Computer Vision Project

Improving the Performance of Crowd Counting Approaches for Public Spaces

Team Public Eye - Tech Members

[redacted]



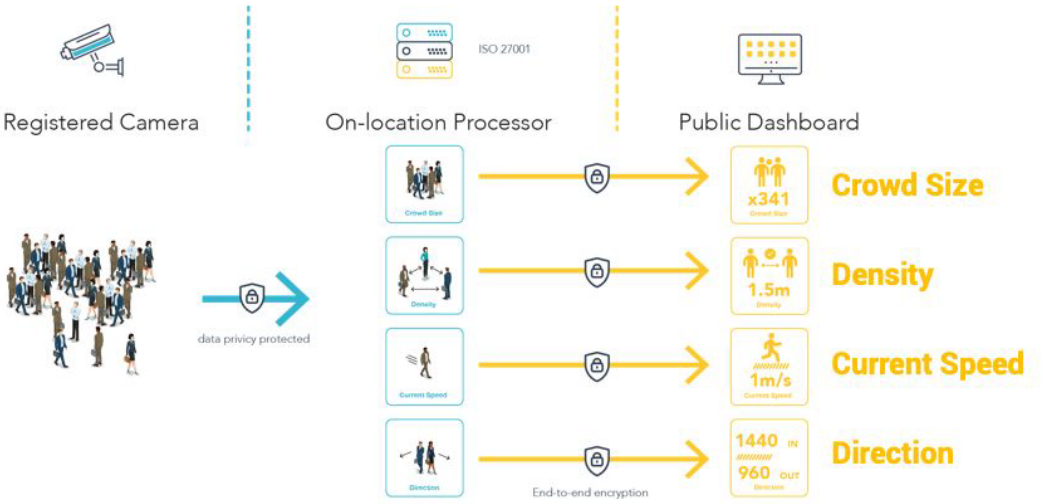
Project Description

The aim of this project is to research the possibility of using existing and new video streams of squares (and other public spaces) in the municipality to count crowd sizes and to get insight in crowd flows.

Historically, the municipality has been working with third parties to do crowd analysis on video material. However, working with third parties meant that the municipality did not have full insight in (and ownership of) the analysis process. Hence, the municipality could not make low-level decisions about the used approach, algorithm(s), trade-offs and involved ethics (privacy concerns etc.). Given the growing importance of these types of decisions, the municipality is now doing its part, and actively conducting research towards developing its own innovative solutions. This research project is called Public Eye.

Currently, the Public Eye project is in its startup-phase. In this phase, active research is being conducted by capturing and annotating our own video material and building and implementing preliminary solutions. We soon hope to test these solutions on real-life events, in and around Amsterdam.

The Public Eye project works towards an open-source alternative which hopes to make an impact on the transparency of crowd monitoring methods used by any governmental institution, today and in the future.



Possible research directions

1. Improving Crowd Counting with Flow Information (Artificial Intelligence)
Most existing crowd counting approaches (e.g. [redacted] - 2018, [redacted]. - 2019) only focus on using singular images to perform crowd counting, thus disregarding any possible temporal information that would be available when aiming to perform crowd counting on video streams. Some older and newer papers already use flow to improve crowd counting (e.g [redacted] & [redacted]. However, given the relatively low amount of attention given to this concept, we feel additional research in this direction could be fruitful.

2. Developing a Generalized Crowd Counting Model (Artificial Intelligence)
Currently, the Public Eye project uses an adaptation of the [redacted] to perform crowd counting. We pre-train this model on the [redacted], however this alone does not provide good performance on our own Dutch crowd-counting image material. This is probably due to the differences of environmental context between the [redacted] images and the Dutch images. To circumvent this problem, we now use transfer learning to retrain our models for specific Dutch camera's/scenes. To improve our counting performance, we re-train our [redacted] models on several individual scenes, hence "overfitting" our models on each of these scenes. This provides us with very good performance, but we sacrifice generalizability. Initial attempts to generalize our model for several Dutch camera's/scenes have not given us acceptable performance. In order to make our approach more robust and scalable, we now want to perform research in order to achieve a more generalizable model for Dutch environments.

3. Improving Computational Performance & enabling [redacted] Computing (Artificial Intelligence / Software Engineering)
Currently, we are working on research, valorization and modification of crowd counting and line-crossing-counting algorithms. Given that the Public Eye project is in its start-up phase,

we tend to lean towards improving our algorithm performance, and initially disregard the computational complexity of the approaches we design. However, this computational complexity will soon become a point of focus when the project transitions towards its scale-up phase. When we want to be able to process more camera streams simultaneously, we want to tweak our models so they work more efficiently, ideally while losing no or very little algorithm performance. In the long run, we probably want to transition towards on-edge computing by directly pairing cameras with local processing chips like the [redacted] Such a transition would massively help to reduce any privacy risks that come up for video processing projects, and would hence be a boon for our public acceptance. We would be very interested in collaborating with an AI researcher with interests leaning towards software engineering and hardware knowledge for this research direction.

What will the work environment look like for the student?

You will work with the Public Eye team, which is mainly located at the Amsterdam Institute for Advanced Metropolitan Solutions and XRBase (both on Marineterrein Amsterdam). Due to the corona crisis, most team members currently work from home. The team does tend to meet up every Friday for a weekly meeting (often digitally, but physically when possible). A physical working place at the Marineterrein could be organized if the student so desires.

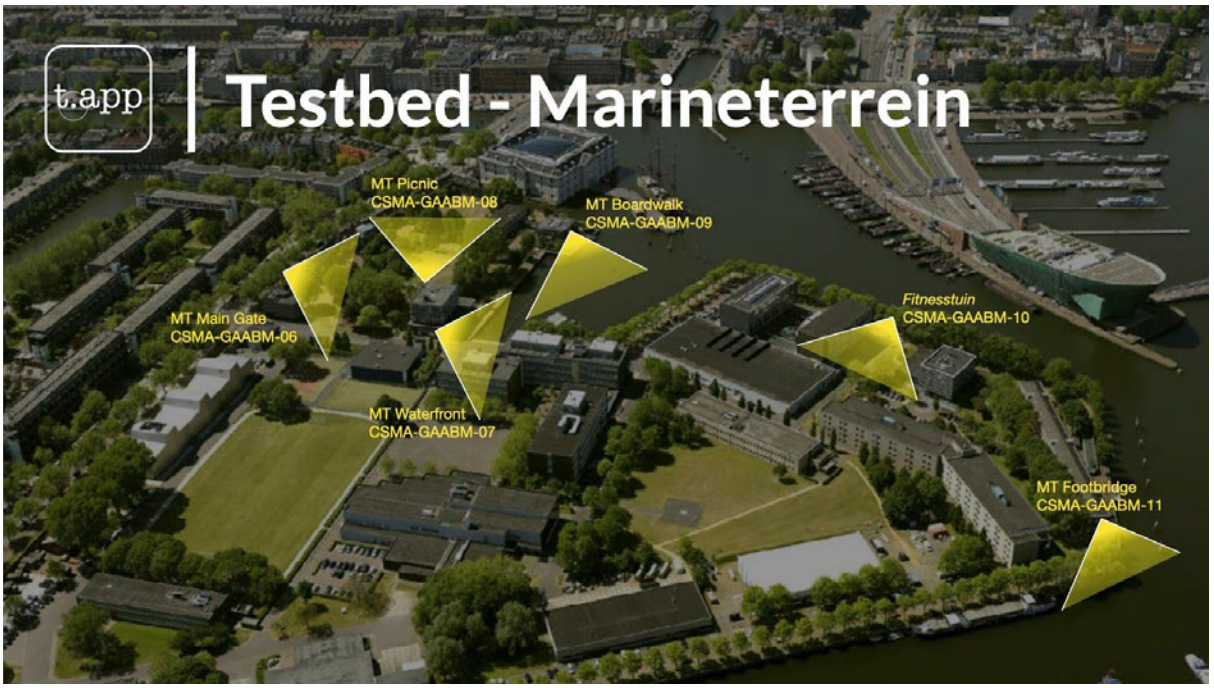
The Public Eye Team is a collaboration of members from both the public and private sector. The team members have a lot of experience in software development, artificial intelligence, and business analysis and have a good track record of implementing practical solutions using these techniques.

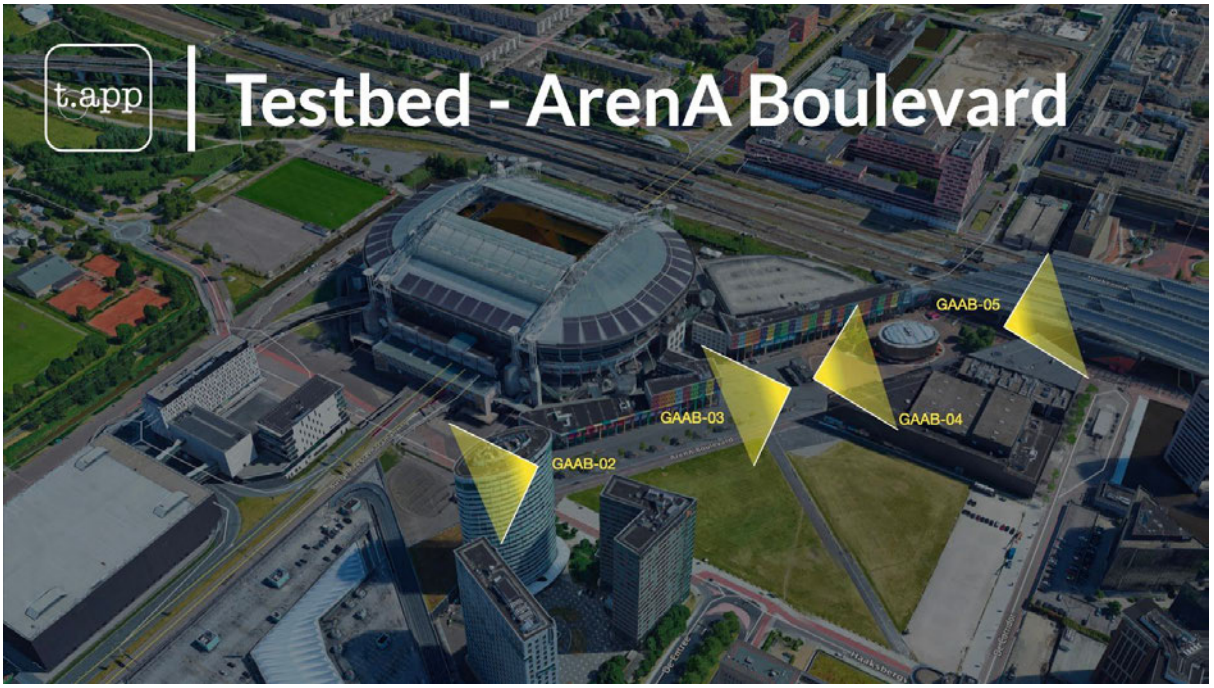
What we offer:

- A pleasant working environment
- Collaboration with a team of experienced people
- Responsibility over your project and progress
- A possibility to contribute to (your own?) smart city development
- A monthly internship compensation

What we expect from students:

- An independent work ethic
- Machine learning knowledge
- A keen interest in computer vision
- Python programming skills
- And most importantly: a passion for their field, an ambition to learn, and a drive to make Amsterdam even more beautiful!





LivingLabs for development:

Students will be able to build, test and deploy their solutions in living laboratories of the The Marineterrein (Inner-city test ground for a sustainable living environment) and Amsterdam ArenA Living Lab. On these locations students will be able use real events to collect, train and publish data.