

# Chapter 7


## Computer Vision

**Taufik Maulana**

 <http://orcid.org/0009-0001-6478-5682>

*Universitas Esa Unggul, Indonesia*

**Binastya Anggara Sekti**

 <http://orcid.org/0000-0001-5489-4888>

*Universitas Esa Unggul, Indonesia*

**Budi Tjahjono**

*Universitas Esa Unggul, Indonesia*

**Riya Widayanti**

*Universitas Esa Unggul, Indonesia*

### ABSTRACT

*Computer vision is a fast-growing field of artificial intelligence. It allows machines to understand and respond to visual information. This article gives a thorough overview of the basics, common image processing techniques, and the move toward deep learning methods like convolutional neural networks and vision transformers. Key computer vision tasks—such as classifying images, detecting objects, and segmenting them into parts—are explored in depth. The chapter also shows how this technology is used in different areas of life, like self-driving cars, healthcare, farming, and smart cities. The authors also look at recent trends like edge computing, multimodal AI, explainability, synthetic data, and low-shot learning. Along with these, they analyze the critical ethical and governance challenges they present. This article explains the technical foundations and societal implications of computer vision. It aims to provide readers with a comprehensive understanding of the field's potential and responsibilities in shaping the future of intelligent systems.*

DOI: 10.4018/404018

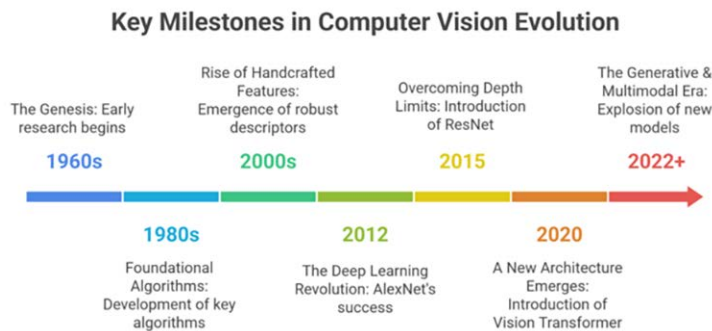
## INTRODUCTION TO COMPUTER VISION

Computer Vision is a branch of artificial intelligence that aims to mimic human vision to enable computers to understand and derive information from digital images and videos. Computer Vision is essentially the automated collection, processing and analysis of visual data.

The development of Computer Vision is related to advances in computer hardware, algorithm development, and digital image quality. Emerging in the 1960s as a development of image processing and pattern recognition, early research focused on geometric modeling and edge detection mainly for object recognition in a controlled environment (Marr, 1982). In the 2000s, SIFT and HOG descriptors emerged which improved the performance of real-world object recognition (Dalal & Triggs, 2005).

In early 2010, there was a major development with the introduction of deep learning, especially Convolutional Neural Networks. Alexnet's success in the ImageNet 2012 competition showing superior performance over traditional methods triggered a paradigm shift in Computer Vision (Krizhevsky et al., 2017). To provide a historical context, Figure 1 presents a timeline of the key milestones in the development of Computer Vision. Since then, Computer Vision has developed rapidly to be able to perform tasks such as real-time object detection, face recognition, and 3D scene reconstructions.

Figure 1. A Timeline of Key Milestones in Computer Vision



Today, Computer Vision is implemented into everyday life such as face authentication on smartphones, self-driving cars, and Advanced Driver Assistance Systems). These technologies impact various industries such as smart cities, manufacturing, healthcare, and agriculture. With the emergence of Vision Transformers (ViT) that use an attention-driven feature learning mechanism has enhanced the capabilities of Computer Vision (Dosovitskiy et al., 2021).

However, along with the development of Computer Vision various challenges both technical and ethical. The issues of dataset bias, privacy violation, clarity of decision-making are in the spotlight among AI researchers, government, and society (Buolamwini & Gebu, 2018). The balance between innovation and responsibility is important in the continued development of this technology.

Multimodal AI systems that can perceive holistically have been made possible in recent years by the integration of computer vision with other modalities like audio analysis and natural language processing (NLP). This convergence is demonstrated by applications like video summarization, visual question answering (VQA), and image captioning

21 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/computer-vision/404018](http://www.igi-global.com/chapter/computer-vision/404018)

## Related Content

---

### Machine Translation of Multiple-Word Expressions: Using NOOJ

Ali Boulaalamand Nisrine El Hannach (2027). *Encyclopedia of Modern Artificial Intelligence* (pp. 1-17).

[www.irma-international.org/chapter/machine-translation-of-multiple-word-expressions/407605](http://www.irma-international.org/chapter/machine-translation-of-multiple-word-expressions/407605)

### Introduction to AI and Big Data in Talent Acquisition

Nagwa Elmobark, Nofal Abdulhadiand Mohamed Badouch (2026). *Strategies for AI and Big Data in Recruitment* (pp. 1-38).

[www.irma-international.org/chapter/introduction-to-ai-and-big-data-in-talent-acquisition/388402](http://www.irma-international.org/chapter/introduction-to-ai-and-big-data-in-talent-acquisition/388402)

### The Use of Rasch Analysis to Enhance Measurement Instruments in Education

Sinethemba Mthimkhulu (2026). *AI, Analytics, and Assessment in Higher Education* (pp. 149-178).

[www.irma-international.org/chapter/the-use-of-rasch-analysis-to-enhance-measurement-instruments-in-education/390357](http://www.irma-international.org/chapter/the-use-of-rasch-analysis-to-enhance-measurement-instruments-in-education/390357)

### SVM-Based Traffic Data Classification for Secured IoT-Based Road Signaling System

Suresh Sankaranarayananand Srijanee Mookherji (2019). *International Journal of Intelligent Information Technologies* (pp. 22-50).

[www.irma-international.org/article/svm-based-traffic-data-classification-for-secured-iot-based-road-signaling-system/221352](http://www.irma-international.org/article/svm-based-traffic-data-classification-for-secured-iot-based-road-signaling-system/221352)

### Network Communication and Electronic Control Strategy of New Energy Vehicles Based on Cloud Platform in the IoT Environment

Yufeng Tang (2023). *International Journal of Ambient Computing and Intelligence* (pp. 1-15).

[www.irma-international.org/article/network-communication-and-electronic-control-strategy-of-new-energy-vehicles-based-on-cloud-platform-in-the-iot-environment/318135](http://www.irma-international.org/article/network-communication-and-electronic-control-strategy-of-new-energy-vehicles-based-on-cloud-platform-in-the-iot-environment/318135)