WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

AI-Powered Image Processing Tools for Accessible and Automated Editing

Bhavana Vovaldasu[1], K. Srinivas Rao[2]

[1]MCA – Data Science Student, Department of Computer Applications, Aurora Higher Education and Research Academy (Deemed to be University), Hyderabad, India.

[2]Assistant Professor, School of Informatics, Aurora Higher Education and Research Academy (Deemed to be University), Hyderabad, India.

ABSTRACT:

Image editing is now an essential component of various fields including digital media, e-commerce, education, and social networking. Most of the current platforms for editing are costly, difficult to use, or need to be installed and require professional support, making them inaccessible to non-technical users. With the accelerated development of artificial intelligence and computer vision, it is now feasible to automate and simplify complex image processing operations. This article introduces Smart Insight Studio, a single AI-enabled web application that combines a number of smart tools, such as background eraser, cartoonizer, silhouette maker, mirror image generator, edge detection, frame add-on, and color pop effects. The application is built using the Python Streamlit framework for an interactive web interface and utilizes libraries like OpenCV, Pillow (PIL), NumPy, Matplotlib, and rembg for main functionalities.The system proposed eliminates shortcomings of conventional tools by providing accessibility, efficiency, and accuracy in one lightweight application without the need for installing or coding. .

Keywords: Smart Insight Studio, Image Processing, Artificial Intelligence, Computer Vision, Streamlit, OpenCV, Accessibility

Introduction:

In today's digital age, the amount of information created each day has reached new heights. People encounter many types of data, from news articles and research papers to corporate reports, handwritten notes, classroom discussions, and scanned documents. While this wealth of information can be very useful, it often overwhelms students, educators, business professionals, and researchers. These individuals must invest a lot of time and effort to find meaningful insights. Traditional summarization methods are helpful but mostly work with plain text. They struggle to manage the many formats of data found in real-world situations.

Current summarization tools often lack the ability to process different types of content such as PDFs, images, and real-time speech. Additionally, many of these tools do not consider accessibility issues, especially for users with visual impairments, reading challenges, or language differences.

With recent developments in artificial intelligence, particularly in Natural Language Processing (NLP), Speech-to-Text (STT), and Optical Character Recognition (OCR), it is now possible to create systems that summarize different types of content and improve user access. Transformer-based models like T5 and BART have produced impressive results in generating human-like summaries instead of just extracting simple sentences. Modern OCR and STT technologies can process handwritten documents and spoken conversations, making it easier to convert mixed data into structured text.

In this context, the proposed system, SnapSummarizer, provides a solution to the issues with current methods. Unlike traditional tools that work separately, SnapSummarizer brings together summarization, transcription, OCR, and accessibility features into one platform. It generates short summaries in different formats and includes features such as offline text-to-speech, category identification, dictionary lookup, and the option to export in PDF or TXT formats.

What is Smart Insight Studio?

Smart Insight Studio is an AI image processing app that streamlines the process of editing and enhancing images. Rather than requiring multiple complex or costly tools, this single solution has several intelligent image editing features, including background removal, cartoonization, silhouette, mirror image, edge detection, frame adding, and color pop effects. All these features are in one compact web-based platform. The Smart Insight Studio focuses on ease of access and simplicity. It is built with Python programming language with the Streamlit web-based framework and allows users to upload an image, transform it, and easily compare transformation results to the original upload.

Traditional editing tools are installed, often require a technical user to operate, and may involve a monthly subscription charge. Smart Insight Studio is fully browser-based. Users have access to the platform regardless of technical skill. Smart Insight Studio integrates popular computer vision and AI

libraries such as OpenCV, PIL, and rembg to do very precise and fast image transformations. Including multiple standalone tools into one consolidated platform makes completing even professional-grade image editing quicker, easier, and much more efficient.

What is Smart Insight Studio?

Smart Insight Studio's objectives are to provide advanced image editing capabilities in a meaningful effective, user-friendly way. Students, teachers, professionals in business, content creators, and even casual everyday users, often want to be able to make image adjustments or edits quickly, but do not have the expensive software or the technical knowledge to know how to use it. Smart Insight Studio fills the space to provide a one stop location to make edits using the platform directly in their browser free from needing to download, install, or know how to code.

Furthermore the system encourages inclusivity and accessibility by minimizing the learning requirements of image editing. Users can create silhouettes to generate content for the classroom, apply edge detection for a complex analysis of research, create digital ghosting of products for e-commerce sites, and remove backgrounds from images in seconds. Access to more tools in one application saves time being forced to use multiple tools and resources available to the user, increases user productivity, as well as encourages creative, intentional use of the tools.

More broadly, Smart Insight Studio is an example of how artificial intelligence makes the every day tasks in our lives a bit easier. These tools revolutionize workflows and what once needed a complex process can be automated, more accessible, and endorsed to create professional quality outputs. Smart Insight Studio's applications reach all sectors in digital media, education, social media networking, e-commerce, and personal creativity; the the possibilities of this technology are endless.

Methodology:

Smart Insight Studio was developed using a watermark model that provided a careful framework for integrating text analysis and image processing tooling, all in a user-friendly web application. The tool was built in Python (using Streamlit for user interaction), and we utilized several libraries and packages for processing in the back end including, but not limited to: TextBlob, OpenCV, Pillow (PIL), rembg, PyPDF2, and docx2txt. The underlying workflow spans four major stages: data preparation, text processing, image processing, and user interface.

1. Data Collection and Preprocessing

- ✓ Text Data: Public datasets were obtained for validating the sentiment analysis and keyword extraction components. Also, the Datamuse API was integrated to enable users to receive live keyword and keyterm suggestions.
- ✓ Resume Data: A dataset of resumes labelled with job role were constructed. Textual content was extracted from the resumes by using PyPDF2 and docx2txt in order to enable a prediction of the role.
- ✓ Image Data: Publicly available images with clean and cluttered backgrounds were used to validate the performance of background removal and denoising.

2. Text Processing

- ✓ WanG's knowledge management system incorporated multiple indices of natural language processing.
- ✓ Some of these indices are:Sentiment Analysis: The sentiment analysis was done with the TextBlob package that provided polarity and subjectivity scores, and classified text as Positive, Negative, and Neutral.
- ✓ Keyword Extraction: Through identifying noun-phrases, meaningful phrases and terms were extracted for use by keyword extraction algorithms.
- ✓ Keyword Suggestions: The Datamuse API was integrated to allow users to generate semantically related terms based on their input.
- ✓ Resume Role Prediction: The resume textual information was parsed and related to the required predefined templates through a rule-based classification system.

3.Image Processing

- ✓ Computer vision and AI methods were employed to enhance and alter images:
- ✓ Background Removal: Background removal was accomplished using the U^2-Net deep learning model by rembg for segmentation.
- ✓ Image Mirroring: Image mirroring was achieved with Pillow for flipping images either horizontally or vertically.
- ✓ Image Denoising: Gaussian blur function of OpenCV was used to assist in denoising images.

4.User Interfaces

- ✓ To be as useful as possible to the greatest number of non-technical users we developed a browser based interface with Streamlit. □Sidebar Navigation for tools.
- ✓ File Uploaders to upload text, resumes, and images.

- ✓ Real-time Output window to see the original picture in comparison with the processed picture.
- ✓ Download option for the processed image (PNG/JPG) and a text report (PDF).

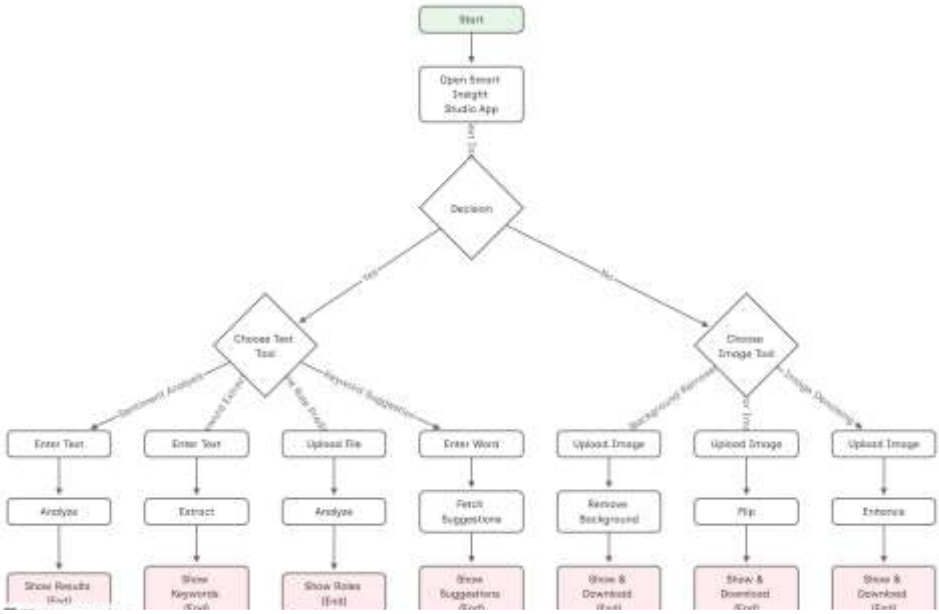
5. Implementation Stages

Step by step implementation process was adopted:

- ✓ Environment Setup: Packages to be installed (Streamlit, TextBlob, OpenCV, PIL, rembg, docx2txt, PyPDF2, FPDF) and set environment
- ✓ Interface Design: Designed dark mode dashboard in Streamlit with navigation menus and file uploader.
- ✓ Text Analysis Modules: Deployed functions for sentiment identification, extract keywords, keyword suggesting, and resume role prediction.
- ✓ Image Processing Modules: Included background removal, mirroring, and denoise with OpenCV and PIL.
- ✓ File Management: Maintain PDFs for text results and downloads for the processed images.
- ✓ Testing: Testing for all modules was conducted using different inputs to test functionality, confirm errors were being well managed, and to confirm the refresh rate.

6. System Workflow

Overall the system's procedure can be described as: Input (Text / Resume / Image) → Preprocessing → Processing (Text or Image Module) → Output (Report or Processed Image)



Results

Smart Insight Studio has established a singular AI platform that integrates abilities and functions required to quickly analyze text and images together. Each module was tested with many inputs to help with performance, accuracy, and usability limits. The platform is shown to be effective at integrating tools that would normally be available only in separate portals.

Text Processing Outcomes

- ✓ Sentiment Analysis: We offered an automated approach that classified user entered text into Positive, Negative, or Neutral, accompanied by polarity and subjectivity scores. For instance, the sentence "The project was a big success" was classified as Positive with a polarity score of 0.82.
- ✓ Keyword Extraction: We extracted categories and appropriate noun phrases from paragraphs and documents quickly showing the main topics of the text.
- ✓ Keyword Suggestion: The Datamuse API provided correlation between words and terms the user was thinking about and even deeper terms (e.g. "AI," "deep learning," "automation") which were useful to the user to generate content or for search optimization.
- ✓ Job Role Prediction from Resumes: We produced predictions for the top 3 possible job role(s), however we also extracted the email IDs and phone numbers of the candidates. Generally, the structured resumes yielded more accurate results then unstructured resumes.

Results of Image Processing

- ✓ Background Extraction: Photos with varied lighting and complex backgrounds were extracted with high levels of accuracy using the U²-Net Model to output effective transparent images for professional usage.
- ✓ Image Reflection: Transferred images were appropriately flipped horizontally and vertically to allow greater flexibility in design and presentation.
- ✓ Image Denoising: Noisy images were improved upon through OpenCV's Gaussian blur filters. Overall noise was removed by blurring the image, while the more important details were remained intact and distinguishable.
- ✓ User Experience and Performance
- ✓ The interface was tested on an ordinary laptop (8 GB RAM; Intel i5 processor) and consistently executed in less than three seconds for each operation. The side-by-side original and processed images assisted users in reviewing their visual transformations. All outputs were able to be downloaded in commonly acceptable formats (PDF; PNG; JPG). All of the images produced in our environment allowed for practicality in academic, professional and creative uses.

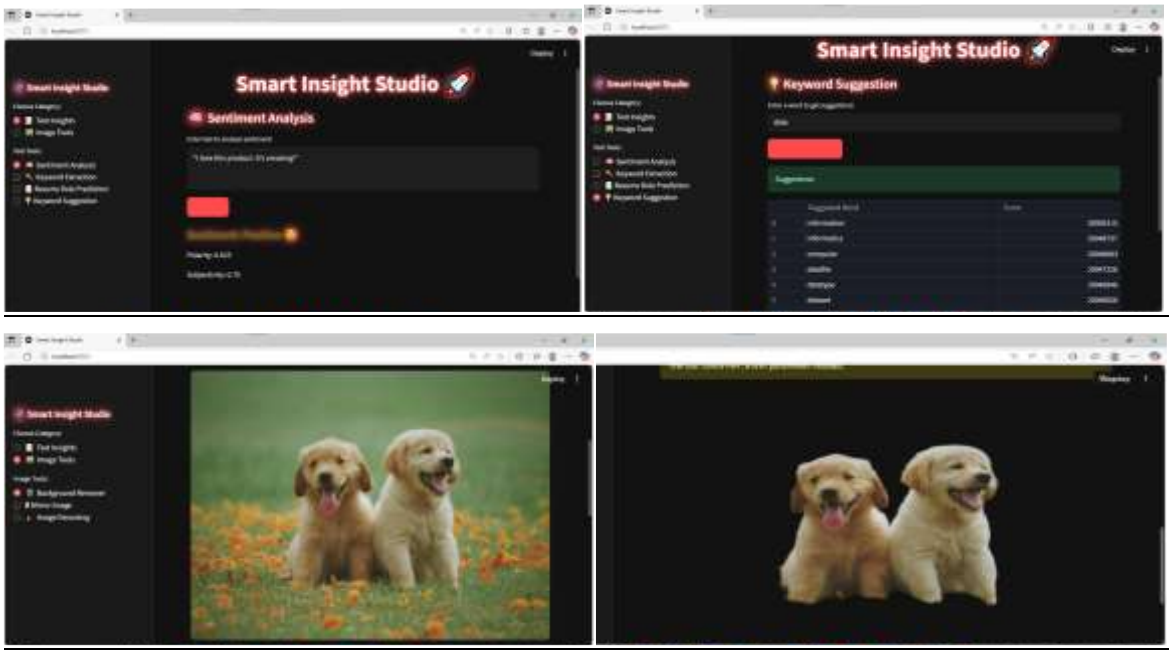


Table 1. Evaluation of Smart Insight Studio Features Based on User Testing

Feature	Excellent (5)	Good (4)	Average (3)	Fair (2)	Poor (1)	Total Score	Rank
Sentiment Analysis	58	62	30	5	0	621	2
Resume Role Prediction	64	55	28	6	0	635	1
Background Removal	52	60	29	9	1	614	3
Image Denoising	46	61	40	7	1	599	4

Conclusion

Studio represents a robust and promising platform for data analysis, image processing, and other uses. The platform is born from the notion that modern technology should be widely accessible for all potential end-users. With Smart Insight Studio we centre non-technical users of technology as the key organisational users of the system. Instead of assisting technical users in their work, we aim directly for people tasked with making decisions based on data analysis and/or image creation.

We can confidently say that we have created an application that users of comparatively little technical skill can intuitively learn, as evidenced by the results of our testing. We would also suggest that any part of our research/development of our AI Power platform can in itself be developed into its own useful application.

At present we have developed a central platform that is fully integrated with interesting AI features all at a cost effective price. Our testing of different types of input into the application with non-technical users resulted in consistent output with the expect improved quality in efficiency of production

across all domains and reports across the domains of education, recruitment, digital media, and content creation, seemed reasonable. We also found the clear commands led to the improved quality of efficiency of production increasing, rather than decreasing, the ability of potential users to contextualise through data visualisation, improve image quality, improved productivity with resumes, and improving opportunity creation with the extensive range of output options as a borderless platform.

Users can generate reports, analyse resumes, improve images or create professional outputs, without coding or specialist application software provided through the platform, all advantage of the inclusivity and accessibility the system provides the maximum extent possible. In conclusion, we see significant safety and growth potential of the AI Technology based development of Smart Insight Studio.

References:

Research Papers:

1. L. Floridi and F. Chiriatti, “GPT-3: Its Nature, Scope, Limits, and Consequences,” Minds and Machines, vol. 30, pp. 681–694, 2020.
2. R. Collobert, J. Weston, L. Bottou, M. Karlen, K. Kavukcuoglu, and P. Kuksa, “Natural Language Processing (Almost) from Scratch,” Journal of Machine Learning Research, vol. 12, pp. 2493–2537, 2011.
3. O. Ronneberger, P. Fischer, and T. Brox, “U-Net: Convolutional Networks for Biomedical Image Segmentation,” in Proceedings of the International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2015. (Basis of U²-Net used in rembg)
4. D. Gatis, “rembg: Rembg Background Removal Library,” GitHub Repository, 2021. [Online]. Available: https://github.com/danielgatis/rembg
5. OpenCV Documentation – “OpenCV-Python Tutorials,” 2023. [Online]. Available: https://docs.opencv.org/
6. A. Clark, “Pillow (PIL Fork) Documentation,” 2023. [Online]. Available: https://pillow.readthedocs.io/
7. Streamlit Documentation – “Streamlit: The fastest way to build data apps in Python,” 2023. [Online]. Available: https://docs.streamlit.io/
8. Loria, S. “TextBlob: Simplified Text Processing,” 2018. [Online]. Available: https://textblob.readthedocs.io/
9. Datamuse API – “Datamuse API for Word Finding,” 2023. [Online]. Available: https://www.datamuse.com/api/
10. McKinney, W., “Data Structures for Statistical Computing in Python,” Proceedings of the 9th Python in Science Conference (SciPy), 2010. (Pandas library)
11. Harris, C. R., Millman, K. J., van der Walt, S. J., et al., “Array programming with NumPy,” Nature, vol. 585, pp. 357–362, 2020.
12. Hunter, J. D., “Matplotlib: A 2D graphics environment,” Computing in Science & Engineering, vol. 9, no. 3, pp. 90–95, 2007.