

Title of Project:

(English) Fast Video Enlightening with Smart Domain Transfer Structure

(Chinese) 用於低光視頻影像增強的快速智能分層基線架構

Abstract:

Darkness makes us lose confidence, and feel nervous and uncomfortable. We encounter this problem when we are walking in the dark, or driving along a road in the late evening with extremely dim light, or even without light. In order to resolve this problem, we may use electric torch from the mobile phone which can only have very narrow lighting spots; or use the bright lamp for driving which still only restricts to narrow coverage of area and some applications extra lighting may not be allowed. One of the basic solutions is to turn the front screen of our car as a screen which can enlighten dark scene close to the daytime scene during driving, or to use a mobile screen (or wear a pair of intelligent glass) for walking which turns the night scene into a day scene. This leads us to our proposed research topic on video enlightening. There is not much study on video enlightening as compared to image enlightening. Conventional learning and deep learning approaches have been used to study video enlightening but most approaches are limited to use standard and conventional techniques. These can only lead to **mediocre results**, which can be reflected from the lack of video demonstrations for most published papers on video enlightening in the literature.

In this of our study, we will try to **discover the root of the problems** of video enlightening and suggest practical solutions. We propose to use **Domain Transfer** as a means for gradual enlightening of a scene, which is natural, but unlike Diffusion Models, without direct involvement of noise addition and noise removal processes in our model. **This is new, and a fast technique** . Most previous approaches treat all darkness situations as a single domain, however, we propose here as a **new idea to quality darkness** into various darkness domains. This requires designing a darkness evaluator for forming a multi-entry domain-transfer enlightening algorithm, which should result in better video quality. Temporal consistency and noise generated in the enlightened domain are two main problems which hinder the demonstration of some video enlightening techniques. We propose the former problem be resolved by making use of **multi-frame back-projection technique**, which is a way to jointly refer back to the low-light image and the neighbor frames for consistency result. The latter problem is suggested resolving by an approach with **generative power**, meaning that **to generate –ve noise means to remove noise**. Say, we may use a diffusion model or domain transfer technique to treat each domain as a specify latent space for training and then reconstruction, and to avoid noise generation we have to force the generation power of the deep learning network to form a clean enlightened domain on video frames. The approach must be

fast enough for practical applications, which might make domain transfer model be more suitable for actual realization. This opens up a new paradise for future research in video enlightening.