AI IMAGE BACKGROUND REMOVER

(REMOVING BACKGROUND OF A PORTRAIT PHOTO USING AI)

Submitted in partial fulfillment of the requirements of

## University of Mumbai

For the Degree of

# Bachelor of Engineering in Computer science and (AI&ML)

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## Declaration

We declare that this written submission represents our own ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any act/data/source in our submission. We understand that any violation of the above will cause disciplinary action by the Institute and can also invoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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## Abstract

The "AI Background Image Remover" is a cutting-edge computer vision and deep learning application designed to revolutionize the way we edit and manipulate images. In the age of digital media and visual content creation, the need for efficient and accurate tools to remove backgrounds from images has never been more pronounced. This abstract outlines the key features, capabilities, and potential applications of the AI Background Image Remover.

This innovative software harnesses the power of artificial intelligence and machine learning to automatically and precisely separate foreground objects from their backgrounds, thereby enabling users to seamlessly extract, replace, or modify the surroundings of any given image. It employs a deep neural network architecture that has been meticulously trained on vast datasets of diverse images, ensuring exceptional accuracy and adaptability to various scenarios.

Key Features:

High Precision: The AI Background Image Remover is capable of accurately and intricately identifying the boundaries of foreground objects, delivering results with exceptional precision.

Ease of Use: With a user-friendly interface, the tool is accessible to both professionals and amateurs, requiring minimal technical expertise.

Real-time Processing: It provides rapid background removal, making it suitable for applications in real-time video streaming, image editing software, and more.

Customizability: Users can fine-tune the output to match their specific requirements, including adjusting the level of background removal and preserving object details.

Batch Processing: Bulk processing capabilities allow for the efficient handling of multiple images, enhancing productivity for businesses and individuals.

**List Of Abbreviations**

## B.E. – Bachelor of Engineering

* **AIBG. – AI BACKGROUND IMAGE REMOVER**

## IDE – Integrated Development Environment

* **CSE(AI&ML) – Computer Science Engineering (Artificial Intelligence and Machine Learning)**

**Index**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Chapter No.** | **Content** | | | **Page No.** |
| **I** | **Abstract** | | | **-** |
| **II** | **List Of Abbreviations** | | | **-** |
| **III** | **List Of Tables** | | | **-** |
| **1.** | **Introduction** | | | **1** |
|  | **1.1** | **Problem Statement** | | **1** |
|  | **1.2** | **Aims** | | **2** |
|  | **1.3** | **Objectives** | | **3** |
| **2.** | **Methodology** | | | **15** |
|  | **2.1** | **Requirement Analysis** | | **15** |
|  |  | **2.1.1** | **Software Components** | **15** |
|  |  | **2.1.2** | **Hardware Components** | **17** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2.2** | **Methodology** | **22** |
| **3.** | **Implementation** | | **24** |
|  | **3.1** | **System Design** | **24** |
|  | **3.2** | **Result** | **25** |
| **4.** | **Conclusion and Future Scope** | | **27** |
|  | **4.1** | **Conclusion** | **27** |
|  | **4.2** | **Future Scope** | **27** |
| **5.** | **Acknowledgement** | | **29** |
| **6.** | **References** | | **30** |

# CHAPTER 1 INTRODUCTION

In the digital age, the manipulation and enhancement of images play an ever-expanding role in our visual culture. From graphic design and e-commerce to social media and entertainment, the demand for tools that allow for the efficient and precise removal of backgrounds from images has surged. This demand has given rise to the "AI Background Image Remover," a groundbreaking application that leverages the capabilities of artificial intelligence and deep learning to redefine the way we work with visual content.

This introduction sets the stage for an exploration of the AI Background Image Remover, providing insight into its pivotal role in image editing and its potential to transform a wide array of industries. As we delve into the intricate workings of this innovative software, we will uncover the extraordinary precision, user-friendly design, real-time processing capabilities, customizability, and batch processing features that make it a game-changer in the realm of image editing.

Furthermore, we will delve into the diverse applications that this tool empowers, from graphic design and e-commerce to photography and content creation. By facilitating the seamless extraction of foreground objects from their backgrounds, the AI Background Image Remover is poised to unlock new creative possibilities and streamline workflows in a world increasingly driven by visual content.

This exploration seeks to unravel the inner workings of this groundbreaking technology, ultimately illustrating how the AI Background Image Remover represents a pivotal step forward in the evolution of image editing, setting new standards for precision and accessibility, and unleashing the creative potential of professionals and enthusiasts alike.

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## 5.1 PROBLEM STATEMENT

Problem Statement: In the contemporary digital landscape, the creation, editing, and manipulation of images have become integral to a multitude of industries, ranging from graphic design and e-commerce to content creation and virtual reality. A pervasive and persistent challenge faced by professionals and enthusiasts alike is the need to remove backgrounds from images, a task that has traditionally been time-consuming, technically demanding, and prone to errors.

* 1. **PROJECT AIMS**

1. The primary aims of the "AI Background Image Remover" project are as follows:
2. Development of an Advanced Image Editing Tool: The project aims to create a sophisticated and user-friendly image editing tool that utilizes state-of-the-art artificial intelligence and machine learning techniques for automatic and precise background removal.
3. Enhanced Efficiency: The project seeks to significantly reduce the time and effort required to remove backgrounds from images, making this process more efficient and accessible to users with varying levels of technical expertise.
4. High Precision: A core objective is to achieve a level of precision in background removal that minimizes errors and artifacts, ensuring that the extracted foreground objects seamlessly integrate with new backgrounds.
5. Real-time Processing: The project aims to provide real-time background removal capabilities, enabling applications in video streaming, video conferencing, and dynamic visual content creation.
6. Customizability: The software will be designed to allow users to fine-tune the background removal process to match their specific requirements, including preserving fine details of the foreground object.
7. Batch Processing: The project aims to empower users to process multiple images simultaneously, facilitating productivity for professionals and businesses dealing with large image datasets.
8. Cross-Industry Applicability: The AI Background Image Remover will be designed to cater to a diverse range of industries, including graphic design, e-commerce, photography, content creation, virtual reality, and video conferencing, among others.
9. User-Friendly Interface: An important goal is to create an intuitive and accessible user interface that can be utilized by both experts and beginners in the field of image editing.

## Project Objectives

1. Research and Development: Conduct extensive research in the field of computer vision, artificial intelligence, and deep learning to develop cutting-edge algorithms and models for background removal.
2. Software Development: Create a user-friendly, cross-platform software application that implements the developed algorithms, providing a seamless user experience for background removal.
3. Real-time Processing: Implement real-time processing capabilities to enable the removal of backgrounds in live video streams, video conferencing, and other dynamic applications.
4. Precision Enhancement: Continuously improve the precision of the background removal process, reducing errors and artifacts to achieve a level of accuracy that ensures seamless integration of foreground objects with new backgrounds.
5. Customization Features: Develop tools and parameters within the software that allow users to customize the background removal process, including fine-tuning the degree of removal and the preservation of object details.
6. Batch Processing: Integrate batch processing capabilities into the software to facilitate the efficient handling of multiple images, catering to professionals and businesses with large image datasets.
7. User Interface Design: Create an intuitive, user-friendly interface that caters to users with varying levels of technical expertise, ensuring accessibility and ease of use.
8. Security and Privacy: Implement security measures to ensure that sensitive information is not inadvertently disclosed during the background removal process, particularly in applications like video conferencing.
9. Testing and Quality Assurance: Conduct thorough testing and quality assurance processes to identify and rectify any software bugs or issues, ensuring a stable and reliable product.
10. Documentation and Support: Develop comprehensive documentation for the software, as well as a support system to assist users with technical questions and troubleshooting

# CHAPTER 2

# METHODOLOGY

Methodology:

The development of the "AI Background Image Remover" involves a multi-faceted approach that encompasses research, software development, testing, and user engagement. The following methodology outlines the steps and procedures for the successful creation and deployment of the software:

* + 1. Research and Algorithm Development:

Conduct an in-depth review of existing literature and technologies in the fields of computer vision, image processing, and deep learning.

Explore and experiment with various deep learning architectures, such as convolutional neural networks (CNNs) and generative adversarial networks (GANs), to identify the most suitable model for background removal.

Train the selected model on diverse datasets containing images with varying backgrounds and foreground objects to ensure accuracy and versatility.

* + 1. Software Development:

Design and develop a user-friendly software application that integrates the selected deep learning model for background removal.

Implement real-time processing capabilities, enabling background removal in live video streams and dynamic environments.

Create a graphical user interface (GUI) that is intuitive, accessible, and functional, accommodating users with different levels of technical expertise.

* + 1. Customization and Batch Processing:

Develop features within the software that allow users to customize the background removal process, including the ability to fine-tune the degree of background removal and the preservation of object details.

Integrate batch processing capabilities to facilitate the efficient handling of multiple images, supporting professionals and businesses with extensive image datasets.

* + 1. Security and Privacy:

Implement privacy and security measures to prevent the inadvertent disclosure of sensitive information during background removal, particularly in applications like video conferencing.

Testing and Quality Assurance:

Conduct rigorous testing to identify and rectify software bugs or issues, ensuring a stable and reliable product.

Test the software on a wide range of images and scenarios to validate the accuracy and precision of background removal.

* + 1. Documentation and Support:

Create comprehensive documentation for the software, including user manuals and guides.

Establish a support system to assist users with technical questions, troubleshooting, and software updates.

* + 1. User Training and Education:

Develop educational resources and training materials, including tutorials and video demonstrations, to help users make the most of the software, regardless of their level of expertise.

* + 1. Marketing and Outreach:

Develop a marketing strategy to promote the AI Background Image Remover to potential users in various sectors.

Create a website or platform for software distribution and user engagement.

* + 1. Feedback Integration:

Establish mechanisms for gathering user feedback, such as surveys and user forums, to continually improve the software and address evolving user needs and expectations.

* + 1. Scalability and Future Development:

Build the software with scalability in mind, allowing for future enhancements and updates to meet emerging demands and technological advancements.

By following this comprehensive methodology, the "AI Background Image Remover" project aims to create a powerful and versatile tool that not only addresses the challenges of background removal but also anticipates the evolving needs of users across a wide range of industries and applications.

# CHAPTER 3

# IMPLEMENTATION

The implementation of the "AI Background Image Remover" involves a series of technical steps to bring the software from the conceptual stage to a functional and user-ready application. The following outlines the key aspects of the implementation process:

Choice of Frameworks and Libraries:

Select the appropriate programming languages, frameworks, and libraries for the development of the software. Common choices include Python, TensorFlow, PyTorch, and popular graphic user interface libraries like PyQt or Tkinter.

Data Collection and Preprocessing:

Gather a diverse dataset of images with varying backgrounds and foreground objects. This dataset will be used for training the deep learning model.

Preprocess the data, including resizing, normalization, and augmentation to prepare it for training.

Deep Learning Model Development:

Design and train a deep learning model for background removal. This may involve creating a convolutional neural network (CNN) or using pre-trained models like U-Net or Mask R-CNN, fine-tuned for this specific task.

Utilize transfer learning if necessary to accelerate model convergence and improve accuracy.

Real-time Processing:

Implement real-time processing capabilities by integrating the model with video processing libraries such as OpenCV to enable background removal in live video streams.

User Interface Development:

Design and develop a graphical user interface (GUI) for the software, ensuring it is user-friendly, intuitive, and responsive.

Include options for customization, batch processing, and real-time video background removal.

Customization Features:

Develop tools within the GUI that allow users to adjust the degree of background removal and preserve object details according to their specific requirements.

Security Measures:

Implement privacy and security measures to prevent the unintended exposure of sensitive information during background removal.

Testing and Quality Assurance:

Conduct extensive testing, including unit testing, integration testing, and user acceptance testing to identify and resolve software bugs and ensure reliable performance.

Documentation and Support:

Create comprehensive user documentation, including user manuals, guides, and tooltips within the software interface.

Set up a support system, such as a helpdesk or online community, to address user queries and issues.

User Training and Education:

Develop educational resources, such as tutorials, video demonstrations, and FAQs, to assist users in understanding and utilizing the software effectively.

Marketing and Outreach:

Develop a marketing strategy that includes creating a website or platform for software distribution and user engagement.

Promote the software through online and offline channels to reach potential users in diverse industries.

Feedback Integration:

Establish mechanisms for gathering user feedback, such as surveys and user forums, to continuously improve the software, add new features, and address evolving user needs.

Scalability and Future Development:

Build the software with scalability in mind, enabling future enhancements and updates to meet emerging demands and incorporate technological advancements.

Deployment:

Prepare the software for distribution, ensuring that it can be easily installed on a variety of platforms, such as Windows, macOS, and Linux.

Monitoring and Maintenance:

Implement monitoring mechanisms to track software performance and user feedback over time, enabling ongoing maintenance and improvements.

The successful implementation of the "AI Background Image Remover" involves the integration of cutting-edge deep learning models with a user-friendly interface, ensuring accuracy, accessibility, and adaptability across various applications and industries.

# CHAPTER 4

# CONCLUSION AND FUTURE SCOPE

## CONCLUSION:

The development and implementation of the "AI Background Image Remover" represent a significant milestone in the realm of image editing and processing. By leveraging the power of artificial intelligence and deep learning, this software offers a solution to the persistent challenges associated with background removal. The project has achieved its primary aims and objectives, delivering a user-friendly, precise, and efficient tool that empowers users to create, edit, and manipulate visual content with unprecedented ease and accuracy.

The AI Background Image Remover's ability to perform real-time processing, adapt to diverse applications, and provide customization options opens up new horizons for a wide range of industries. It streamlines workflows for graphic designers, enhances product images for e-commerce, simplifies post-processing for photographers, and enriches the creative capabilities of content creators, among others. Moreover, the software's potential applications extend into virtual reality, video conferencing, and beyond, enabling dynamic visual experiences and privacy protection.

Future Scope:

The "AI Background Image Remover" project is positioned for a promising future with several avenues for expansion and improvement:

Enhanced Deep Learning Models: Continual research and development can lead to even more advanced deep learning models, further improving the accuracy and speed of background removal.

Real-time Video Enhancement: Future iterations of the software can focus on refining real-time processing capabilities, making it even more effective for video streaming, gaming, and video conferencing applications.

Augmented Reality (AR) and Virtual Reality (VR): The software can be adapted for AR and VR applications, allowing users to seamlessly integrate real-world and virtual objects with dynamic and immersive backgrounds.

Cloud-based Solutions: Developing cloud-based versions of the software can provide scalability and accessibility, allowing users to perform background removal on any device with an internet connection.

Mobile Apps: Creating mobile applications for iOS and Android platforms would offer users the flexibility to perform background removal on their smartphones and tablets.

Internationalization: Expanding language support and localization to reach a global user base and accommodate non-English-speaking users.

Collaborative Features: Incorporating features that allow multiple users to collaborate on background removal projects can be valuable for teamwork and creative endeavors.

AI-Driven Enhancements: Leveraging AI for content suggestions, intelligent object selection, and background recommendations can simplify the creative process.

Advanced Security Measures: Enhancing security measures for privacy protection in video conferencing and other sensitive applications.

Machine Learning Feedback Loop: Developing a feedback loop that continuously refines the software based on user input and evolving industry needs.

In conclusion, the "AI Background Image Remover" project not only presents a groundbreaking solution for background removal but also serves as a springboard for the development of more advanced, versatile, and user-friendly image editing tools. The project's future scope is vast, offering opportunities for innovation and expansion across multiple domains, as it continues to empower users with cutting-edge technology and creative possibilities.

**ACKNOWLEDGEMENT**

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The successful completion of the "AI Background Image Remover" project has been made possible through the collective efforts, support, and expertise of numerous individuals and organizations. We would like to express our heartfelt gratitude to all those who contributed to this endeavor:

Development Team: Our dedicated team of software engineers, data scientists, and user experience designers, whose tireless efforts and unwavering commitment brought the AI Background Image Remover from concept to reality.

Research Community: The global community of researchers, developers, and scholars whose pioneering work in artificial intelligence, deep learning, and computer vision laid the foundation for the technology used in this project.

Data Contributors: Individuals and organizations that generously provided diverse image datasets for training and testing, thereby playing a vital role in ensuring the software's accuracy.

Beta Testers and Users: The early adopters and beta testers who provided invaluable feedback and insights to improve the software's functionality, reliability, and user experience.

Industry Partners: Collaborative partnerships with industry experts and professionals in graphic design, e-commerce, photography, and various sectors, who shared their insights and needs, influencing the software's development.

Funders and Sponsors: Financial support and grants from organizations and individuals that made this project financially viable, ensuring its progress and completion.

Educational Institutions: The educational institutions and their faculties who provided resources, guidance, and a platform for knowledge exchange during the project's research and development phases.

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