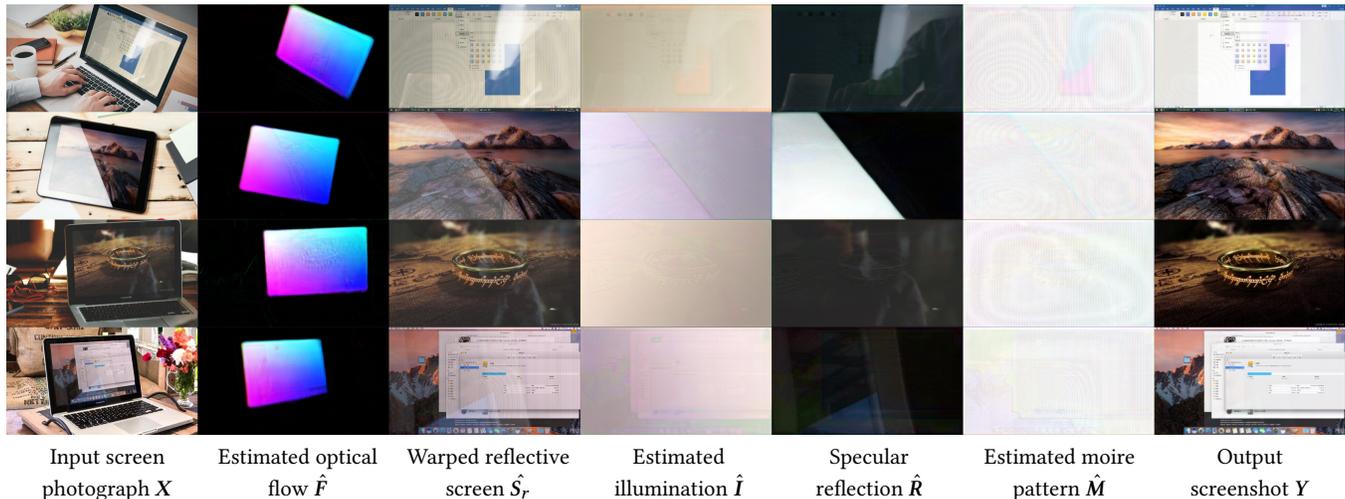


# Screenshots from Screen Photography

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**Figure 1: Screenshots from screen photography.** Given the left input screenshot, our approach warps it using optical flow and then decompose the illumination and reflection to obtain the output screenshots.

## ABSTRACT

Screenshot is a frequently used tool in our daily life, while the screenshot capturing techniques are not much discussed in computer graphics and image processing researches. Capturing a screenshot is not always as easy as it seems. Firstly, the target devices for screenshot capturing must have screenshot software installed or featured in their operating systems. Secondly, the users must have input access to control the screenshot software within the target devices. Thirdly, the target devices must have Internet access or other hardware interfaces (such as USB ports) so that the users can take their screenshots out. When these requirements are not met, people often need to use their smartphones to take photographs in front of the screens as a substitute of screenshots. This allows direct sharing of the screen content, but the fidelity of the obtained content is apparently not as good as software screenshots. Might we be able to achieve a computer graphic solution to directly convert a screen photography to a screenshot, which looks like as if it was taken using software?

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## CCS CONCEPTS

• Applied computing → Media arts.

## KEYWORDS

screenshots, computational photography, image processing

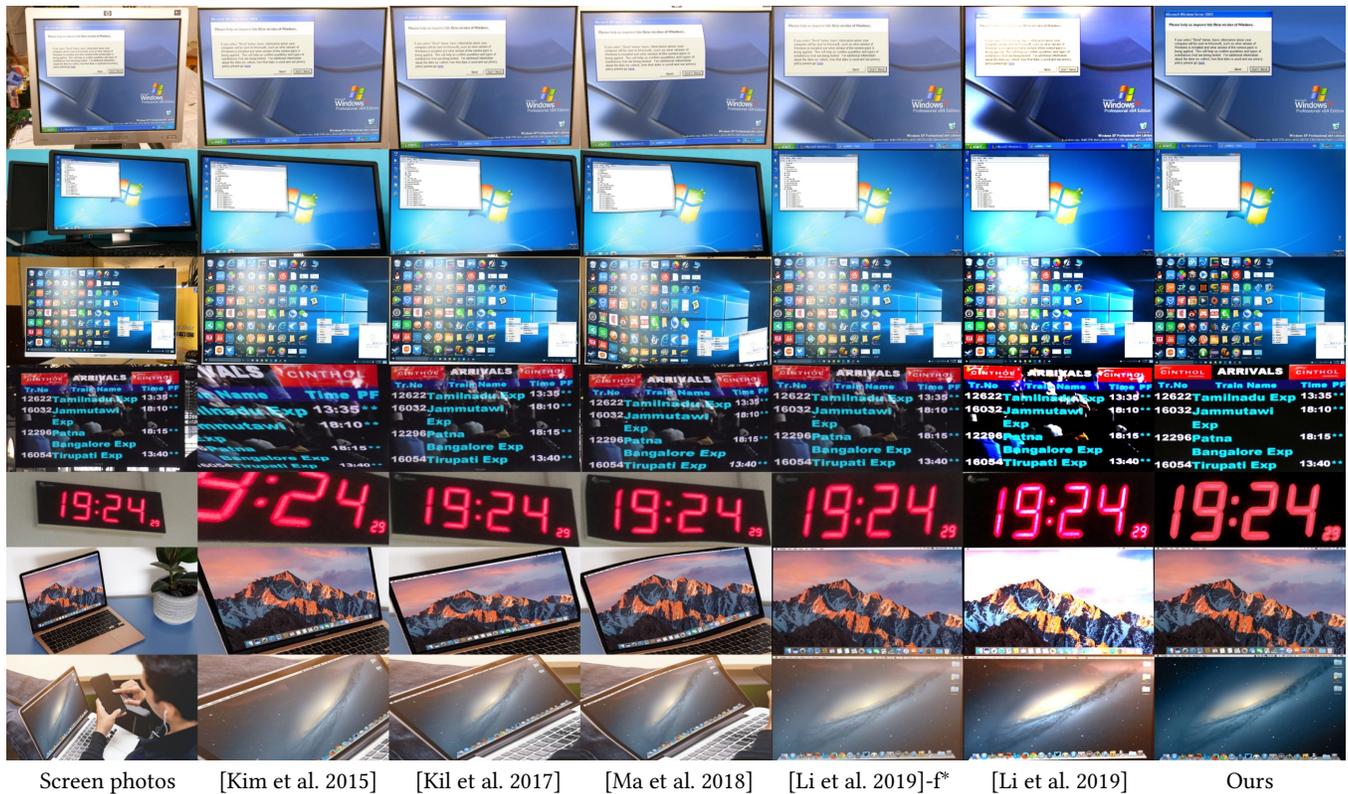
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## 1 INTRODUCTION

Every day when we want to share something on the screen, we take screenshots. Although it seems to be easy by just pressing the “PrintScreen” key on the keyboard, it can be fairly difficult to take screenshots in many other cases. For instance, students may have difficulties getting screenshots directly from their teachers’ slider screens during the class; hospital doctors may have difficulties obtaining screenshots from their hospital’s electrocardiogram instrument screens, etc. While the displayed contents on those screens are valuable for digital storing and sharing, the actual screen capture can hardly be flexible. Perhaps the most common workaround is to pull out our smartphones, take some photographs in front of those screens, and, inevitably, suffer from the apparently poor fidelity.

Might we be able to achieve a computer graphic solution that can automatically convert a screen photo to a screenshot, just as if it was



**Figure 2: Comparisons to alternative methods.** The mark “-f” indicates only using warping flow correction without illumination corrections. \* Li [Li et al. 2019] provides models for both geometry corrections and illumination corrections.

captured using native screenshot software? To answer this question, this poster studies a brand new problem called Screenshots from Screen Photography (SfSP) to convert captured screen photos to screenshots.

## 2 METHOD

We observe a large number of screen photographs, and discover that (1) screens may have different orientations and surface curvatures, and we denote this geometry deformation by an warping flow  $F \in \mathbb{R}^{w \times h \times 2}$ ; (2) screens may be exposed to sophisticated illumination conditions, and we denote the illumination by an illumination map  $I \in \mathbb{R}^{w \times h \times 3}$  and a specular reflection map  $R \in \mathbb{R}^{w \times h \times 3}$ ; and (3) screen photography may suffer from moire patterns, and we denote these patterns as a moire pattern map  $M \in \mathbb{R}^{w \times h \times 3}$ . With these three observations, we provide a simple yet effective SfSP formulation

$$X_{\{p \rightarrow F(p), \forall p\}} = (Y \odot I + R) \odot M = S_r \quad (1)$$

where  $X$  is the input screen photo,  $p$  is pixel position, and the transform  $X_{\{p \rightarrow F(p), \forall p\}}$  refers to warping  $X$  using the flow  $F$ . The  $Y$  is the screenshot, and  $\odot$  is Hadamard product.

We learn Convolutional Neural Networks (CNNs) to approximate these maps as shown in Fig. 1. To train the neural networks, we collect a large-scale dataset with both synthesized and real-world data. The synthesized data contains 10k image&annotation pairs of

{screen photography image  $X$ , optical flow annotation  $F$ , illumination decomposition annotation  $I$ , specular reflection decomposition annotation  $S$ , and moire pattern decomposition annotation  $M$ } composed with Blender [Community 2018]. The real data contains 195 pairs of {screen photography image  $X$ , screenshot image  $Y$ }.

## 3 RESULT

We present qualitative results in Fig. 2, where we also compare with Kim [Kim et al. 2015], Kil [Kil et al. 2017], Ma [Ma et al. 2018], Li [Li et al. 2019], and Li [Li et al. 2019]-f (Li’s method without illumination corrections). See also the supplementary material for more details.

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