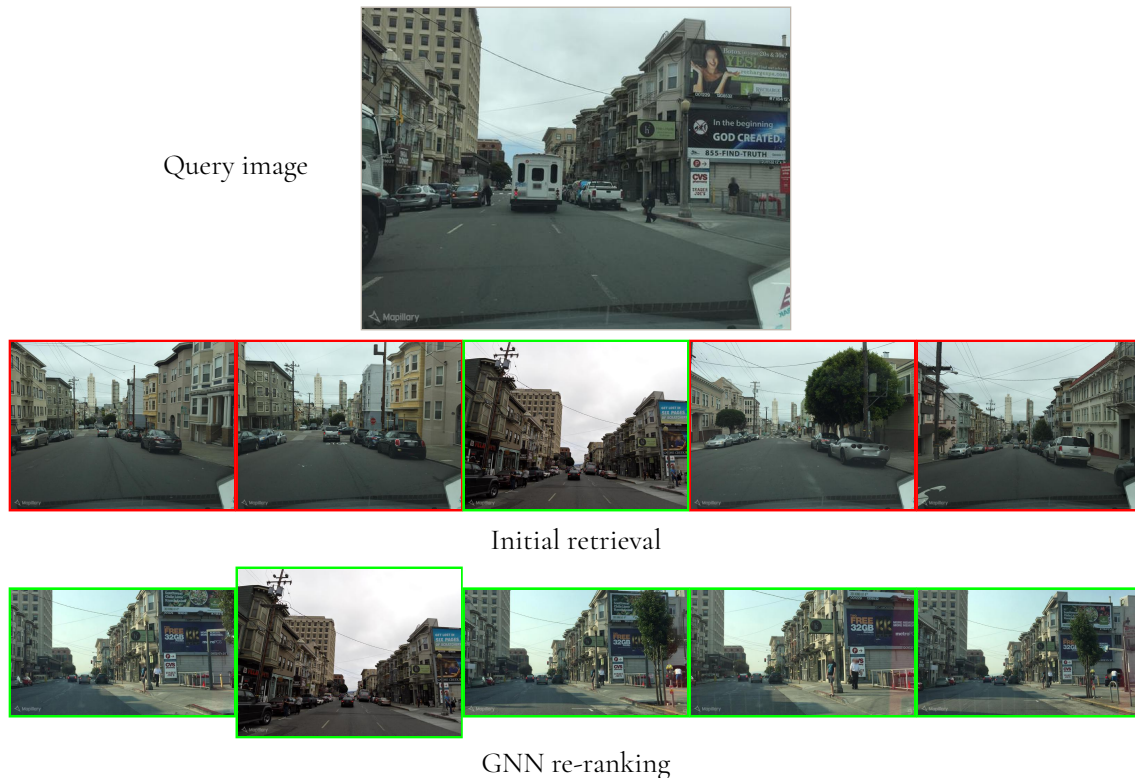


# Image Retrieval Re-ranking using Graph Neural Networks

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Imagine that we want to find the location of a self-driving car equipped with a camera by searching a database of images with known positions. Can a neural network be trained to help retrieve database images captured in the vicinity of the car?

The problem of finding images in a database most similar to a given query image is known as *image retrieval*. As the database may contain thousands or even millions of images only a small subset can be retrieved.

Initially the retrieved database images are sorted based on their visual likeness with the query image. However even if two images are similar they are not necessarily captured at the same location.

Further analysis can be performed to *re-rank* (re-order) the database images so that those relevant to the query image increase in rank and vice versa. In the case of the self-driving car we are only interested in images captured close to the position of the

vehicle.

This work explores the use of a special type of neural network, called *graph neural network* (GNN), for image retrieval re-ranking. A large-scale dataset of street-level images is utilized to train the network with the goal of learning how to re-order the database images. The proposed GNN re-ranking algorithm is compared against three other methods and it is shown that it achieves significantly higher precision.

The figure above displays an example query image (top), the top five most similar database images (center) and the top five images after GNN re-ranking (bottom). The border around each database image indicates whether it is captured within 25 meters (green) of the query or not (red). In this example the re-ranking is successful as the number of relevant database images increases from one to five.