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Being an AI analytics SaaS start-up in the Earth observation market

By Georgy Potapov and Andrey Pirogov, Geoalert, Uzbekistan/USA

What is it like to be a start-up in the Earth observation market? Geoalert has developed an AI-powered SaaS platform called Mapflow.ai and promotes streaming services for Earth observation data. After being established in Russia in 2018, the company relocated to Uzbekistan in 2022 and was incorporated in the USA in 2023. The company actively supports open geodata activities in Central Asia.

Analytic services and Earth observation (EO) data would appear to be well matched, as it's all about the interpretation of a large number of pixels and extracting information about real-world objects. Moreover, the development of big-data tech has unlocked opportunities for cost-effective solutions and implementations into many business processes, contributing to overall market growth. However, the Euroconsult Report (2021) says that there is still poor adoption: Earth observation accounts for about about 2% of all downstream applications vs 14% of upstream, which means that the data services from the growing number of sensors are far exceeding the capacity of the applications market. Therefore, building a software-as-a-service (SaaS) product seems like a viable and reasonable strategy.

▲ *Building detection and classification with Mapflow Buildings model.*

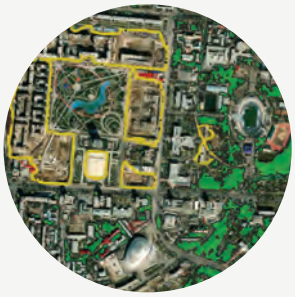
Data distribution via streaming services

The SaaS model heavily depends on data as a service (DaaS) and both significantly contribute to market development by increasing data consumption and leveraging the use of geospatial imagery. Data providers like Maxar moved their most recent archives to the cloud, so every data analyst or developer can now connect online to the latest, updated high-resolution imagery. In Geoalert's experience, however, the traditional imagery distribution model (files by FTP) still prevails in the customer mindset, especially among customers in the governmental sector.

Platform as a business model

For Geoalert, as for many companies, the SaaS business model is a trade-off between maximizing the revenue and investing in product development for company capitalization. When it comes to SaaS and analytics, Geoalert's business model broadly covers data distribution and analytics, but does not extend to sales distribution. The start-up has two revenue streams: subscriptions to the platform (Mapflow Premium) and integrated solutions (Mapflow Custom). The first category comprises all customers who purchase standard plans and require little to no customization. The second category constitutes customers who require Mapflow to be extended or integration with external products as a custom solution.

"Usually, it comes down to the adoption of the current AI analytics models to the customer's domain," states Georgy Potapov, CEO of Geoalert. "Our optimistic forecast is based on the assumption that



▲ *Urban Green Patterns, Amsterdam. Extracted with Mapflow Forest model.*

▲ *Tashkent city – AI-detected vegetation and construction sites in high-resolution satellite imagery.*

the contribution of Mapflow subscriptions (SaaS model) will rise with the increase in the number of clients, while the share of tailored projects will diminish as Mapflow's functionality evolves and starts covering more cases." To this end, Geoalert provides a Mapflow API to encourage more partners to leverage geospatial imagery analysis and mapping for their own solutions and applications. Image Search API allows external developers to search for the available imagery while the Mapflow integration with the data streaming providers enables instant processing of the selected imagery with an AI model. The Data API is designed to manage the user's own data, organize it into collections (mosaics), reuse it for future processing, and preview it as an XYZ/TMS layer.

AI implementation matters

"We see the growing interest in the idea of AI-assisting tools that help to reduce costs for imagery and human work and speed up the whole thing many times," comments Andrey Pirogov, Geoalert's CMO. "However, when it comes to investing in the modification of traditional workflows, business users are somewhat reluctant. To facilitate companies in this integration, we have developed various tools for interacting with the core platform."

Different stages of the mapping workflow differ in terms of labour costs. For example, an aerial survey can be done in just a couple of hours, while satellite images can be purchased online. Orthomaps can be generated with a high degree of automation using today's photogrammetric software. The final stage is the most labour-intensive due to manual vectorization. To achieve maximum effectiveness of AI implementation at the next stage, mapping companies usually need to start with a semi-automatic approach based on GIS integration.

According to Geoalert, the basic approach to fine-tuning and customizing the model to meet extended project requirements can be described as follows:

1. Study the specific area patterns with different models and data sources to prepare samples,
2. Agree on the best-fit-possible output to analyse and decide whether further fine-tuning of the model is required.
3. Agree on all the terms and kick off the project. At this stage, AI-generated data can be validated by cartographers; the more accurate it is, the less validation is required at the next stage.
4. Achieve fully automatic processing with sufficient quality on a large scale.

Custom fine-tuning of Mapflow

Whatever neural network architecture is used, the output results depend on the quantity and quality of the training samples. Geoalert's approach is to go for a 'best-fit baseline model' that can be quickly fine-tuned with additional training sets. These fine-tuned models are integrated into the platform to be selected by the recommendation algorithm with adjusted processing parameters based on the user input data. Around a year ago, the Geoalert team implemented the feedback option into Mapflow.ai, allowing users to rate the processing results by simply scoring them from 1 to 5. As the visual patterns and image conditions change substantially, this user feedback helps them to identify the problematic areas where the current models perform poorly as well as the areas where they can showcase the best of Mapflow performance. By reviewing this feedback, the Geoalert developers concluded that SaaS users consider it to be a useful communication channel.

Powerful imagery integrations

Unlike many EO analytics projects, Geoalert didn't start with free Landsat and Sentinel data. Due to low resolution, these sources are not suitable for detailed topographic mapping. Instead, Mapflow is connected to default basemaps like Mapbox Satellite and to commercial imagery streaming services like Maxar SecureWatch. The core Mapflow machine learning (ML) models (Buildings, Forests, Roads, Construction Sites, Fields) were trained with a ground sample distance (GSD) of 50cm, and the new Aerial models are optimized for 10cm resolution. This kind of image resolution makes it possible to train models to detect and map relatively small objects such as rooftop structures or single trees. That works for topomap creation (for scales from 1:500 to 1:25,000), radio frequency network design, classification of vegetation in rural and urban areas, and many other applications.

What's next?

In terms of next steps to develop the platform, Geoalert has drawn up an ambitious AI-mapping plan:

- To provide the mapping and research community with AI-assisted mapping tools accessible via UI and API.
- To perform AI-mapping on a global scale thanks to the processing engine and active learning framework.
- To enable best-fit imagery selection at the highest possible time rate for rapid change detection and the respective mapping updates.

"The map is never complete," as they used to say in the OpenStreetMap community – not only because of the blanks or incompleteness of the map features, but also because changes are happening every minute, all over the world. Geoalert's mission is to ensure they are detected in a timely manner and interpreted intelligibly to provide a clear and current view of the Earth. ■