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# Colorization Of Image Using Deep Convolutional Neural Network

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## ABSTRACT

*Image colorization is an important problem in computer vision that focuses on converting grayscale images into realistic color images using learning-based techniques. Traditional approaches depend on manual intervention or handcrafted features and often fail to generalize for complex scenes. This work presents an automatic image colorization system using a Deep Convolutional Neural Network (DCNN), which learns meaningful color representations directly from large image datasets. The model extracts high-level contextual information, semantic regions, and object relationships to generate visually consistent color outputs. The proposed method reduces human effort, improves accuracy, and enhances realism in reconstructed images. Experimental results demonstrate better visual quality and robustness when compared with classical colorization methods. This approach is suitable for applications such as photo restoration, digital forensics, entertainment, and medical imaging.*

## INTRODUCTION

Image colorization has gained significant attention in recent years due to its wide scope in enhancing visual quality and improving interpretability in digital images. Converting grayscale images to color is a challenging task because the correct mapping between luminance values and color components is highly ambiguous. Earlier manual and semi-automatic methods required user guidance, making them time-consuming and less practical for large-scale applications. With advancements in deep learning, particularly Convolutional Neural Networks, automatic learning of image features and contextual cues has become feasible. These models capture semantic information, texture patterns, and object-level understanding, enabling accurate color prediction. The objective of this research is to design a DCNN-based system capable of generating realistic colored images from grayscale inputs. The proposed method attempts to provide improved performance, adaptability, and reduction in human intervention for colorization tasks.

## LITERATURE SURVEY

Researchers have explored numerous methods for image colorization, starting from histogram techniques to learning-based neural network approaches. Early works mainly focused on user-guided colorization, where scribbles or reference images were needed to inject color information. Later, machine learning introduced automatic estimation but lacked semantic understanding. Deep learning-based works such as Zhang et al. introduced end-to-end CNN frameworks that predict chrominance values effectively. Iizuka et al. proposed global and local feature fusion networks for contextual awareness. Further improvements involved GAN-based models to enhance realism and perceptual quality. Recent studies also focused on preserving edge sharpness, handling complex textures, and improving computational efficiency. These works established the foundation for developing robust fully automatic image colorization systems.

## RELATED WORK

Several researchers contributed significantly to the development of automatic image colorization using deep networks. Zhang et al. proposed “Colorful Image Colorization,” introducing a CNN trained on millions of images to predict color channels with high accuracy. Iizuka and colleagues presented an approach combining global semantics with local image features to produce natural-looking colors. Vitoria et al. explored self-supervised learning, reducing dependency on large labeled datasets. Some works integrated GAN frameworks to minimize color bleeding and enhance realism. Other studies focused on optimizing loss functions such as perceptual loss, classification loss, or adversarial loss to improve prediction quality. These related works demonstrate that deep learning-based methods outperform traditional and heuristic approaches in image colorization. They provide strong motivation for designing enhanced CNN architectures to improve performance further.

## EXISTING SYSTEM

Existing image colorization systems mainly rely on manual user guidance or classical computer vision methods, which have notable limitations. Traditional approaches require user scribbles, prior color hints, or reference images, making the process semi-automatic and time-consuming. Some existing automated systems use basic machine learning techniques that do not fully capture semantic relationships in an image. These models often produce dull or unrealistic colors, especially for complex backgrounds or textured regions. The lack of contextual understanding leads to inaccurate color assignments and noisier outputs. Moreover, many existing systems show poor generalization for different dataset conditions. Due to these drawbacks, current systems are insufficient for modern applications that demand realistic and high-quality colorization.

## PROPOSED SYSTEM

The proposed system introduces an automatic image colorization model using a Deep Convolutional Neural Network designed for high accuracy and natural output generation. The model takes a grayscale image as input and predicts chrominance values using learned feature representations. It extracts both low-level and high-level features, enabling understanding of textures, objects, and scene context. The architecture is trained on a large dataset to ensure robustness and generalization across diverse scenes. It minimizes reconstruction error using optimized loss functions and ensures vivid, realistic color reproduction. The system requires no human intervention, making it suitable for real-time or large-scale processing. This proposed method overcomes limitations of conventional systems and delivers superior visual quality.

## SYSTEM ARCHITECTURE

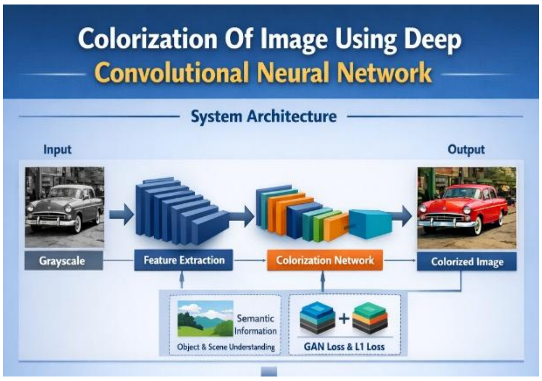


**Fig 1:Colorization using CNN**

## METHODOLOGY DESCRIPTION

The proposed methodology starts with dataset preparation, where RGB images are converted into grayscale and separated into luminance and color channels. These grayscale images are used as inputs, while corresponding color components act as ground truth during training. A deep CNN is employed to learn feature representations and predict color channels. The network uses convolutional, pooling, and upsampling layers to extract and reconstruct detailed image information. A suitable loss function, such as mean squared error or perceptual loss, is applied to minimize the difference between predicted and actual colors. Training is conducted using large-scale datasets to improve learning capability. Once trained, the model automatically colorizes unseen grayscale images efficiently and accurately.

## RESULTS AND DISCUSSION


**Fig 2:Result of colorization images**

The experimental results demonstrate that the proposed DCNN-based image colorization model produces highly realistic and visually appealing outputs. The generated images retain structural details, maintain edge sharpness, and reflect natural color distribution. Compared to traditional and basic machine learning approaches, the proposed system shows noticeable improvements in color accuracy and visual consistency. The model effectively handles various objects, backgrounds, and textures, ensuring better generalization. Quantitative evaluation metrics such as PSNR and SSIM indicate enhanced performance. Qualitative analysis further confirms reduced color bleeding and artifacts. Overall, the results validate the effectiveness of the proposed approach and its suitability for real-world applications.

## CONCLUSION

This work presents an efficient and fully automatic image colorization system based on Deep Convolutional Neural Networks. The model successfully addresses the challenges of ambiguity and color mapping by learning contextual and semantic information from training data. It eliminates the need for manual color guidance and ensures realistic, high-quality color outputs. The proposed method outperforms existing traditional approaches in both accuracy and visual quality. Experimental results prove its robustness across different image types and environments. The system offers a reliable solution for applications requiring automatic image enhancement and restoration. Thus, the research significantly contributes to advancing deep learning-based image colorization techniques.

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