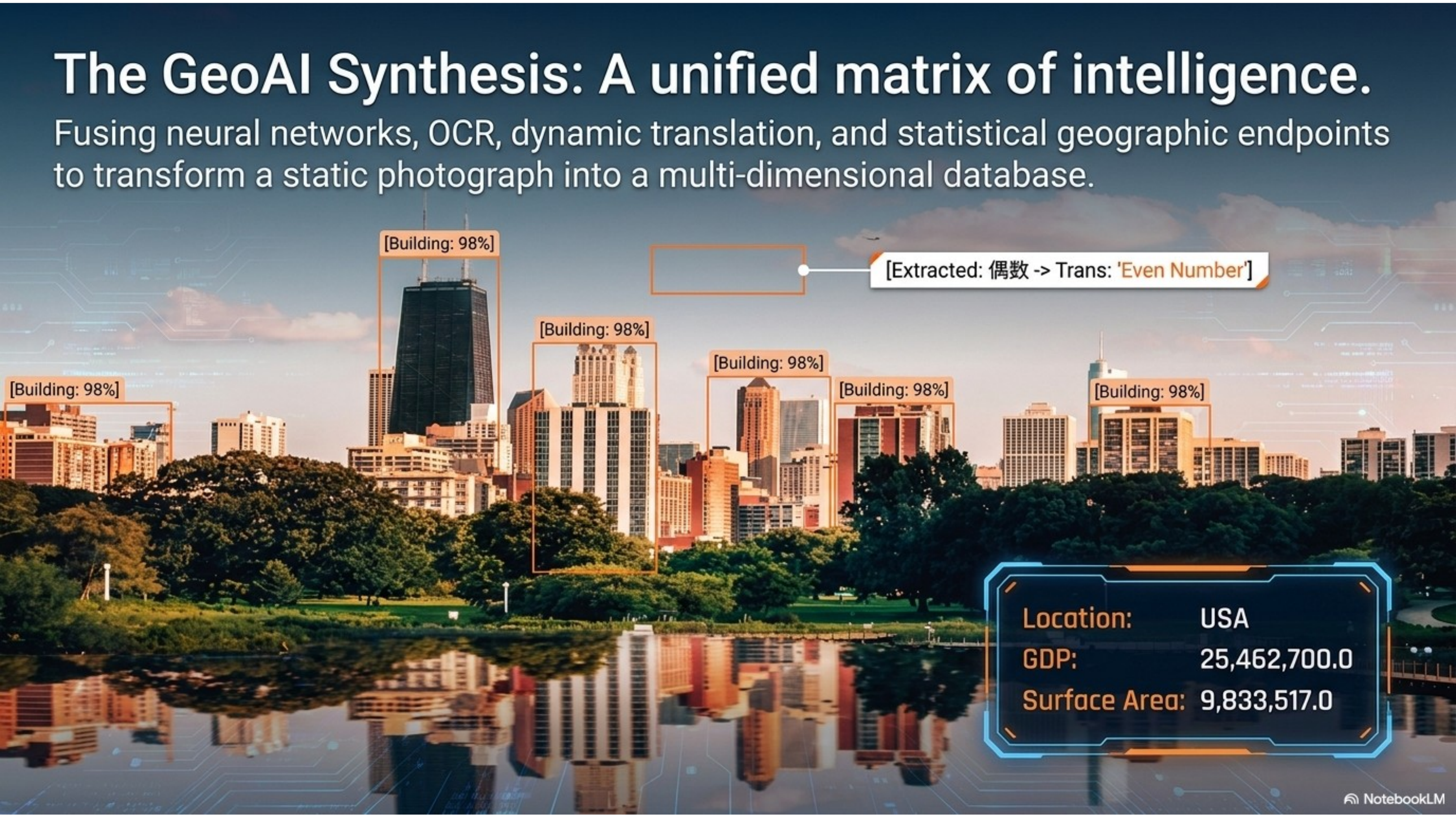
2.3%

Homicide Rate

0.3

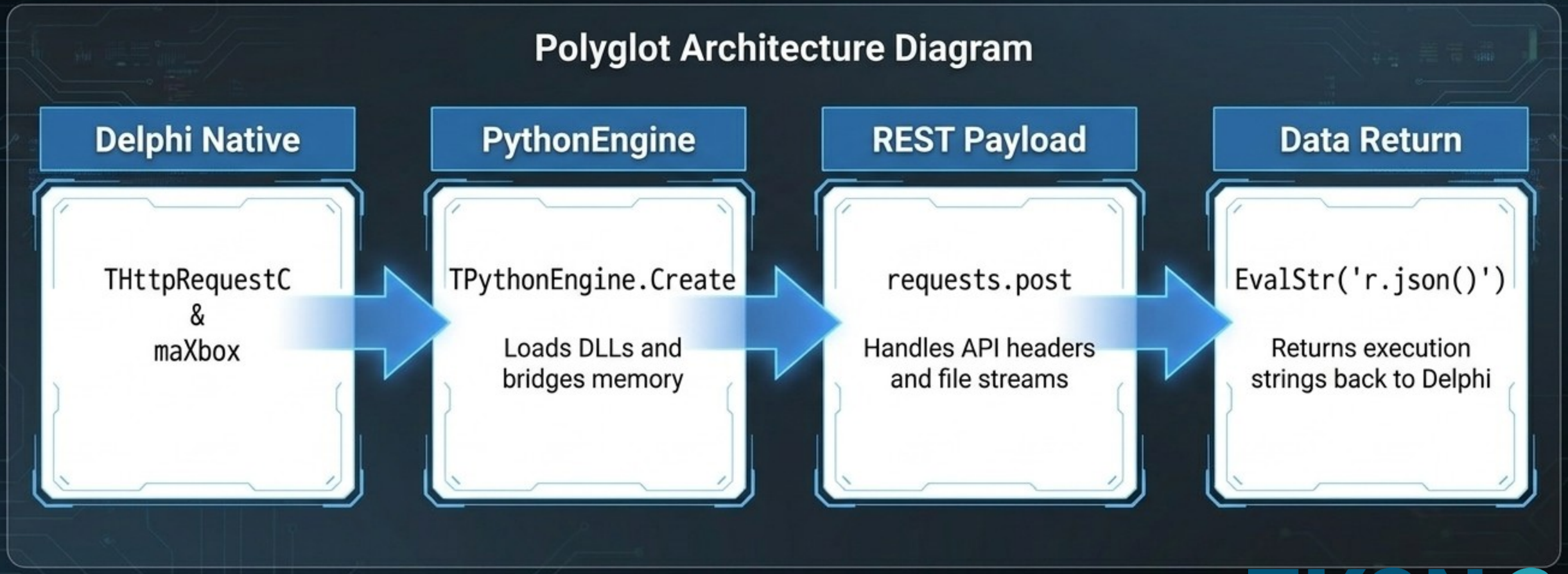
The GeoAI Synthesis: A unified matrix of intelligence.

Fusing neural networks, OCR, dynamic translation, and statistical geographic endpoints to transform a static photograph into a multi-dimensional database.



Orchestrating the pipeline via polyglot architecture.

A seamless integration of Delphi and Python natively handles HTTP requests, memory management, and REST API payloads.



GEO Guessing

https://maxbox6.wordpress.com/ekon-30/

https://github.com/maxkleiner/maXbox5/tree/main/EKON30

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Key Takeaways

- GEO intelligence is about combining weak signals.
- One API is not enough for strong inference.
- Visual search or similarity search is an enrichment
- Correlation across objects, text, and geography improves accuracy.
- GEO intelligence is a pipeline, not a single API.
- Stronger inference comes from correlation across signals.
- Object detection, OCR, translation, and geography work best together.

- Speaker notes: Close with the central idea: the pipeline is more powerful than any single model.

https://maxbox6.wordpress.com/ekon-30/

https://github.com/maxkleiner/maXbox5/tree/main/EKON30

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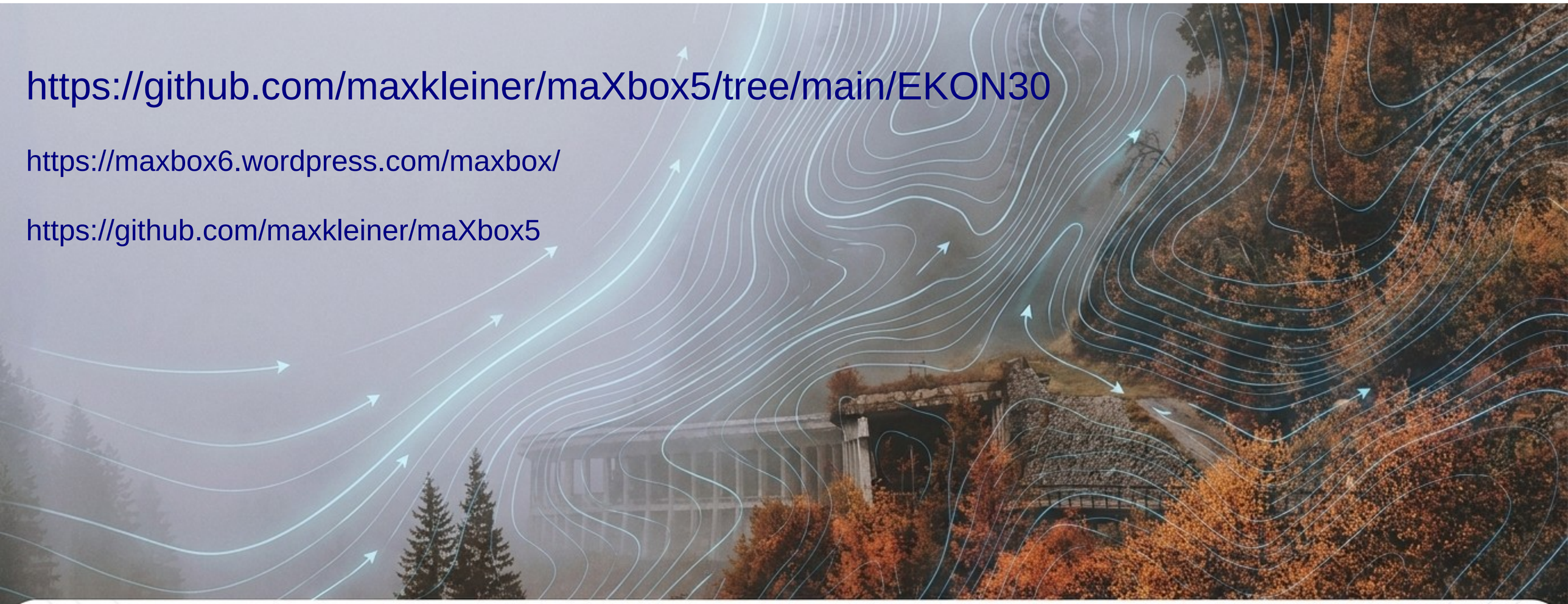
https://github.com/maxkleiner/maXbox5/tree/main/EKON30

https://maxbox6.wordpress.com/maxbox/

https://github.com/maxkleiner/maXbox5



Expanding the aperture: The future of spatial data science.

maXbox5

GeoAI has rapidly evolved past specialized applications in basic computer vision. Modern enrichment pipelines are now scaling to evaluate vast environmental time series, predict meteorological shifts, and autonomously identify complex topological anomalies on a global scale.

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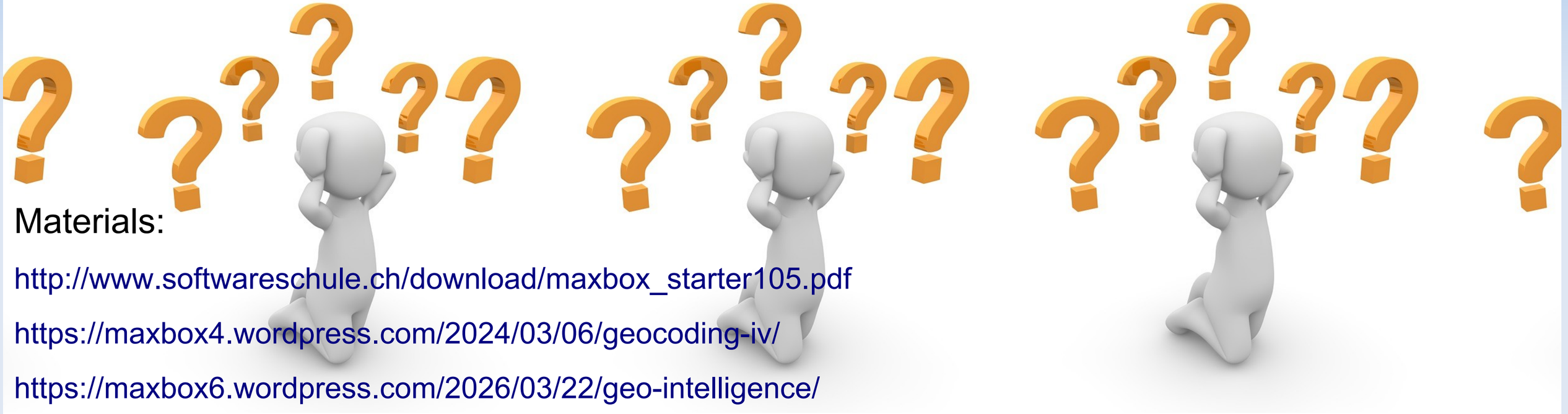
GEO AI Cod

Thanks for coming!



Materials:

http://www.softwareschule.ch/download/maxbox_starter105.pdf

https://maxbox4.wordpress.com/2024/03/06/geocoding-iv/

https://maxbox6.wordpress.com/2026/03/22/geo-intelligence/

https://maxbox6.wordpress.com/ekon-30/