Forprosjektrapport gruppe 20

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Summary

The company Triona has a product called *SINUS.Infra* that is used to capture and display infrastructure related image data. The data pipeline for this system currently requires a lot of manual processing work and looking through many images with no relevant data. We are tasked with developing a prototype to see if you could save time and resources by using machine learning/object detection on said images. Theoretically the entire data processing could be automated with machine learning. However, cost, reliability and accuracy needs to be explored before we can deploy any ML(Machine Learning)/AI(Artificial intelligence) solution in production. We will be using the Azure Custom Vision api as the ML backend. The solution we are developing will hopefully provide a solid foundation for a system that in the future will be a part of the SINUS.Infra product.

Introduction

We are group 20 for bachelor project at TKD OsloMet spring 2019. Our group consists of the following members;

- Isak K. Torgersen, s311516@oslomet.no
- Lukas Haug Langøy, s311508@oslomet.no
- Pål Magnus Østern, s305471@oslomet.no

We will be doing our project for the company Triona. They say the following about themselves on their website;

“Triona is a leading and reliable supplier of innovative IT solutions within logistics- and infrastructure-oriented operations. We combine industry-specific competence and skills in transport infrastructure, power/energy, contractor related businesses, transports and forest industry with leading-edge experience within software engineering and maintenance.”

Our contacts in Triona is as follows;

- Erik Bosnes, utvikler, 902 75 027, Erik.Bosnes@triona.no
- Emil Nesvoll Maana, Avdelingsleder og seniorutvikler, 905 78 500, emil.maana@triona.no

Current state of affairs

Triona has a product called SINUS.Infra, which is described in the following manner on their website;

"SINUS.Infra is a web-based product which helps you capture infrastructure-related image data in a cost saving, efficient, and secure way.

SINUS.Infra can be used both in the office and out in the field delivering quality assured data directly to the Norwegian NVDB[1] or TNE[2] for example, without time consuming and costly intermediate steps. The mobile solution is customized for tablets and smartphones.

Here is a selection of the product's features:

- *Display of images and maps. In the mobile solution the map display takes place automatically based on your current position.*
- *Search for objects. When using the mobile solution this can be within a search radius of your current position.*
- *Display of objects on map.*
- *Functionality to fetch images with objects.*
- *Register, edit, and delete objects, with direct storage in a database, e.g. Norwegian NVDB or TNE.*
- *Registration module with option to browse images and register objects.*
- *Built-in module for issue management, where issues can be connected to objects.*
- *Functionality in the mobile solution for display of issues/assignments, which are allocated to the user, and status reporting for completed assignments.*

[1] Nasjonal vegdatabank
[2] Transport Network Engine

- *Registration of object documentation with storage of image or file to e.g. Norwegian NVDB or TNE.*
- *Photogrammetry, measurement (length and area), and position calculation based on images.*
- *Filter functions for objects."*

The gathering and processing of data for the SINUS.Infra system is done in two main stages. Firstly, a camera and GPS equipped car drives along the roads that needs to be mapped taking pictures every five meters. Secondly, a person (the data processor from now) manually processes the image data by looking through all the pictures, identifying road signs and anonymising license plates and people. The data processor essentially presses play and the system starts showing each picture sequentially and then the data processor pauses each time the picture contains relevant data. A triangulation method is used to tag the GPS coordinates of the road signs. The second part of this process is currently very time consuming as it requires that the data processor looks at each image, including those that contain no relevant data.

Goals and conditions

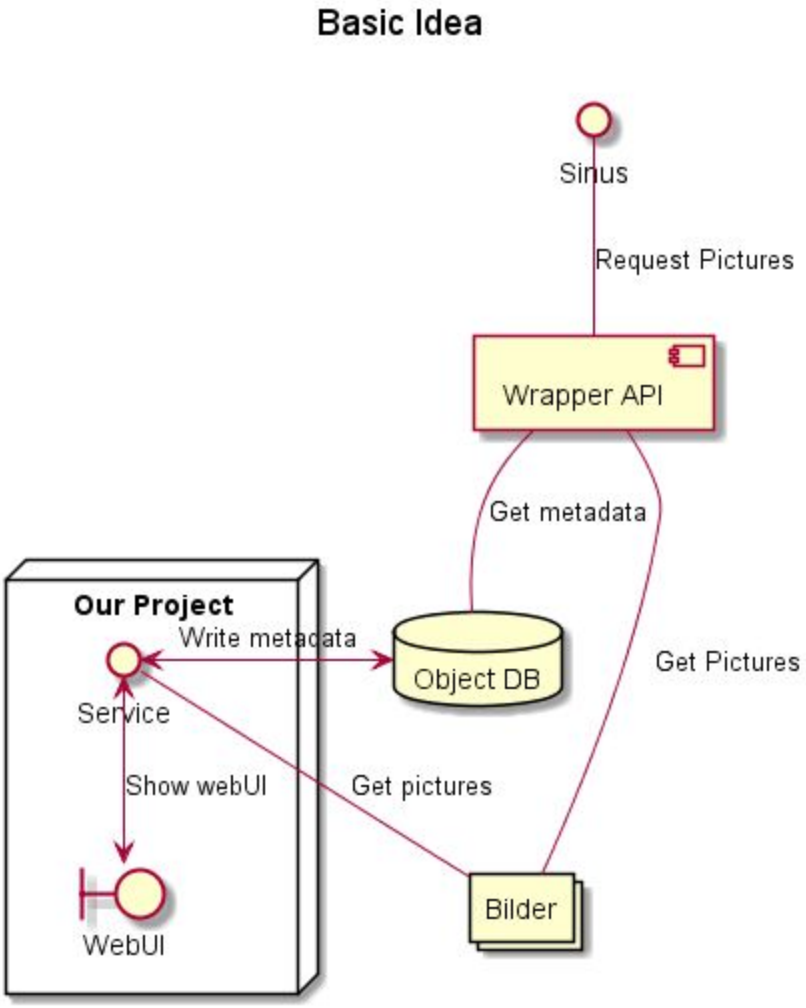
The goal of this project is to streamline the manual data processing part in the data pipeline of SINUS.Infra by creating a solution that automatically tags the images that contain relevant data. Relevant data in this case is road signs, car plates and people. The system should also be able to identify what kind of road sign it is. A possible goal would be that the system could automatically tag the position of road signs. We do however not know how feasible this is.

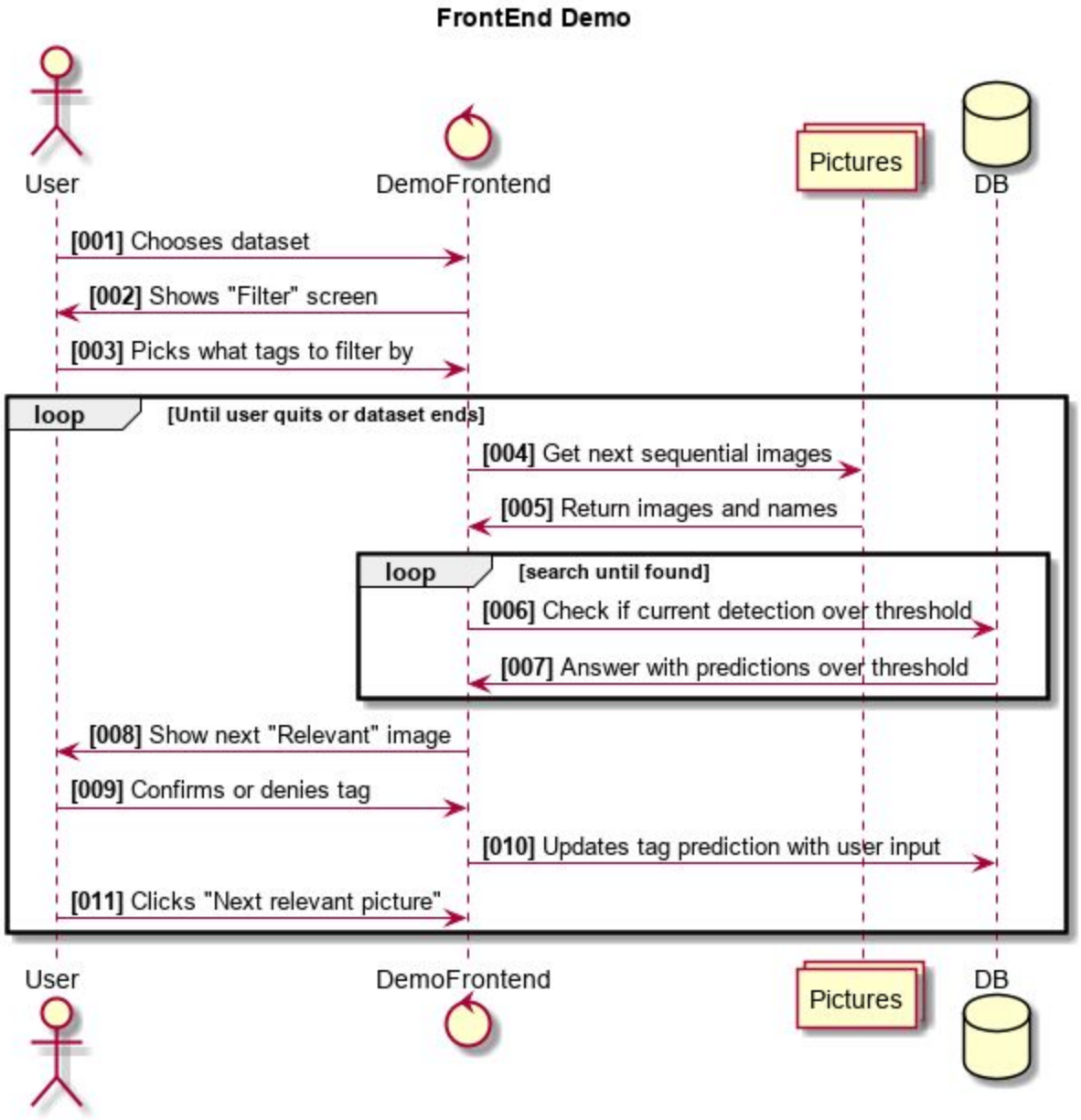
The system should eventually be able to integrate with SINUS.Infra in a way that allows the data processor to skip between each relevant picture instead of having to press play and watch every picture. Integration with the SINUS.Infra system is a secondary goal dependent on how much time the rest of the project takes.

The system we are developing also require a UI web interface that allows for the following functionality;

- Loading pictures into the system. How the pictures will be stored and loaded into the system is yet to be determined.
- Tagging pictures with metadata and object classifications.
- Training the machine learning algorithm on the given datasets.
- Prediction and testing of the current iteration of the algorithm.
- Give rapports/feedback on training and prediction.

These goals are explained by the solution for the problem, which we will cover in the next part of the report.





Solution

In order to reduce the time spent on the manual processing of the image data, Triona has decided they want to try a machine learning/object detection solution. We will be using the newly released Azure Custom Vision api to create a system that uses object detection to identify pictures with relevant data. The system will retrieve images from storage and allow the user to tag objects in the picture and train the machine learning algorithm. The system should also

allow the user to test the algorithm and should give the user relevant feedback on the training and predictions. User interaction with the system will be done through a web interface. The system should ultimately provide an api allowing the SINUS.Infra system to interface with it which will provide the skip function mentioned before.

The web interface will be created using Microsoft's .NET/.NET Core and the MVC framework. We will mainly be coding in C# and using Visual Studios.

Benefits

The possible benefits of the system that we are making are greatly reduced time and costs associated with processing the image data. If the data processor only has to look at pictures were there is relevant data then it would save a lot of work hours. If the system could also tag GPS coordinates and blur license plates and cars automatically, it might possibly eliminate the need for manual processing all together. This is however a best case scenario and it is very unlikely that we will get to that point during the bachelor project. How much time and resources would be saved with the new system depends on how accurate predictions the system would be able to make and the cost of processing the images in this way. Both of these are currently unknowns, but will become clearer as we proceed with the project. This is an exploratory project to see if machine learning/object detection is a viable cost saving tool for the SINUS.Infra system.