OPEN ACCESS Freely available online

ISSN: 2469-4134
Journal of Remote Sensing & GIS

Perspective

# Exploring the Potential of Convolutional Neural Network (CNNs) for GIS Applications

**Saro Wook Lee***

*Department of Smart Regional Innovation, Kangwon National University, Gangwon-do, Republic of Korea*

## DESCRIPTION

Convolutional Neural Networks (CNNs) have revolutionized the field of image recognition and processing, and they have also found applications in various other domains. One such domain is Geographic Information Systems (GIS), where CNNs are being used for spatial analysis and image processing. GIS is a powerful tool that can be used to manage, analyze, and visualize spatial data. It is widely used in various domains, including environmental monitoring, urban planning, natural resource management, and public health. The use of GIS is not limited to just visualizing data; it can also be used to analyze and process spatial data. One such use case is in the field of remote sensing, where satellite images are used to study the earth's surface. CNNs have been successfully applied to remote sensing applications, such as land cover classification, change detection, and object detection.

CNNs are a type of deep learning algorithm that uses a hierarchical structure of layers to learn and recognize patterns in images. The layers of a CNN consist of convolutional layers, pooling layers, and fully connected layers. Convolutional layers are the most important layers in a CNN, as they learn features from the input images. These features are learned through a process called convolution, which involves sliding a filter over the input image and computing the dot product between the filter and the local image patch. The output of the convolutional layer is a feature map, which contains the learned features from the input image. Pooling layers are used to down-sample the feature maps, which reduces the size of the input for the fully connected layers. Fully connected layers are used to classify the input image based on the learned features.

The application of CNNs to GIS involves the use of these layers to learn features from spatial data. CNNs can be used to analyze spatial data in various forms, such as satellite images, aerial images, and Light Detection and Ranging (LiDAR) data. CNNs can be trained to recognize features in these data sets, such as land cover types, buildings, roads, and water bodies.

One of the primary applications of CNNs to GIS is in land cover classification. Land cover classification involves the identification and mapping of different land cover types, such as forests, grasslands, and urban areas. CNNs have been used to classify land cover types using satellite images. The CNNs are trained on a labeled dataset of satellite images, where each pixel in the image is labeled with its corresponding land cover type. The CNNs learn the features of the different land cover types and are then used to classify new images. CNNs have also been used for change detection in GIS. Change detection involves identifying changes in land cover over time. This is important for environmental monitoring and natural resource management. CNNs can be trained to detect changes in land cover using time-series satellite images. The CNNs learn the features of the land cover types in each image and are then used to detect changes in the land cover over time.

Object detection is another application of CNNs to GIS. Object detection involves the identification and localization of objects in images. CNNs have been used to detect objects such as buildings, roads, and water bodies in satellite images. The CNNs are trained on a labeled dataset of satellite images, where each object in the image is labeled with its corresponding class and location. The CNNs learn the features of the different objects and are then used to detect new objects in the images. CNNs have also been used for image segmentation in GIS. Image segmentation involves dividing an image into segments, where each segment corresponds to a different object or land cover type. CNNs can be trained to segment satellite images into different land cover types. The CNNs learn the features of the different land cover types and are then used to segment new images.

In addition to these applications, CNNs have also been used for terrain analysis in GIS. Terrain analysis involves analyzing the elevation, slope, and aspect of the earth's surface. CNNs have been used to predict terrain features using LiDAR data. LiDAR data is collected using airborne laser scanning, and it provides high-resolution information about the elevation and structure of

**Correspondence to:** Saro Wook Lee, Department of Smart Regional Innovation, Kangwon National University, Gangwon-do, Republic of Korea, E-mail: sarwolee@kangwon.ac.kr

**Received:** 17-Feb-2023, Manuscript No. JGRS-23-21002; **Editor assigned:** 20-Feb-2023, Pre QC No. JGRS-23-21002 (PQ); **Reviewed:** 06-Mar-2023, QC No JGRS-23-21002; **Revised:** 13-Mar-2023, Manuscript No. JGRS-23-21002 (R); **Published:** 20-Mar-2023, DOI: 10.35248/2469-4134.23.12.287

**Citation:** Lee SW (2023) Exploring the Potential of Convolutional Neural Network (CNNs) for GIS Applications. J Remote Sens GIS. 12:287.

the earth's surface. CNNs can be trained to predict terrain features such as slope, aspect, and landforms from LiDAR data. Another application of CNNs to GIS is in the field of urban planning. CNNs can be used to analyze urban features such as building height, density, and orientation. This information can be used to design more sustainable and efficient urban environments. CNNs have also been used to predict urban growth patterns, which can be used for future planning and development.

## CONCLUSION

In conclusion, CNNs have found various applications in GIS, including land cover classification, change detection, object detection, image segmentation, terrain analysis, and urban planning. These applications have the potential to revolutionize the way spatial data is analyzed and processed. With the increasing availability of spatial data, there is a growing need for advanced machine learning algorithms such as CNNs to analyze this data. The application of CNNs to GIS is still in its early stages, and there is a lot of research that needs to be done to fully exploit the potential of these algorithms. However, the results obtained so far are promising, and it is expected that CNNs will continue to play a significant role in the future of GIS.