Geophysical Research Abstracts
Vol. 20, EGU2018-2988, 2018
EGU General Assembly 2018

Neural network approach for automatic fog detection using surveillance camera images

Giuliano Andrea Pagani, Wiel Wauben, and Jan Willem Noteboom
Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands

Fog is a meteorological phenomenon that has a considerable impact on human activities related to transportation and logistics on land, on water, and in the air. Reduced visibility causes delays, economic damages, and in the worst cases loss of lives.

Modern visibility sensing technology can be used to detect fog and this solution is applied at most airports. Nevertheless, this approach is too expensive and not feasible for country-wide coverage of all roads and waterways. Cameras showing visual landmarks at known distances are another solution in which a human operator can estimate the visibility conditions of a remote location. This approach requires continuous monitoring by remote observers and therefore has clear limitations to the number of sites that can be concurrently supervised. Instead of using expensive visibility sensors or remote observers to detect fog, nowadays it is possible to take advantage of dense networks of surveillance cameras along roads and waterways. These networks offer big amounts of image data that might be usable for automated fog detection. However, there are a set of complicating factors such as the many different types of cameras used, the wide variety in sceneries, the pan-tilt and zooming, and the privacy regulations that must be respected.

In order to make optimal use of the surveillance cameras already in place, we have developed an automated system that can recognize fog conditions (i.e. visibility lower than 250 meters) in daylight. In order to be able to successfully recognize fog conditions from many different sceneries, we have employed a deep neural network. Deep neural network have proven to be good in adapting to the changing scenery in which cameras can zoom in and out and turn suddenly, thus changing the objects in focus. In this study we used the daytime images captured every 10 minutes from more than 160 surveillance cameras of the road authorities spread across the Netherlands. We have trained a 5-layers networks with a (balanced) set of foggy and non- foggy images totaling 9000 images. Evaluation of the neural network model on an unseen (unbalanced) dataset consisting of more than 5000 images gave promising results.

Our current efforts are in improving the performance of the neural network model by collecting a larger training and test set. Furthermore, we are committed to bring the developed fog detection system closer to operational duties for automated fog monitoring and alerting along Dutch highways.