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Artificial Intelligence Based Web Application Design For Photographic Image Quality Optimization Through Digital Image Filtering Method

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A B S T R A C T

Image quality in photography is often disrupted by factors such as poor lighting or incorrect focus, resulting in blurry images. This study aims to enhance image sharpness using digital image filtering methods, namely Unsharp Masking, High-Pass Filtering, and Sobel Filter. These methods are tested to evaluate their effectiveness in clarifying image details. The study also develops a web-based application powered by AI to help users edit images without requiring technical skills. A quantitative experimental method with a descriptive approach is used, and evaluation is conducted using PSNR, SSIM, and user questionnaires. The results show that the application of sharpening methods can significantly improve the quality of photographic images, and integration into a web platform provides easy access for the general public. This application is expected to be a practical solution for photographers, editors, and general users to obtain high-quality images efficiently and quickly.

INTRODUCTION

In the modern technological era, photography has become an essential part of everyday life, both personally and professionally. Photographers can capture high-quality images thanks to advances in camera technology, such as the use of high-resolution sensors and advanced image processing features. Despite these advances, image sharpness remains a significant issue. Several factors, such as poor lighting, camera movement during shooting, or incorrect focus, can result in blurry or blurry images. These issues can affect a person's visual perception and the aesthetic value of the resulting image. Sometimes, images taken during the photo process are considered to have good results, but when they are entered into editing software, they still have several flaws that need to be corrected.

An image is a form of information in the form of an image. Often images experience interference or have poor quality, making it difficult for humans to interpret. To overcome this, image processing is carried out. Image processing aims to obtain better image quality compared to the original image. Image improvement is the initial stage of image processing which will then be used for image analysis needs. Various methods or image improvement algorithms have been developed, one of which is image sharpening. Image sharpening is needed to overcome images that have noise, noise, or blur so that objects can be clarified or sharpened). is needed to overcome images that have noise, noise, or blur so that objects can be clarified or sharpened [1,2,3].

Sharpening methods, which are one of the most widely used solutions for sharpness issues, aim to improve image clarity by highlighting edges and fine details in the image. Commonly used sharpening methods, such as unsharp masking, Sobel

filters, and Laplacian filters, each have their own advantages and disadvantages. Unsharp masking, for example, is a long-standing technique and has proven successful in improving image sharpness. Laplacian and Sobel filters, on the other hand, focus on edge discovery, which can yield more significant results in some situations [4,5].

As technology advances, many photographers are now adopting more advanced post-production techniques, including the use of artificial intelligence (AI)-based software capable of automatically enhancing image quality. However, a thorough understanding of traditional sharpening methods remains crucial, as not all situations can be handled effectively by automated algorithms. This research aims to explore the application of sharpening methods in modern photography, where these techniques can be integrated with the latest tools and technologies [6,7].

Through in-depth analysis, this research is expected to help photographers address image sharpness issues and produce high-quality results. By utilizing sharpening techniques within the context of modern tools and technology, photographers can more effectively create compelling and high-quality images, thereby enhancing viewer satisfaction and visual experience.

METHOD

The research process in this study begins with problem identification, namely the low quality of photographic image sharpness due to various technical factors such as poor lighting or improper focus. After that, a literature review was conducted to understand the basic concepts of digital images and sharpening methods such as Unsharp Masking, High-Pass Filtering, and the Sobel Filter. Next, image data was collected from various types of photos (portraits, landscapes, and static objects), which were then processed using each image sharpening method. The results of this process were analyzed using quantitative metrics such as PSNR (Peak Signal-to-Noise Ratio) and SSIM (Structural Similarity Index), as well as subjective evaluations from users through questionnaires. Based on the results of this analysis, the most effective method will be identified and integrated into an AI-based website designed to make it easier for people to improve image quality automatically. The final stage of this research is an evaluation of the functionality and usability of the website, as well as the preparation of conclusions and suggestions for further development.

Data Collection and Dataset Preparation

The dataset used in this study consists of digital photographic images collected from publicly available image repositories and user-generated photographs. The images vary in resolution, lighting conditions, noise levels, and sharpness to represent real-world photographic scenarios. Prior to processing, all images are standardized by resizing, color normalization, and format conversion to ensure compatibility with the filtering algorithms and AI models. The dataset is divided into training, validation, and testing sets to support AI model development and performance evaluation.

Artificial Intelligence-Based Image Analysis

Artificial intelligence techniques are employed to automatically analyze image quality characteristics and determine appropriate filtering strategies. A machine learning model is trained to identify common image quality issues such as noise, blur, low contrast, and uneven illumination. Feature extraction is performed using statistical and spatial image features, including histogram distribution, edge intensity, and texture descriptors. Based on the extracted features, the AI model classifies the image condition and recommends suitable digital filtering operations to optimize image quality.

Digital Image Filtering Techniques

Digital image filtering methods are applied as the core optimization mechanism within the system. Spatial domain filtering techniques are utilized, including smoothing filters (such as Gaussian and median filters) for noise reduction, and sharpening filters (such as Laplacian and high-pass filters) for edge enhancement. Contrast enhancement is performed using histogram equalization and adaptive contrast enhancement methods. The filtering parameters are dynamically adjusted based on the AI model's recommendations to achieve optimal visual results while minimizing artifacts and loss of image details.

RESULTS AND DISCUSSION

Login and Registration Page

The user interface is a crucial component in application development, particularly web-based applications aimed at general users from various backgrounds. In this study, the application interface was designed with a user-friendly and modern minimalist approach, which facilitates interaction between the user and the image processing system being developed. The main objective of the interface design is to enable the process of uploading, processing, and downloading images to be carried out intuitively without requiring technical expertise from the user.

The login page is used by users who already have an account to access the system. The login form consists of two input fields: a username and a password. Server-side validation is implemented to ensure security, including data authenticity checks by hashing the password using the generate_password_hash algorithm.

The registration page provides a form for new users, requiring input of a username, email address, and password. The system also implements validation to ensure that the username and email address cannot be the same as those of other registered users, to prevent data duplication. User input security is maintained through data sanitization and feedback messages in the form of Bootstrap Alert-based notifications.

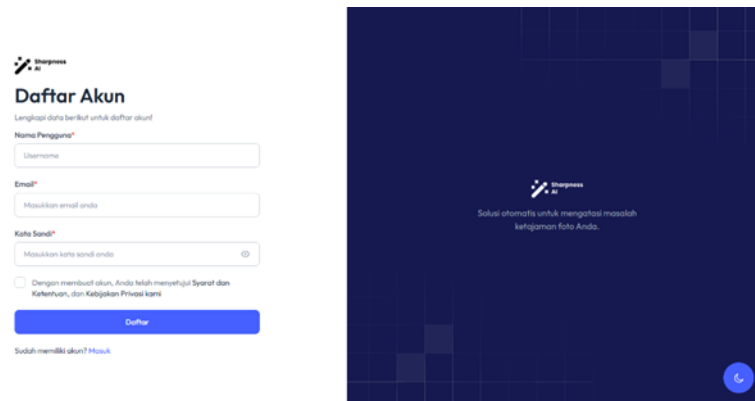


Figure 2. List Page

Application Home Page

The homepage design emphasizes practicality, minimizing the number of clicks a user needs to complete their task.

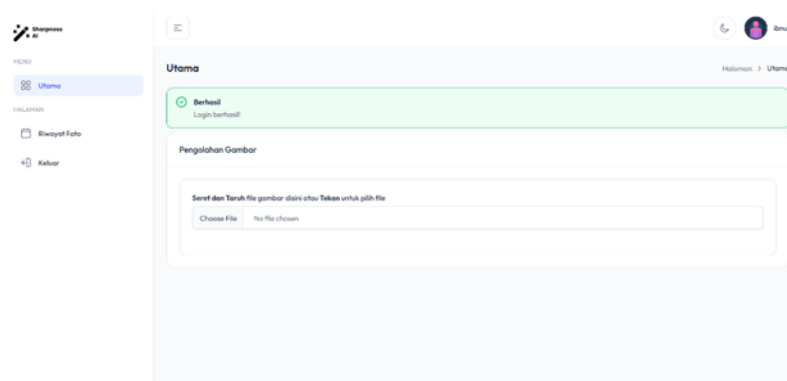


Figure 3. Home Page

Processing History Page

This data is displayed in a table that can be sorted by the most recent upload time. This page makes it easy for users to access previously processed images without having to re-upload them.

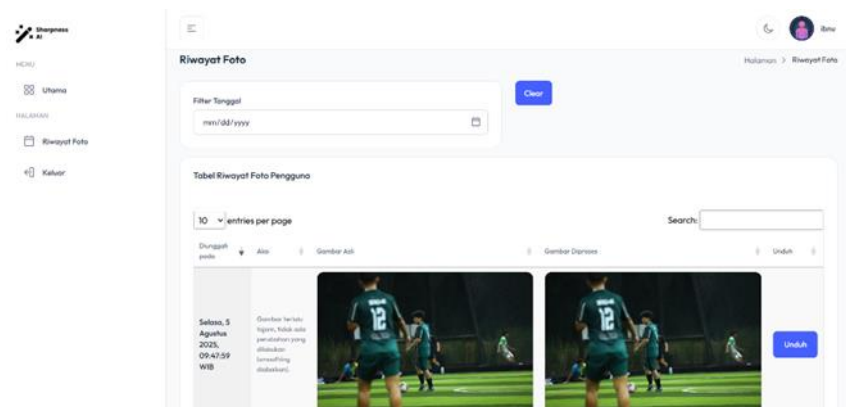


Figure 4. History Page

Responsiveness and Accessibility

The entire interface is developed using a CSS framework like Bootstrap to ensure responsiveness across various screen sizes, including desktop and mobile devices. Furthermore, accessibility is taken into consideration by adding alt text to image elements and maintaining color contrast and font size for easy readability for all users.

Image Upload and Validation Process

The image upload and validation process is a crucial initial step in a web-based image processing system. This step lays the foundation for ensuring that only properly formatted and undamaged images can be processed further. The system must be designed to handle a wide range of possible user input, including input errors, invalid files, and potential security threats from files masquerading as images.

In the developed application, the upload and validation process includes five main stages, namely: (1) file selection by the user, (2) checking the existence of the file, (3) file extension validation, (4) file structure validation using the image verification library, and (5) secure file storage.

Automatic Image Analysis and Sharpening Process

Once the image file is successfully uploaded and validated, the system proceeds to the core stage: automatic image sharpness analysis and quality enhancement (sharpening). This entire process is designed to run without user intervention, making it easy for novice users without technical knowledge of image processing.

The system implements an approach based on the sharpness value of the original image. If an image is detected as insufficiently sharp, the system automatically applies a sharpening technique using the Unsharp Masking method with dynamically adjusted parameters. Conversely, if the image is deemed sufficiently sharp or even too sharp, the system makes no changes to avoid overprocessing or visual artifacts.

CONCLUSION

This research aims to improve the sharpness of digital images through the Unsharp Masking method, implemented in a Python Flask-based web application. Based on the results achieved, several key points can be concluded as follows: The Unsharp Masking method has been proven to improve the sharpness of images with low quality due to poor lighting or improper focus. By analyzing the Laplacian variance values of the original image, the system automatically determines whether the image requires sharpening. The developed web application successfully provides a user-friendly, easy-to-use interface that does not require technical expertise. Users simply upload an image, and the system will automatically analyze and improve it. Image quality evaluation was conducted using the Laplacian Variance, SSIM, and PSNR methods. The evaluation results showed an increase in visual sharpness in the processed image compared to the original image.

Interface documentation and system functional testing demonstrated that the application runs stably, stores user history, and is compatible with various devices and browsers. This program opens up great opportunities for further development into an AI-based automatic image editing platform that can be widely used by the general public, especially in the fields of photography, design, and digital media.

REFERENCES

- [1] Aripin, S. (2019). Perbaikan tingkat kekaburan gambar akibat pembesaran pada hasil screenshot dengan metode Unsharp Mask. *Jurnal Media Informatika Budidarma*, 3(2), 83–89. <https://doi.org/10.30865/mib.v3i2.1096>
- [2] Bansal, S., & Kaur, A. (2011). Image enhancement using hybrid enhancement techniques. *Journal of King Saud University - Computer and Information Sciences*, 27(3), 261–272. <https://doi.org/10.1016/j.jksuci.2011.03.002>
- [3] Kurniawan, R., & Lestari, S. A. (2022). Peningkatan kualitas citra menggunakan metode CLAHE pada citra paru-paru. *Jurnal Informatika: Jurnal Pengembangan IT*, 7(2), 76–81. <https://doi.org/10.30591/jpit.v7i2.29020>
- [4] Rahmadhani, M. (2023). Analysis of image quality using Sobel filter. *Jurnal Sistem Komputer dan Informatika (JSON)*, 4(1), 8–13. <https://doi.org/10.33395/json.v4i1.11004>
- [5] Rambe, R. W. (2022). Penerapan algoritma pengolahan citra untuk deteksi kelayakan buah pisang berbasis Raspberry Pi. *Jurnal Komputer Terapan*, 2(1), 7–14. <https://doi.org/10.31294/jkt.v2i1.12378>
- [6] Suhendar, A., & Sarwinda, D. (2023). Penerapan metode CLAHE dan algoritma Canny edge detection untuk peningkatan kualitas citra rontgen paru-paru dalam mendeteksi penyakit TBC. *Jurnal Teknologi dan Sistem Komputer*, 11(2), 374–380. <https://doi.org/10.14710/jtsiskom.2023.374-380>
- [7] Sunandar, A., & Aripin, S. (2019). Perbaikan tingkat kekaburan gambar akibat pembesaran dengan metode Interpolasi Linier. *Jurnal Media Informatika Budidarma*, 3(1), 55–61. <https://doi.org/10.30865/mib.v3i1.957>