Interactive RGB+NIR Photo Editing

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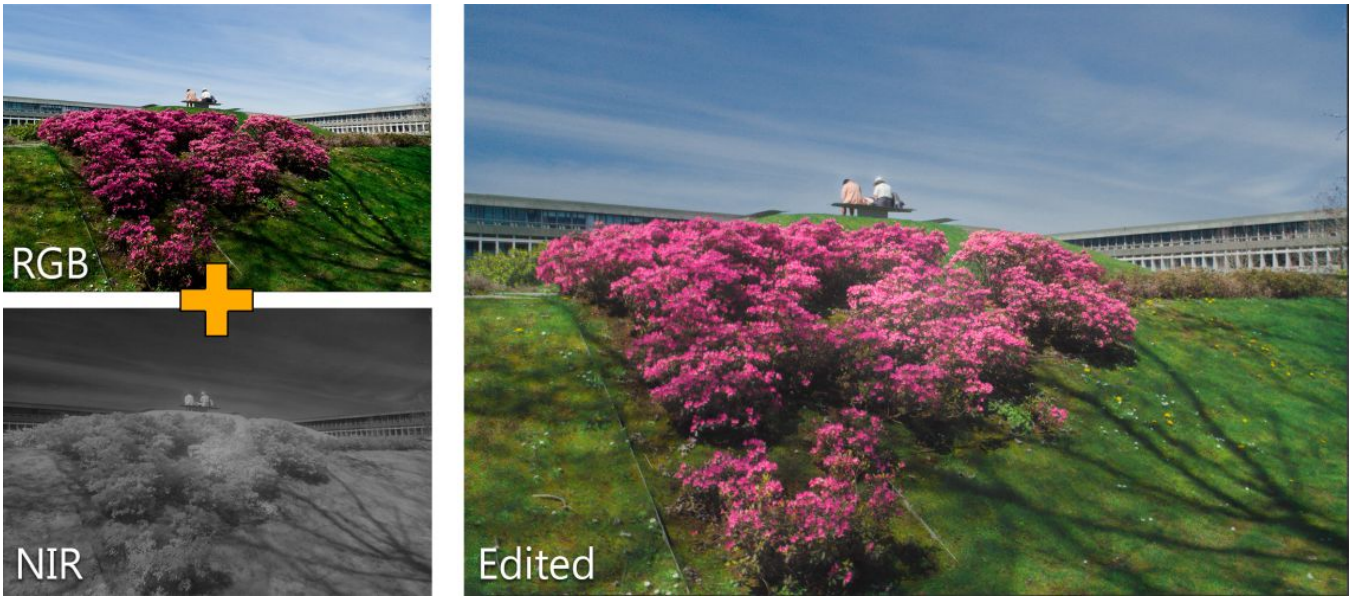

Figure 1: Our application allows users to combine RGB and NIR images for flexible image editing and enhancement.

CCS CONCEPTS

• **Computing methodologies** → **Computational photography**.

KEYWORDS

near infrared, NIR, image editing

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1 INTRODUCTION

Near-infrared imagery offers great possibilities for creative image editing. Lying outside the visual spectrum, the NIR information can effectively serve as a fourth color channel to common RGB. Compared to the latter, it shows interesting and complementary behavior: its intensity strongly varies with the surface materials in the scene and is less affected by atmospheric perturbations. For these reasons, NIR imaging has been a long-standing topic of interest in research and its integration has been proven successful for applications like false coloring [Fredembach and Süsstrunk 2008], contrast enhancement [Vollmer and Shaw 2022], image dehazing [Dümbgen et al. 2018], and purification of low-light images [Wan et al. 2023]. Recent developments in smartphone technology [Sharma et al. 2023] have simplified the capturing process, making NIR data readily available for broader use outside the research community. At the same time, existing tools for NIR processing and manipulation are rare and still limited in functionality. With many solutions lacking specialized features, the editing process is inefficient and cumbersome, making them prone to generate suboptimal results. To tackle this issue, we introduce a simple and intuitive photo editing tool that combines RGB and NIR properties, offering functions tailored specifically for the RGB+NIR combination, and granting the user the ability to edit and refine images more creatively.

2 EDITING PHOTOS WITH RGB + NIR

We present an interactive web-based interface that allows users to upload pairs of RGB and NIR images for editing. Users can apply

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Figure 2: Our web-based RGB+NIR photo editing interface.

Figure 3: Different recoloring results of an image from [2011].

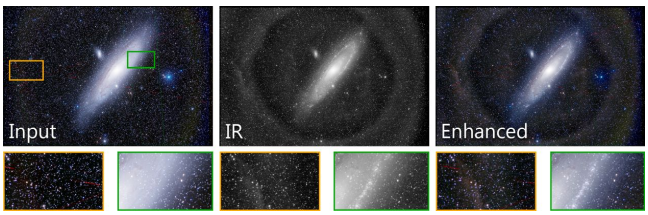

Figure 4: Contrast enhancement on a galaxy photo from Telescope Live.

intuitive tools for recoloring or enhance the RGB image with powerful NIR-guided filtering. Our interface allows for fine-tuning the parameters of each tool, viewing the enhanced results on the canvas, and downloading the edited images as desired. An overview of the interface is illustrated in Figure 2. In the following, we describe the implemented tool set in detail.

Color Editing. The material-dependent intensity of NIR makes it a valuable addition as a separate color channel to the RGB palette. As an extended measurement of the scene's spectrum, it can augment visible data and be integrated into three output channels as desired. The resulting false colors open up the possibility for artists to highlight specific areas such as vegetation or create novel color settings resembling fantastic worlds. Our interface offers the tools to linearly combine NIR data with the colors of the photograph. Using sliders, the user can freely adjust the mixing weights of NIR with one or multiple color channels, or replace individual colors completely. Surface-dependent behavior and expressive color casts can thus be fine-tuned accurately without limiting the ease of use. For additional flexibility, we provide the option to combine the data either in RGB or in CIE XYZ color space. We show examples of NIR-based color editing performed with our software in Figure 3.

Figure 5: Guided denoising on an image from [2009].

Contrast Enhancement. The longer wavelength of NIR is more robust against atmospheric perturbations. When visualizing the NIR intensity, it shows less visual distortions such as haze or color shifts compared to the visible light information from the same scene. NIR thus serves as a valuable source of information to enhance the contrast and clarity of an image. We integrate a dedicated tool in our interface to enable artists to effortlessly modify the contrast and details of an image. To exploit the available NIR information, users can blend it with the linear intensity of the scene or, alternatively, with the perceptual lightness in CIE LAB. We show an astronomical photograph of a galaxy with the corresponding enhanced result in Figure 4. Note how the higher contrast of the edited image brings out stars in the galaxy's center and accurately depicts the ring-like structure of the nebulas surrounding it.

NIR-guided Filtering. Image filtering is an essential tool in computational photography for enhancing the quality of a photo. The challenge here lies in reducing image noise while simultaneously preserving the edge details. Using the Guided Filter from He *et al.* [2012], we can incorporate the NIR information to direct the filtering process. Its robustness against noise and distortions associated with visible light enables more powerful and context-sensitive noise suppression while reliably preserving edges. The unique textural characteristics provide an additional tool for the users to express their creative vision. We show an example of an NIR-filtered image in Figure 5.

3 CONCLUSION

We present an innovative photo editing tool that combines an RGB image with the hidden NIR properties of the scene, utilizing color fusion and filtering techniques. Our tool enables professional and non-professional users alike to experiment and expand their creative horizons, surpassing conventional color limitations and crafting captivating visuals.

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