# Chapter 5
# Boosting Artificial Intelligence Performance in Sentinel-2 Imagery Analysis:
## A DL Approach for Water Bodies Detection

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## ABSTRACT

*The combination of remote sensing with AI methods such as deep learning, along with tools like geographic information systems, has transformed both spatial analysis and how decisions are made in a variety of fields. In this chapter, the authors show how important these AI technologies and techniques can be for improving the accuracy of information produced by remote sensors when it comes to monitoring water resources managing them sustainably, assessing flooding risks and environmental monitoring, thus contributing to a more informed and sustainable future. Accurate identification of water bodies using satellite images is crucial for purposes such as managing water resources, the environment, urban planning, and reacting to disasters. This study evaluates the performance of three advanced deep learning models DeepLabV3+, U-Net, and FCN in the semantic segmentation when looking*

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*at water bodies in pictures taken by Sentinel-2 satellites. The three models were assessed by metrics of accuracy, recall, precision, F1score, and Dice coefficient. The best performer was U-Net: it scored highest overall.*

## INTRODUCTION

The analysis of spatial data has been fundamentally transformed by the integration of artificial intelligence (AI), Geographic Information Systems (GIS), and remote sensing (RS). Janga et al., 2023. These technologies allow us to access geospatial information as never before from its acquisition right through interpretation leading to progress in areas like environmental monitoring, urban planning disaster response management for water resources and public health. Remote sensing provides a means of obtaining information about earths surface or atmosphere from a distance. Satellite imagery has been especially useful for monitoring Hu et al., 2023 an array of phenomena with great detail accuracy (land cover changes, vegetation patterns, water bodies, atmospheric properties).GIS enables storage manipulation analysis visualization spatial datasets it merges information from different sources so users can identify trends relationships patterns that help with decision-making processes Juhász, 2024. By using GIS alongside remote-sensing techniques new possibilities open up furthering our ability to solve problems. But when AI specifically deep learning (DL) techniques are included the full potential unleashed Pierdicca and Paolanti, 2022. DL subset machine learning methods has changed how we analyse information including geospatial details . These complex mathematical algorithms learn automatically from large amounts data such as patterns enabling prediction classification tasks be undertaken accurately. Combining all three models has opened doors for spatial analysis development fresh solutions complex real-world problems there is even greater capability than any single system by itself Fu et al., 2024.The Deep learning models such as Convolutional Neural Networks have shown impressive capabilities in extracting useful information from satellite and aerial images . This allows for more precise and efficient analysis of things like land use, bodies of water, urban areas and natural resources. In this study, researchers focus on analysing data that includes pictures of water taken by the Sentinel-2 satellite Drusch et al., 2012. There are also black and white images created using something called the Normalized Difference Water Index (NDWI). This method is often used to find out if there is plant life in a body of water McFeeters, 1996.The pictures are split into two groups: training images and testing images. 80% are for training, and the remaining 20% are for testing after researchers make sure the data is standardised so that they can compare different sets of results fairly. The article compare three types of cutting-edge deep learning model: DeepLabV3+, U-Net, and Fully Con-