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System and Method for Processing An Image

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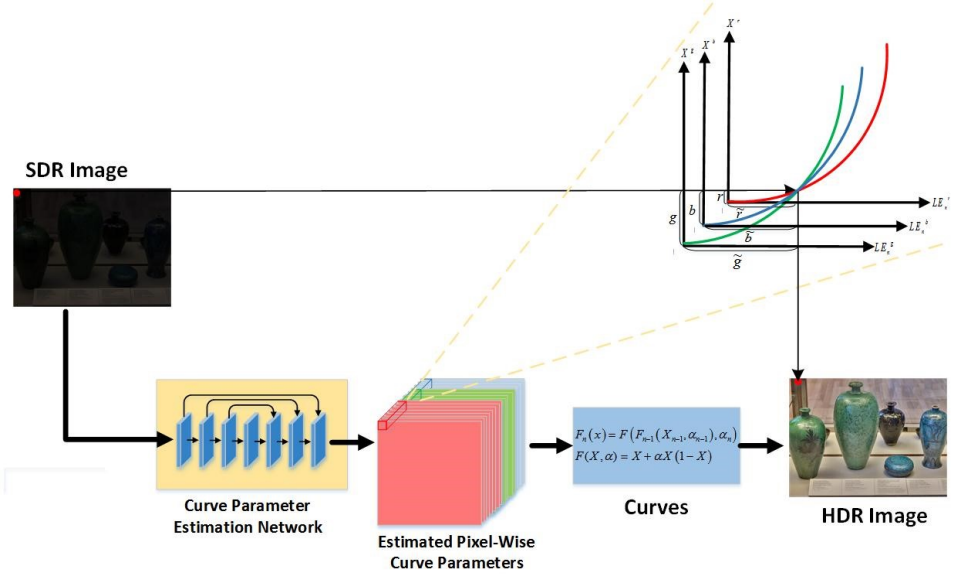

Figure 1. The pipeline of zero-reference learning.

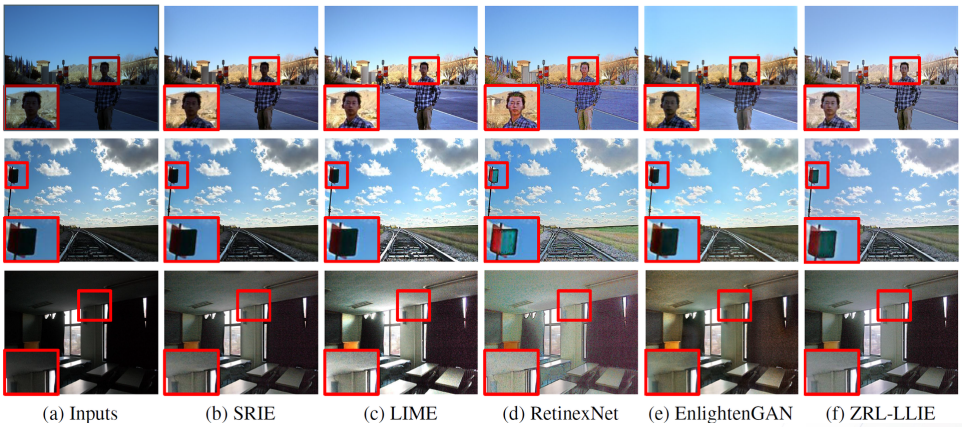

Figure 2. Visual comparisons on typical low-light images. Red boxes indicate the obvious differences.

IP Status
Patent granted

Technology Readiness Level (TRL) 5

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Opportunity

Over the past few years, commercial high dynamic range (HDR) TVs have become widely available, but these TVs still need to display video produced in standard dynamic range (SDR). A variety of solutions for this problem have been proposed, with one of the most prominent being single-image reconstruction (involving reconstructing a single SDR image into HDR). State-of-the-art methods for performing single-image reconstruction are

primarily based on deep learning, but these deep-learning methods rely heavily on paired data for supervised learning, and this may degrade their performance.

In comparison with other contemporary deep-learning approaches to single-image reconstruction, this invention can achieve greater visual quality with lower computational costs, and it can do so without needing to rely on the constraints of specific training data.

Technology

This invention is a deep-learning-based methodology for converting SDR video to HDR video without relying on supervised training for the algorithm. To be specific, single-image reconstruction of SDR video relies on reverse tone mapping (RTM). In this invention, RTM can be handled without first training the algorithm with paired or unpaired data. This is achieved, first of all, by using a parameter-adjustable quadratic curve that considers values and gradients using Convolutional Neural Networks (CNNs). This quadratic curve can also progressively approximate other curves by iteratively applying itself. In addition, a lightweight CNN is used to learn the best-fitting curve parameters. Finally, a non-reference loss function drives these parameters without the need for learning references.

Extensive experimental results show that this invention can effectively convert from SDR to HDR on either synthetic or real SDR video. The invention can perform at speeds up to 500 FPS, meaning that it can readily be implemented in a variety of practical applications.

Advantages

- This invention improves performance in converting SDR video to HDR video.
- This invention relies on deep-learning strategies in video conversion when computational resources are limited.
- This invention avoids the risk of overfitting specific data, since it does not require reference data for training.
- This invention's mapping curves can be extended to other image-processing tasks such as low-light image enhancement and non-uniform illumination removal.

Applications

- Commercial HDR TVs