

A Review: Night-to-Day Image Translation Leveraging GANs for Enhanced Visual Perception for Autonomous Driving Systems

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Autonomous driving systems hold significant potential for improving safety and efficiency. Their effectiveness is often challenged under low-visibility conditions at night, primarily due to their reliance on visual inputs. This review analysed these challenges by exploring the use of GANs for translating night-time images into their daytime equivalents, thereby enhancing the perceptual capabilities of autonomous systems. A systematic review of the existing literature was conducted by IEEE Xplore, arXiv, and Google Scholar, covering publications from 2009 to 2024. The selection criteria employed specific keywords such as “image-to-image translation”, “Night to Day image translation”, and “autonomous driving systems”, focusing on studies directly contributing to the enhancement of visual inputs in low-light conditions. The findings suggest that inherent constraints limit conventional methods like enhancing sensor sensitivity. GAN-based approaches, exclusively those leveraging unsupervised learning paradigms, offer promising alternatives. Hence, the review focused on unsupervised and semi-supervised GANs, which offer robust solutions by eliminating the need for paired datasets and providing greater adaptability in diverse nocturnal driving environments. These methods not only reduce logistical challenges associated with dataset preparation but also demonstrate superior performance in managing the complexity and variability of real-world nighttime driving scenarios compared to traditional and supervised methods. In conclusion, the application of GANs for night-to-day image translation represents a promising path forward for improving the reliability and safety of autonomous systems under low-light conditions. This review provides valuable insights for both practitioners and researchers, highlighting the potential for further refinement of GAN architectures to enhance the operational capabilities in diverse environments.

Keywords: *night-to-day image translation, autonomous driving systems, generative adversarial networks.*