MAJALAH ILMIAH JOURNAL
LPPM Universitas Putra Indonesia YPTK Padang
Lubuk Begalung Highway, Padang, Sumatera Barat, Indonesia, Pos Code: 25221
Volume: 33, Issue: 1, Page: 61 - 64, 30/06/2026, e-ISSN: 1412-5854

# Introduction to Image-Based Computer Vision Applications in Modern Medical Practice

Rika Rosnelly[1], Bob Subhan Riza[2], Edy Victor Haryanto[3], Wahyu Saptha Negoro[4]✉, Iwan Fitrianto Rahmad[5], Vidi Agung Fragastia[6], Annisa Ashari[7]
[1234567]University Potensi Utama, Medan, North Sumatra, 20241, Indonesia.
Correspondence email: wahyusaptha1707@gmail.com

**Abstract**

The advancement of Artificial Intelligence (AI)—specifically image-based computer vision—has significantly contributed to modern medical practice by enabling more accurate and efficient medical image analysis. However, understanding and practical skills regarding the application of computer vision in community and educational settings remain limited. This community service initiative aims to enhance participants' conceptual understanding and foundational skills in applying image-based computer vision within a medical context through a hands-on learning approach, addressing the issue that many partner participants did not yet understand how computer vision models function to support AI systems. The program was conducted as an integrated workshop combining theoretical instruction with practical exercises using the cloud-based platform Google Colab. Evaluation was carried out via pre-tests, post-tests, and practical assessments. Results showed an improvement in participant understanding, with the average score rising from 54.2 to 82.6 (a 52.4% increase). Notably, 85% of participants were able to execute image processing modules independently, and 88% successfully completed the practical case study. Participant satisfaction reached a score of 4.6 out of 5. This initiative contributes to improved technology literacy and bridges the gap between conceptual understanding and practical competence in the application of AI within the healthcare sector.

Keywords: Community Service, Computer Vision, Artificial Intelligence, Medical Imaging, Google Colab



## 1. Introduction

The rapid advancement of Artificial Intelligence (AI) has driven significant transformation across various sectors, including healthcare. A key branch of AI playing a vital role is computer vision—a technology that enables computers to interpret and analyze visual data. In modern medical practice, computer vision is utilized for the analysis of medical images such as X-rays, CT scans, MRIs, and microscopic images to support diagnostic processes and clinical decision-making [1], [2].

The advancement of digital technology and artificial intelligence (AI) has brought about significant changes across various fields, including the healthcare sector. One rapidly evolving technology is Computer Vision (CV), which enables computers to acquire, process, analyze, and interpret visual information from images. In the medical field, Computer Vision holds great potential to assist healthcare professionals in analyzing various types of medical images more quickly, systematically, and objectively [3], [4], [5], [6].

Despite its significant potential, the adoption of computer vision in educational and community settings still faces challenges, particularly regarding practical skills. Many participants grasp AI concepts theoretically but are unable to implement them in real-world contexts. This gap stems from limited practical experience, technical complexity, and restricted access to user-friendly programming environments [7], [8], [9].

Based on these issues, this community service activity was designed to provide a practice-based learning experience in image-based computer vision within a medical application context, utilizing the Google Colab platform as an easily accessible learning solution

Through learning and hands-on practice, participants are expected not only to become familiar with Computer Vision concepts but also to understand the workflow of medical image processing—from image input, preprocessing, and analysis to result evaluation. This knowledge is intended to serve as a foundation for developing and implementing Computer Vision-based solutions that foster improved quality, efficiency, and innovation in modern healthcare services [10], [11].

### *1.1 Community Service Solution Framework*

Recent studies demonstrate that a hands-on training approach is more effective at fostering the adoption of AI technology than lecture-based methods alone [12], [13]. Practice-based training models enable participants to understand system workflows from an operational perspective and enhance the retention of technical skills.

This Community Service activity is designed using a structured practical training framework comprising four main stages, aimed at gaining early insight into developments in computer vision:

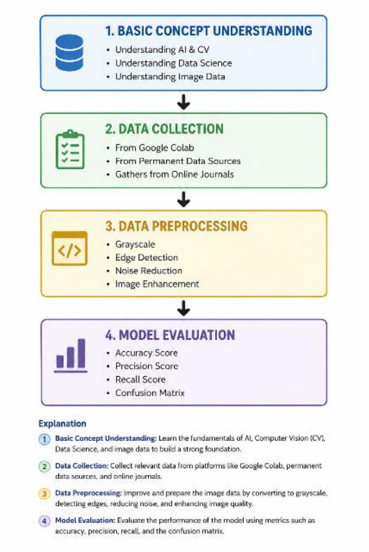


Figure 1. Workflow of the Community Service Implementation Method.

## 2. Methods

This community service activity was conducted as a one-day workshop integrating conceptual presentations with hands-on practice. The methods employed included:

1. Presentation of Conceptual Material: Participants gain a foundational understanding of Artificial Intelligence and computer vision, as well as their roles in modern medical practice, particularly regarding medical image analysis. Many individuals within the partner organizations do not yet understand how computer vision models function to support Artificial Intelligence [14], [15].
2. Cloud-Based Hands-On Practice: Practical exercises are conducted using Google Colab as a cloud-based programming environment. Participants are guided to write and execute Python code utilizing the OpenCV, NumPy, and Matplotlib libraries [16], [17].
3. Image Processing Case Studies: Examples of image processing tasks included image creation and loading, grayscale conversion, edge detection using the Canny method, color segmentation, image contrast enhancement, and visualization of processing results.

Figure 2. Community Service Module

This approach was chosen to lower technical barriers while bridging theoretical concepts with practical implementation.

## 3. Results and Discussions

The results of the activity indicate an improvement in participants' understanding of the image-based computer vision workflow. Participants were able to operate Google Colab, write simple Python code, and understand the function of each stage of image processing.

Figure 3. Discussion on the Introduction to Google Colab

Technically, participants successfully converted images to grayscale, applied edge detection, performed basic color segmentation, and enhanced image visual quality using contrast enhancement techniques.

Visualizing the processing results helped participants understand the relationship between computational processes and medical image interpretation. This activity was part of the "Introduction to Image-Based Computer Vision Applications in Modern Medical Practice" program at UCYP University, conducted by the ITCYP school.

Figure 4. Providing education.

Figure 4 above shows an educational session led by a presenter to introduce computer vision applications in the medical field from the initial stage, enabling partners to understand how computer vision models function in support of artificial intelligence. The activity took place on Monday from 09:00 to 11:00.

Figure 5. Closing of the computer vision education session at ITCYP School.

Figure 5 above shows the completed community service session, followed by a group photo. A group photo featuring the speaker and other participants can be seen in the following image.

Figure 6. Group photo of participants and speakers.

These findings indicate that a practice-based learning approach supported by a cloud platform is effective in enhancing foundational computer vision competencies, aligning with the need for technological literacy in the healthcare sector.

Figure 7. Signing of the MoU

Figure 7 above shows that the educational activity was conducted alongside the signing of the MoU, serving as a tangible manifestation of the collaboration. Beyond providing education on the computer vision models that support artificial intelligence, the presenters also established an intensive partnership.

However, based on the understanding demonstrated by ITCYP students—assessed via a pre-test involving an average score calculation (comprising 10 multiple-choice questions, with 10 points per correct answer and a maximum score of 100; this assessment instrument was administered by the presenter to evaluate comprehension of the educational material)—the percentage of improvement can be calculated as follows:

$$\text{Peningkatan} = \frac{\text{Post-test} - \text{Pre-test}}{\text{Pre-test}} \times 100\%$$

The following is a graph generated from the pre-test and post-test calculations for students during the community service activity, as shown in Figure 6 below.

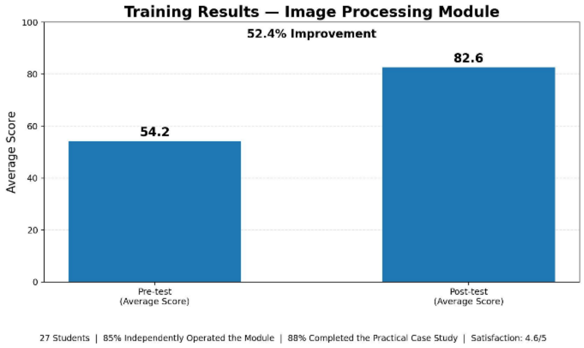


Figure 8. Graph of Pre-test and Post-test Results

Figure 6 above presents results indicating improved understanding among the 27 participants—serving as a measure of success—with the average score rising from 54.2 to 82.6, representing an increase of approximately 28.4% in comprehension of the educational material provided. Based on these results, 85% of the participants were able to complete the image processing module independently, and 88% successfully completed the practical case study. Participant satisfaction with the activity reached a score of 4.6 out of 5.

## 4. Conclusions

This community service activity for ITCYP students demonstrated high levels of motivation and an improved understanding of how computer vision models function in support of Artificial Intelligence. The program focused on developing knowledge regarding the fundamental concepts of Artificial Intelligence and computer vision, as well as their roles in modern medical practice—specifically in medical image analysis. Post-program evaluations of the 27 participants revealed an 82.6 percentage-point increase in understanding, indicating that the students had gained a solid grasp of the material concerning Artificial Intelligence and computer vision in medical image analysis.


## Acknowledgements

The author wishes to express gratitude to Main Potential University for its assistance with this community service activity, as well as to the partners who provided support for its implementation.

## Funding Information

The implementation of this community service activity is funded by individuals and various other funding sources.


## Author Contributions Statement

Contributor Role Taxonomy (CRediT) to recognize individual author contributions, the contributions made can be seen in the following table.

| Name of Author | C | M | So | Va | Fo | I | R | D | W |
|---|---|---|---|---|---|---|---|---|---|
| Rika Rosnelly | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Wahyu Saptha Negoro | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bob Subhan Riza | ✓ | | ✓ | ✓ | | | ✓ | | ✓ |
| Annisa Ashari | | ✓ | | | ✓ | | ✓ | | ✓ |

## References


[1] Alzubaidi, L., Bai, J., Al-Sabaawi, A., et al. (2021). Review of deep learning: Concepts, CNN architectures, challenges, applications, future directions. Journal of Big Data, 8, Article 53. https://doi.org/10.1186/s40537-021-00444-8

[2] Esteva, A., Robicquet, A., Ramsundar, B., Kuleshov, V., DePristo, M., Chou, K., Cui, C., Corrado, G., Thrun, S., & Dean, J. (2019). A guide to deep learning in healthcare. Nature Medicine, 25(1), 24–29. https://doi.org/10.1038/s41591-018-0316-z

[3] Liu, X., et al. (2024). The medical AI evaluation problem. The Lancet Digital Health, 6(1), e18–e28.

[4] Shen, D., Wu, G., & Suk, H.-I. (2017). Deep learning in medical image analysis. Annual Review of Biomedical Engineering, 19, 221–248. https://doi.org/10.1146/annurev-bioeng-071516-044442

[5] Zhou, S. K., Greenspan, H., & Shen, D. (Eds.). (2023). Deep learning for medical image analysis (2nd ed.). Academic Press.

[6] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.

[7] Litjens, G., Kooi, T., Bejnordi, B. E., Setio, A. A. A., Ciompi, F., Ghafoorian, M., van der Laak, J. A. W. M., van Ginneken, B., & Sánchez, C. I. (2017). A survey on deep learning in medical image analysis. Medical Image Analysis, 42, 60–88. https://doi.org/10.1016/j.media.2017.07.005

[8] Rajpurkar, P., Chen, E., Banerjee, O., & Topol, E. J. (2022). AI in health and medicine. Nature Medicine, 28(1), 31–38. https://doi.org/10.1038/s41591-021-01614-0

[9] Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine, 25, 44–56. https://doi.org/10.1038/s41591-018-0300-7

[10] Aggarwal, C. C. (2023). Neural networks and deep learning: A textbook (2nd ed.). Springer. https://doi.org/10.1007/978-3-031-29642-0

[11] Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer. https://doi.org/10.1007/978-3-030-34372-9

[12] Prince, S. J. D. (2012). Computer vision: Models, learning, and inference. Cambridge University Press.

[13] Holzinger, A., Biemann, C., Pattichis, C. S., & Kell, D. B. (2017). What do we need to build explainable AI systems for the medical domain? arXiv. https://doi.org/10.48550/arXiv.1712.09923

[14] Shortliffe, E. H., & Sepúlveda, M. J. (2018). Clinical decision support in the era of artificial intelligence. JAMA, 320(21), 2199–2200. https://doi.org/10.1001/jama.2018.17163

[15] Lundervold, A. S., & Lundervold, A. (2019). An overview of deep learning in medical imaging focusing on MRI. Zeitschrift für Medizinische Physik, 29(2), 102–127. https://doi.org/10.1016/j.zemedi.2018.11.002

[16] Saptha Negoro, W., Adinda Destari, R., Hendra Azhar, A., & Agustin, F. (2026). Artificial intelligence education and training based on machine learning and computer vision to improve technological literacy of Bina Satria Vocational School students in Medan City. Majalah Ilmiah UPI YPTK, 33(1), 44–50. https://doi.org/10.35134/jmi.v33i1.221

[17] Saptha Negoro, W., Adinda Destari, R., Hendra Azhar, A., & Syahrian, A. (2025). Combination of active contour and CNN-based segmentation methods to improve accuracy in detecting rice diseases. Jurnal KomtekInfo, 12(4), 246–251. https://doi.org/10.35134/komtekinfo.v12i4.671

## Biographies of Authors

**Rika Rosnelly** He is a full-time lecturer at the Faculty of Computer Science and Engineering, Universitas Potensi Utama, Medan. He earned his doctorate in Information Technology from Universitas Gadjah Mada. His research interests include Digital Image Processing and Computer Vision. He can be contacted via email rikarosnelly@gmail.com

**Wahyu Saptha Negoro** is a full-time lecturer at the Faculty of Computer Science and Engineering, Potensi Utama University, Medan. He earned his Doctorate in Information Technology from Putra Indonesia University "YPTK", Padang. His research interests include Digital Image Processing and Computer Vision. He can be contacted via email at wahyusaptha1707@gmail.com

**Iwan Fitrianto Rahmad** He/She is a full-time lecturer at the Faculty of Computer Science and Engineering, Universitas Potensi Utama, Medan. He/She holds a Doctorate in Information Technology from Universitas Sumatera Utara, Medan. His research interests include Digital Image Processing and Computer Vision. He can be contacted via email at iwanfitrah@yahoo.com