Kadaster proeftuin BGT change detection

Motivation

The BGT must be updated annually by the source holders. Traditionally, changes to BGT have been recorded with the help of stereo aerial photos. The changes are manually recorded or updated by comparing two aerial photos or aerial photo with the map.
Object recognition from digital images like aerial photos or satellite imagery has been quickly developing over the past years. In addition, experiments to automatically detect triggers for change by comparing two aerial photos or aerial photo with the BGT have been conducted. However, these techniques have not yet been scaled up since the processes need to be highly efficient and the quality requirements of the product are high. The challenge therefore is to save time and the end product must be advantageous for the source holders of BGT in providing a same or higher quality result at less cost.

Innovative “proeftuin”

The Kadaster aims to create an innovative testing ground (“proeftuin”) together with private organizations and government organizations to explore and improve the current state of automated change detection for BGT. The central idea of the “proeftuin” is knowledge sharing, communicating, and learning from each other. This brings out the advantages and disadvantages of automated change detection, which can then be used to improve and implement them within governments. This initiative is supported by the SVB-BGT and the Ministry of the Interior and Kingdom Relations (BZK).

Goal

To create understanding and improvements to AI algorithms for automated change detection for large scale implementation and use by source holders and Kadaster in their BGT and BRT maintenance process. This practical question aims to provide insight in bringing innovation a step closer to the production process.

A Unique project for all participants

In this proeftuin, suppliers, source holders and the Kadaster work together to acquire a realistic picture of the current state of the art techniques in AI. The focus lies in communication and learning from each other in order to improve the process where:

- Suppliers are given the opportunity to train, test and improve their product or service based on the feedback from Kadaster, SVB-BGT and the requirements of the source holders. Ground truth will be delivered by the Kadaster so that companies do not have to prepare this data set. This saves a lot of time and effort.
- SVB-BGT, BZK and the Kadaster gain insights onto the quality and efficiency of the techniques used and are intrigued by the possibility of automating the process of detecting changes in the current BGT process.
- Source holders request their requirements where possible so that suppliers can use this information in their process development. This is essential to be able to implement the process in reality. In addition, source holders can get acquainted with the added value of the technique and further contribute to its development.
- The proeftuin is facilitated by making the ground truth available to the participant by Kadaster. Kadaster will also provide insight into the development of the key registrations. Since Kadaster manages many key registers, it has knowledge and experience about the corresponding data acquisition process.

Moreover, Kadaster is also looking into smarter ways of data acquisition for BRT as it is the source holder for this product.

- The methods and concepts are to be shared completely with the SVB-BGT, BZK and the Kadaster. We respect the sensitivity of “know-how” of the companies. Therefore, the suppliers can themselves determine what knowledge they would like to share with other companies within the proeftuin.

Work and learning sessions

Werkplaats AI en locatiedata

The *werkplaats AI en locatiedata* (Workplace AI and location data) is an initiative by GeoSamen. It is an open and transparent community or practice for professionals from the government, business, and education sectors, working on the application of AI and spatial data, focused on three themes:

- Identifying changes in outdoor spaces,
- Inspection and enforcement of regulations in public spaces and
- Security issues related to mobility

Practicality and speed are important for each of these themes. AI offers the possibility of providing more accurate and faster results with fewer people. Given that one of the themes within the “werkplaats” focusses on change detection and since the “werkplaats” also has a large network within government and education sectors, this facilitates several open knowledge sessions. Below you will find more information about the intended work and learning sessions.

Types of work and learning sessions

In collaboration with the “*Werkplaats AI en locatiedata”*, Kadaster will offer a program to discuss the (interim) results and related themes in each phase of the project. This includes open and closed work sessions aimed at knowledge exchange, learning and innovation, such as:

- a closed learning and working session with BGT source holders about the use of automated change detection in the source holder’s process.
- an information session in which the BZK and the Kadaster explain the future vision of the key registrations and information flows.
- a learning session in which recent research from universities will be presented and how this can be used in context with the results from the “proeftuin”.
- a session on ethics and AI as governments would like to be transparent about the algorithms used.
- an innovation session in which the participating companies present their services and the workshop participants together can address the bottlenecks or put forward points for improvement.
- an open session where the results of the “proeftuin” are presented to the community of the “*Werkplaats AI en locatiedata”*.

The open sessions will take place within the “*Werkplaats AI en locatiedata”*, external companies (outside the “proeftuin”) can take part these open sessions. The closed sessions are only for participants of the “proeftuin”. The objective is to have a dynamic in-depth discussion during the sessions with plenty of room for questions and interaction.

The subsequent document contains information about the “proeftuin” and the conditions for companies to participate.

The “proeftuin”

Data analysts are well acquainted the problems associated when working with large data sets. 80% of the time is usually spent on data preparation and data cleaning for further analysis, especially, when it comes to ground truth preparation for training AI algorithms. After all, no matter how smart the models are, it is always “garbage-in, garbage-out”.

Data Preparation by Kadaster

Data preparation, i.e. base data sets that are required for training the models, is carried out by the Kadaster. 10cm RGB aerial photos that have been flown in 2018 and 2019 will be made available. In addition, a change layer from the BGT will be included where actual locations of changes are marked on comparing these years.
What is delivered?
Ten municipalities in the Netherlands have been selected from where BGT data will be used. For each municipality, the changes that have been detected in the BGT between 2019 and 2020 are captured. In total 1500 BGT features are made available where changes have taken place and 1500 features where no changes have taken place. During this process, attention is paid to achieve a good distribution of different feature types. In addition to the BGT features, the corresponding stereo aerial photos with as 60/30 overlap from 2018 and 2019 with a resolution of 10cm including metadata are delivered. These stereo aerial photographs are made available specifically for this study and may not be used for any other purpose.
When a company is ready to deliver results, a one-time set of aerial photos will be released for testing the models; this will be the set on which Kadaster will carry out the quality control.

Execution by participants

By means of the prepared data, participants can perform photo to photo comparison with the objective of delivering a list of detected changes. It is expected that a 95% accuracy can be guaranteed, in compliance with BGT specifications. This means that a detection list along with details stating how much needs to be controlled to achieve this quality should be submitted. These results are checked by the Kadaster. In addition, the company can also perform the above-mentioned step (quality control) to indicate how much time they spend on this, if smart control processes have already been developed for this purpose. In this manner, smart control processes could also be incorporated the assessment. The actual editing of features is not within the scope of this project. The 95% accuracy concerns the features mentioned in appendix I. Since, 95% is a high score it is expected that manual work will be required to achieve this. Ultimately, the goal is to be able to reduce time and costs, a process that is partly automatic and partly manual can contribute well to this goal. Optionally, participants can perform a map to photo comparison, in which errors in the map are detected. This is not a mandatory part of this project. However, this is seen as an important product as there is clear interest in this type of product not only from the source holders, but also from BZK.

Terms and conditions

- A maximum of 10 private businesses can take part in this project. Companies can register until September 17, 2020.
- Participants take part in this project (“proeftuin”) at their own expense.
- The “proeftuin” will continue up until April 1, 2021. Until then, the offered data will be available strictly for the purpose of working on the “proeftuin”.
- Part of the participation agreement is a non-disclosure agreement in which the participant declares to use the data only for the purpose of this project and adheres to the conditions as described here.
- A company that wants to participate must be committed to delivering results. Companies are dissuaded from withdrawing halfway through the project, as other interested companies couldn’t participate due to the limited number of places.
- Methods and concepts must be exchanged with the Kadaster, BZK and SVB-BGT. This pertains to:
  - Information to be shared: type of algorithms and data layers used. Consider, for example, were height information or satellite data used? Is shadow, for example, considered? What are the main steps undertaken for preprocessing and postprocessing?
  - Not to be shared: neither the code nor detailed information about how the algorithms were trained nor the order in which the process is put together does not need to be shared.
- The Kadaster accesses the results in this project considering the following factors
  - Accuracy assessment and quality scores
  - Processing time
  - How complete is the process?
  - How much manual work does it contain?
  - How robust is the process and durability over the years?
  - How applicable are the results?
  - How much time does the whole process save?

When delivering the results, a document needs to be filled which comprises the above-mentioned information. The objective is to provide **detected changes with location** in an Excel document, a file geodatabase, or a shapefile format.

Registration

A maximum of ten companies would be selected for this project so that Kadaster can deliver the right quality in terms of cooperation, correspondence, and quality assessment. Registrations are open until September 16, 2020. The end date of the project and access to data is April 1, 2021. Admissions will be on “first come, first served” basis.

For registering, e-mail to Proeftuin@kadaster.nl

Every company that is interested will be contacted to discuss possible cooperation, so individual expectations are clear.
Final confirmation of admission to the “proeftuin” is always by email.

Save the date: The first joint meeting of the “proeftuin” is scheduled on September 29, 2020 from 10 a.m. to 12 p.m.
The companies participating in the “proeftuin” will then be known and the project officially commences during this kickoff meeting!

Appendix I Polygons BGT

The following features must at least be included in the process:

- BEGROEIDTERREINDEEL
- KUNSTWERDEEL
- ONBEGROEIDTERREINDEEL
- ONDERSTEUNENDWATERDEEL
- ONDERSTEUNENDWEGDEEL
- OVERBRUGGINGSDEEL
- OVERIGBOUWWERK
- PAND
- WATERDEEL
- WEGDEEL

kadaster

SVB BGT

Ministerie van Binnenlandse Zaken en Koninkrijksrelaties

Appendix II Feature Manual BGT

https://imgeo.geostandaarden.nl/