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OBJECT RECOGNITION ON SATELLITE IMAGES

Every year, the development of neural networks is becoming more and more active and their impact on society is increasing, including the implementation of pattern recognition systems.

A neural network (NN) is a mathematical model in the form of software and hardware implementation based on the principles of human neural networks. Neural networks can be trained, which allows them to be optimized and constantly increase their performance.

More and more often, new types of neural network architectures are being created. They are called “unique” and “breakthrough”, but in fact, many of them have many of the same features and are similar.

Object recognition is actively used to detect various objects in the photos of the Earth's surface taken with the help of satellites. It is actively used in geographic information systems, military, environmental monitoring, and urban planning. Thanks to neural networks that are able to automatically recognize objects (houses, roads, water bodies, fields, forests, etc.) quickly and accurately, it is now possible to analyze the surface of our planet and quickly draw conclusions based on this data.

Deep learning based on neural networks ensures high recognition accuracy. One of the most popular architectures is U-Net.

U-Net is a widely used deep learning architecture that was first introduced in the “U-Net: Convolutional Networks for Biomedical Image Segmentation” paper. The primary purpose of this architecture was to address the challenge of limited annotated data in the medical field. This network was designed to effectively leverage a smaller amount of data while maintaining speed and accuracy [1].

Object recognition on satellite images is used in environmental monitoring to detect changes in forests, control deforestation, and monitor changes in coastlines. In agriculture, this technology helps to analyze the condition of crops, predict yields, assess irrigation levels, and recognize fields and water bodies (Figure 1). In urban planning and transportation, it is used to analyze buildings, recognize road infrastructure, and optimize transportation routes. In the military and security spheres, object recognition helps to identify strategic objects, monitor the movement of military equipment, and analyze potential threats.

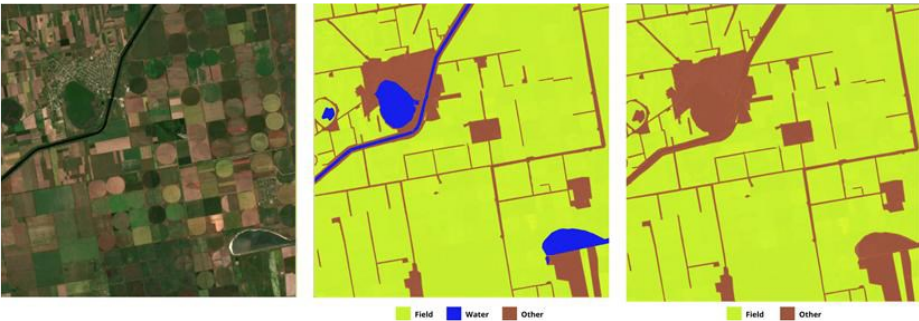


Figure 1 – Example of recognizing water bodies and fields on satellite images [2]

The ability to detect new buildings directly from satellite images (Figure 2) is particularly useful in regions where the population is changing very rapidly and in remote and large-scale areas where census of these new buildings is often done manually and quickly becomes out of date. The processing of aerial images can also be very important in assessing building damage in natural disasters. Finally, it can be very useful for solar panel manufacturers who want to estimate the usable roof surface at a particular site [3].

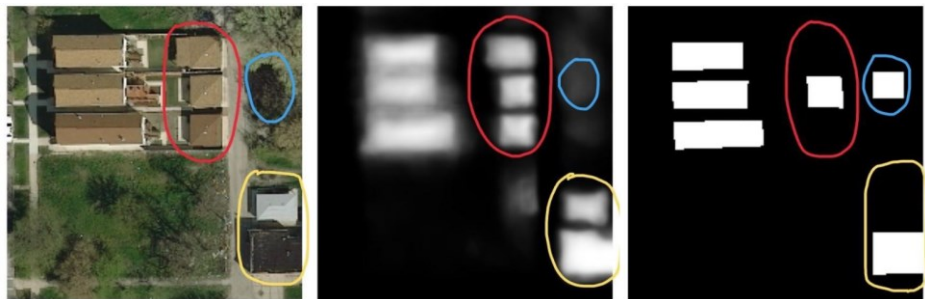


Figure 2 – Example of building recognition on satellite images [3]

Research in this area is providing new opportunities for automating the analysis of satellite images, which allows for more efficient use of data for various areas of activity, including environmental monitoring, natural resource management, security research, logistics, and urban planning. Improvements in algorithms and the development of computing technologies will help improve the accuracy, speed and efficiency of object recognition, making this area extremely promising in the future.

LIST OF REFERENCES

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