

# Improving Visibility at Night with Cross Domain Image Translation for Advance Driver Assistance Systems

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The most difficult time for driving is at night because of the dreadful lighting conditions. It was identified that 50% of the traffic deaths happen at night, even though only one-quarter of our driving happens at night. Therefore, having clear visibility at night is crucial for a safe drive at night. Most Advanced Driver Assistance Systems (ADAS) also fail at night due to poor lighting. Considering this matter, this study will explore the possibility of translating night-time images to clear and detailed images with day-time lighting (i.e., equivalent daylight images). This can be identified as a cross-domain image translation problem between the day-time domain and the night-time domain. Even though many deep-learning-based techniques to transform images between domains exist, most of them require pixel-to-pixel paired datasets for training. However, it is challenging to develop such a dataset in this scenario, since roads are dynamic and uncontrolled environments. As a solution, this study utilised a well-known Cycle-GAN model, which can be trained using an unsupervised training approach. Therefore, this study explores the possibility of transforming images between day-time and night-time using Cycle-GAN. The other challenging task of this study is to access the quality of the Cycle-GAN generated images, since there is no pixel-to-pixel paired image to compare against. Therefore, this study utilizes a reference-less image quality evaluation technique called Blind Reference-less Image Spatial Quality Evaluator (BRISQUE). The day-time images synthesised by the trained Cycle-GAN indicated a 28.0416 average BRISQUE score, whereas the original day-time images indicated a 26.2156 BRISQUE score, which indicates that there is only a 0.069% deviation. Dataset and the source code used for this study are available at <https://github.com/isurushanaka/GANresearch/tree/main/Night2Day/Experiments/Unpaired>

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