Chapter 3
Harnessing AI in Geospatial Technology for Environmental Monitoring and Management:
Applications of AI for Geospatial Data Processing

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ABSTRACT

The chapter explores the role of Geospatial Technology in processing, and analyzing geographically-referenced data from various sources, such as satellite imagery, sensor networks, and climate models. Geospatial Technology tools like GPS, remote sensing, GIS, and LiDAR have proven invaluable in areas like urban planning, disaster management, and environmental conservation. These technologies provide real-time, accurate geographic data, enabling organizations to make informed decisions. Geospatial Technology is widely used in urban development for optimizing infrastructure, tracking deforestation, and monitoring biodiversity. In disaster management, it supports early warning systems and enhances coordi-

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nation during crisis response. Additionally, it helps manage natural resources and monitor agricultural productivity. The chapter highlights the evolution of Geospatial Technology, emphasizing its growing importance in environmental monitoring and resource management, while showcasing how its applications continue to expand across sectors such as defense, urban planning, and agriculture.

INTRODUCTION

Geospatial data refers to information linked to specific geographic locations and is primarily categorized into vector and raster data. Vector data represents geographic features using points, lines, and polygons, each defined by coordinates, enabling precise representation of elements like roads, boundaries, and landmarks. Raster data, by contrast, represents information as digital images, such as scanned maps, aerial photos, or satellite imagery. Converting vector data to raster data is a crucial process in geospatial analysis. First, an original image is captured, with points marked to identify distinct regions or features. A grid is overlaid, dividing the image into cells, and each cell is assigned a value based on the vector data it covers, transforming points, lines, and polygons into a pixel-based raster format. This creates a grid where each cell corresponds to a specific portion of the vector data. For more clarity, the rasterization process is illustrated in Figure 1. It begins with an input vector image (Figure 1(a)), then mapping a vector data onto a grid (Figure 1(b)) by assigning each cell a value based on corresponding vector attributes, and ultimately producing a raster image (Figure 1(c)).This conversion allows for the integration of various data sources and supports analyses like spatial modeling and remote sensing. Additionally, raster data is vital for visualization in Geographic Information Systems (GIS), as it presents complex phenomena in a user-friendly format for applications such as environmental monitoring, urban planning etc.

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