Up-to-Date Road Maps Using SAT2MAP

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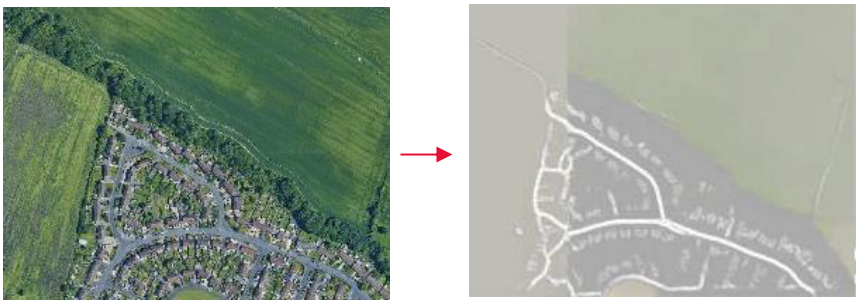
Transforming near-live satellite images into detailed up-to-date road maps using SAT2MAP for CycleGAN ensures reliable ground mapping and navigation.

THE CHALLENGE

Up-to-date road maps are of use in many fields of application. They provide improved navigation in areas struck by a catastrophe and enhance first aid response. They are of great use for military purposes as well: up-to-date road maps are highly beneficial for getting supplies to frontline troops or to direct first aid responders in disaster areas – for instance, after a crisis. Existing road maps can be outdated, and crises in certain areas could cause roads to become unusable or extremely dangerous to travel on. The quick conversion of near-live satellite imagery into maps can provide the solution to these problems and mitigate the risk to humans working in disaster areas.

OUR SOLUTION

In 2016, the British Ministry of Defence (MOD) called for a hackathon. CGI took the first place with SAT2MAP, a demonstrator for CycleGAN (Cycle consistent Generative Adversarial Network). CycleGAN is a machine learning algorithm that allows to calculate image-to-image transition and can be taught with unpaired training data.



Road recognition from satellite images.

This technology makes it possible to map current changes in road topology at short notice - and promises to deliver updated GeoJSON maps after a major change in road topology and specific areas of interest faster than other map service providers. The images in this document were calculated using training data consisting of 37,000 satellite images of the UK.

ABOUT CGI SPACE

CGI has more than 40 years of experience in consulting and system integration for Earth observation, navigation, satellite monitoring and control, the ground segment, flight dynamics, and data processing.

Our focus is on customer-oriented solutions, in which innovation and new technologies are applied, for example automation of operations for satellite constellations, data processing with artificial intelligence, and modern cloud solutions for Software-as-a-Service (SaaS).

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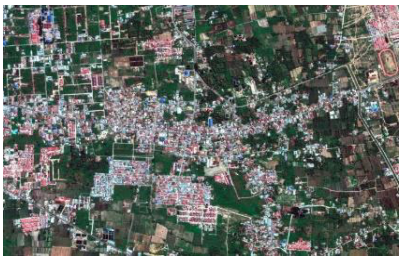
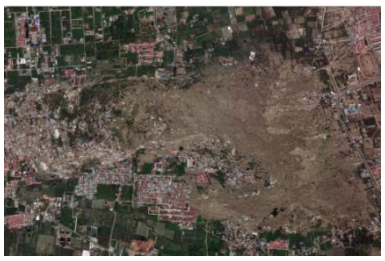
REAL EXAMPLE

In September 2018, Palu, Indonesia, was hit with a 7.5-magnitude earthquake. The impact of this earthquake on the infrastructure in Palu can be observed comparing satellite images of the area before and after the quake.

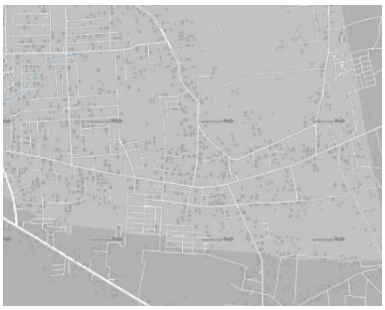


Before the earthquake

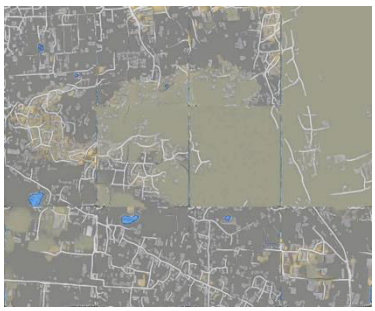


After the earthquake

The road map retrieved using Google Earth and GAN vary greatly.



After the earthquake (Google)



After the earthquake (SAT2MAP)

The software architecture of SAT2MAP ensures the integration of established geographical map formats like ArcGIS and the material provided by ZGeoBw for the Bundeswehr (German armed forces).

Potential for development

A set of training data can only be generic in only limited means. Differing city architecture as well as differing geographies come into play. To reliably apply this technology in differing geographic regions, more than one training set should be used and the results should be compared.

In addition, the results would need to be vectorized and related map features need to be extracted. To distinguish different objects on the satellite imagery, a variety of training sets should be applied (e.g. street detection, woods, water, cars etc.) and combined.

The initial prototype as developed in the hackathon is currently being further developed by a development team at CGI. We aim at developing within the next few months a first solution that can be used within limits operationally. At this stage, CGI has great interest to communicate with users from the public domain to cover all requirements.

ABOUT CGI

CGI is a global service provider for IT and business processes. We were founded in 1976 and have a total of 77,500 employees at 400 locations in 40 countries.

We are on-site for our customers – with strategic IT and business consulting, systems integration, managed IT, business process services, and intellectual property at a top level.

We support our customers in making better use of ongoing investments, while at the same time leveraging new digital technologies and business strategies that enable customers to achieve the best solutions across the entire value chain.

Regarding time and budget, we are regularly awarded due to our strict delivery discipline To this end, we have consistently achieved more than nine out of ten potential points in customer satisfaction surveys over the past ten years.

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