

Qualcomm VisionX Challenge: Reflection Removal from Images

Susmit Neogi

Abstract

Reflection removal from images captured through reflective surfaces such as glass or water is a significant challenge in computer vision, with applications in security, autonomous vehicles, and photography. This work aims to develop an AI-based framework for automatically detecting and removing reflections from images, preserving scene details and minimizing unwanted artifacts. The proposed solution leverages state-of-the-art deep learning techniques, combining image decomposition models and generative networks to isolate and remove reflections under diverse lighting conditions and reflection types. Real-world applicability will be demonstrated in scenarios such as enhancing surveillance footage, improving personal photo quality, and enabling robust vision for autonomous systems.

Solution Roadmap

1. Data Collection and Preprocessing

- Gather diverse open datasets containing reflection images and corresponding ground truth (clean images).
- Augment datasets with synthetic reflections to ensure robustness under various conditions.

2. Model Development

- Design a dual-stream convolutional neural network (CNN) for reflection and background separation.
- Experiment with generative models like CycleGAN and diffusion models for reflection removal.

3. Training and Optimization

- Train the model using perceptual loss and structural similarity index to preserve fine details.
- Regularize the network with adversarial training to improve realism.

4. Evaluation and Validation

- Test the model on unseen datasets using metrics like PSNR, SSIM, and user studies.
- Compare results with existing benchmarks for reflection removal.

5. **Deployment and Application**

- Integrate the solution into real-world systems such as security cameras, autonomous vehicles, and photo editing software.
- Demonstrate practical use cases through visual examples and quantitative performance reports.