Improved cyclist monitoring using spatiotemporal information

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There has been a growing interest on improving road safety in the Netherlands. In the case of cyclists, there has been increased interest in promoting the use of bike helmets. To measure the success of helmet promotion campaigns, policymakers typically rely on human counters stationed near cycling lanes to count the number of cyclists wearing helmets. However, this method poses challenges due to scarcity, high cost, and potential inaccuracies of human resources. To overcome these limitations, an AI-powered automated system offers a promising alternative. We suggest a solution designed for automatic detection, tracking, and counting of cyclists and bike helmets on the road. Despite the effectiveness of such an approach, it often fails to distinguish a cyclist and people walking beside their bikes or scooter riders, leading to false positives.

The analysis of these false positives revealed a correlation with the speed of objects. Scooters traveled faster than a normal cyclist and people walking beside their bike much slower. This led us to use spatiotemporal information, like distance traveled and travel time, to calculate the speed of the objects and leverage this information to suppress false positives. The distance was calculated using the tracklets of the tracker as the difference between the first and last tracklet positions, and time as the difference between positional timestamps. Speed was then calculated using this data. Speed data later has been normalized against a baseline cyclist to account for variations in the cyclists appearance at various distances from the camera. The normalized data was used to classify objects as cyclists or non-cyclists.

Our approach has shown a reduction in false positives, increasing precision by 1.5%, but also a decrease in true positives, decreasing recall by about 3.6%. The true positives that were removed consisted mainly of ”racing cyclists”, as their speeds were much higher than regular cyclists. Although this approach cannot suppress false positives without significantly suppressing true positives, future work could potentially involve classifying different types of cyclists as slowly new types of bicycles emerge, like fat bikes. Moreover, when working with live footage, ethical concerns can be minimized using identity anonymization.



Figure 1: An example of a true positive (left) and a false positive (right) and their speed, width, and height information. These values are normalized using the same baseline information that can be seen in both frames. The final S/W value is used to classify the object.