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Enabling Smart City Infrastructure

Deloitte's road degradation detector: RoadRunner

Deloitte's road degradation solution "RoadRunner" utilizes computer vision to help local authorities prioritize roadworks – quickly and inexpensively.

The Need

Ripping up roads is tricky business. It is necessary for many reasons: whether surface repair or other work below ground, such as electrical, telephone/cable, or water works. Construction must

be meticulously planned: re-routing traffic, scheduling equipment, assembling teams of experts and machine operators... even before the work itself begins, which may then go on for months. A costly operation, in terms of money, time, and inconvenience to taxpayers.

Preventative maintenance – patching a hole or a crack at early stages – can stave off the need for major repairs. Coordinating surface

repair and underground works avoids duplicated efforts. Both of these strategies are in place around the world today, yet they are limited by the effort required to collect and interpret critical information. The associated costs make surveyor work a relatively infrequent undertaking, leaving authorities to work with less than current information, and base their roadworks proposals on loose approximations at best. ❯

Our Solution: RoadRunner

RoadRunner provides a regularly updated gauge of road health out of images that can be crowd-sourced from the road-faring community, either by smartphone or from in-vehicle cameras. It employs convolutional neural networks trained to recognize pot-holes, cracks and rips in captured images.

RoadRunner achieves this with to a high degree of accuracy – despite the relative difficulty of discerning cracks from seems, pot-holes from man-hole covers. It is a far from trivial task, substantially more difficult than differentiating between people, cars, trucks, signs – objects popular with autonomous driving solutions. Mastery requires a massive initial training set and careful tuning, as well as rigorous quality control of labeled data (facilitated by a separate aiStudio solution, "Green Label").

RoadRunner processes images to detect damage, then deduces the degree of "road health" from the images, as well as tracking the age of the source image. It associates health and age with geo-location. The result is an interactive map, along which the user may view "road health" and "image relevance" (the newer the image, the more relevant) superimposed in colored scales on top of the roads.

Advantages/Benefits

· Regularly updated image databank from the user community rather from periodic surveys.

· Substantially lower data collection cost via crowdsourcing vs schedule surveyor work.

· Negligible processing cost vs human inspection through fully automated assessment.

· Lower infrastructure costs through timely maintenance and improved scheduling of roadworks.

· Less inconvenience to the public due to fewer closed roads/shorter durations.

Example Use Cases

· Preventative maintenance of road infrastructure (base case).

· Machinery damage inspection (retrained neural networks for machine specificities).

· Processing of drone/robot footage for assessment of hard-to-reach spaces.

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