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Google Street View Images Support the Development of Vision-Based Driver Assistance Systems

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Motivation

- The development of vision-based modules typically requires large amounts of data.
- Collecting appropriate data is often more time-consuming and more expensive than the algorithm development itself.
- Sometimes publicly available data sets can be useful.

- Google already did a lot of recording. The retrieval of images from Google Street View becomes a powerful alternative!

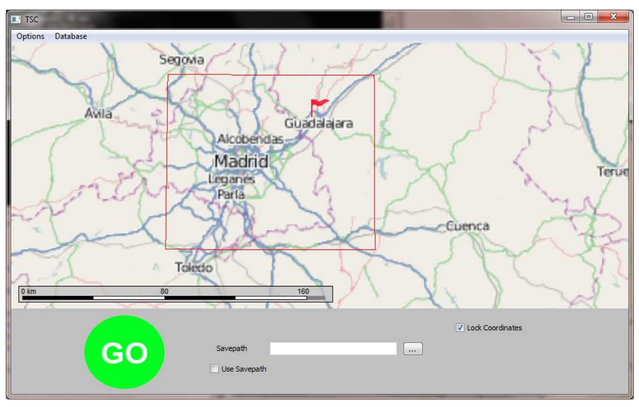
The Google Street View Static API

- Google Street View is a network of adjacent $360°$ high resolution panorama images.
- Those images are intended to be accessed via the Google Maps API. In order to make them usable for algorithm development, some undocumented features have to be considered.
- It is not completely clear that the presented way of usage is compliant with Google's terms of service.
- Many of the technical details have been described recently by Jamie Thompson in his weblog: `http://jamiethompson.co.uk/web/2010/05/15/google-streetview-static-api`
- Access to thumbnail images ...

- ... and image tiles can easily be achieved via an URL interface.

- In the largest zoom level, a panorama image with an impressive resolution of 90 mega pixels can be accessed.

Our framework



- GUI for virtual driving in Google Street View.
- Map scrolling and zooming realized with the freely available *Marble* toolkit: `http://edu.kde.org/marble`
- Definition of starting point and rectangular search.
- Using a *depth-first-search* algorithm.
- Saving panorama images, image processing, collection of statistical data, visualization of virtually driven distances and overall progress.
- Mean virtual driving speed up tp $300\,km/h$.

First evaluation

City	Distance *[km]*	#Panoramas	Time *[h]*
San Fransisco, USA	3023.8	268,127	10:03
Penghu Islands, Taiwan	514.8	44,736	1:41
Port Elizabeth, South Africa	2105.1	175,369	5:58
Belo Horizonte, Brazil	1426.3	128,459	4:33
Alcalá de Henares, Spain	409.9	32,645	1:01
Gold Coast, Australia	2509.8	219,558	8:34

Example application

- Collecting traffic sign images from Google Street View using a Viola-Jones detector.
- *Semi-supervised* training procedure, final detector with a precision of $49.3\,\%$ and a recall of $81.6\,\%$.

- For the very first detector training, we used images from the "'German Traffic Sign Recognition Benchmark"' (GTSRB, see `benchmark.ini.rub.de`) as positive examples and randomly chosen images from Street View as negative examples.
- If no data had been available, one could have collected a few training examples manually from Street View panorama images or any other image source.
- We were able to collect more than $10{,}000$ images of traffic signs within a single week...
- ... already more different sign *instances* than in our GTSRB dataset. Collecting data for GTSRB took our group several months!
- Virtual driving speed of approx. $40\,km/h$ on our test system.

Discussion

- The available data is biased – Recordings were predominantly made during daytime with stable weather conditions.
- No context between recordings – There are only few recordings of the same object and sometimes acquisitions were done months apart even with connected panoramas.
- A data set of this size has to be processed automatically – False Possible results are excluded systematically.

$\Rightarrow$ It becomes much easier for scientists and developers to train and test their approaches on large data sets.

$\Rightarrow$ In future work, we plan to collect datasets for object detection and classification in different countries.