# Chapter 4
# Next-Generation Computer Vision for Autonomous Drone Navigation:
## Cutting-Edge Techniques and Real-World Applications

**Chikesh Ranjan**
https://orcid.org/0000-0003-1197-601X
*National Institute of Technology, Rourkela, India*

**Jonnalagadda Srinivas**
*National Institute of Technology, Rourkela, India*

**P. S. Balaji**
https://orcid.org/0000-0002-6364-4466
*National Institute of Technology, Rourkela, India*

**Kaushik Kumar**
https://orcid.org/0000-0002-4237-2836
*Birla Institute of Technology, India*

DOI: 10.4018/979-8-3693-7525-9.ch004

## ABSTRACT

*This chapter explores the cutting-edge advancements in computer vision technologies that are revolutionizing autonomous drone navigation. As drones are increasingly deployed in diverse applications such as mapping, surveillance, search and rescue, and delivery services, the need for precise and reliable navigation systems is paramount. The chapter begins with an overview of the fundamental principles of computer vision and its role in enabling autonomous navigation. The integration of machine learning algorithms, such as convolutional neural networks (CNNs) and deep learning frameworks, is discussed, highlighting their impact on enhancing the accuracy and efficiency of drone navigation. Furthermore, the chapter examines practical applications of these techniques, showcasing real-world scenarios where computer vision has significantly improved the performance of autonomous drones. Through this comprehensive examination, the chapter aims to provide valuable insights for researchers, engineers, and practitioners working to advance the field of autonomous drone navigation.*

## INTRODUCTION

Advancements in computer vision have revolutionized the field of autonomous drone navigation, allowing for more precise and efficient operations in dynamic environments. Drones can now navigate with greater autonomy by integrating key techniques like object detection, visual SLAM (Simultaneous Localization and Mapping), and deep learning-based obstacle avoidance (Arafat et al. 2023). These techniques enable drones to recognize and avoid obstacles, map environments in real-time, and adjust flight paths accordingly.

One of the most significant impacts is seen in agriculture, where drones can autonomously survey crops, and logistics, where they assist in package delivery. In defense, autonomous drones are used for surveillance and reconnaissance missions, offering enhanced safety and operational efficiency. Using AI-driven algorithms for real-time data processing enables drones to make intelligent decisions, further expanding their application in