IMAGE RECOGNITION METHODS

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Introduction

In the 1960s, a special science of images called "iconics" began to develop. It is dedicated to the study of the common properties of images, the purposes and tasks of their transformation, processing, and reproduction, as well as the recognition of graphic images. The term "iconics" comes from the Greek word "eikon" which means image or likeness. Today, advancements in the recognition of graphic images have led to computers and smartphones being able to simulate human vision. Modern devices come equipped with highly advanced cameras capable of capturing high-resolution images (over 30 MP), and new software can then extract the necessary data from these images for further processing and recognition by a server.

Image recognition is an information technology created to obtain and understand real-world photographs, convert them into digital information for further processing and analysis. This field involves machine learning, expanding knowledge bases, intelligent data analysis, and pattern recognition.

Image recognition is the process of automatically analyzing, detecting, and classifying objects in images using computer vision and machine learning methods. The task of image recognition is to develop algorithms that can recognize and classify objects in an image. This can be useful for creating systems that can automatically process large volumes of images, such as searching for specific objects in medical images, controlling product quality in manufacturing, automatically classifying images on social media, creating unmanned vehicles capable of recognizing road signs, as well as recognizing faces in photos or videos, determining the condition of geological samples, and more.

Main part

Due to the complexity of solving the general image recognition task and the lack of a clear understanding of universal approaches, a large number of specific methods arise. When solving a particular problem, questions arise about the effectiveness of existing methods, their similarities, and differences.

To apply a certain method to an image, which is initially represented as an array of pixels, so-called levels of image representation are introduced. A level of representation is understood as a system that contains algorithms for obtaining descriptions of objects in the image in a certain form. Based on this, the process of object recognition can be interpreted as a process of sequential transformation of information from the initial image, represented as an array of pixels, to a semantic description of the image through some set of intermediate representations.

There are many methods of image recognition, which can be classified into several categories:

1. Feature-based methods: these methods use characteristics (features) of images, such as color, texture, shape, etc., to recognize objects in the image.

2. Deep learning-based methods: also known as neural networks, these methods use machine learning algorithms to recognize objects. Learning occurs hierarchically, where each subsequent layer of the network learns to recognize more abstract features of the image. They can be used for face recognition, image classification, object detection, and other tasks.

3. Statistical analysis-based methods: these methods use statistical models to recognize images. For example, methods based on hidden Markov models (HMMs) use statistical models to describe the sequence of pixels in an image.

4. Decision tree-based methods: these methods use decision trees to classify images. A decision tree is constructed for each pixel in the image, which determines to which class this pixel belongs.

5. Machine learning-based methods: these methods use machine learning algorithms to recognize objects in images. For example, methods based on support vector machines (SVMs) use machine learning algorithms to separate objects into classes.

6. Template-based methods: these methods use pre-known patterns to match with new images. For example, a database of face images can be used to identify a specific person in a photo.

7. Filtering-based methods: this method uses various filters to process images and extract features of objects. For example, Gabor filters can be used to extract texture in an image.

8. Contour-based methods are used to detect object boundaries in an image. They are based on analyzing brightness differences between pixels in an image. Contour-based methods can be applied to highlight objects that have clear boundaries, but may not work well for objects with fuzzy or blurred edges.

9. Structural methods are based on analyzing the shape of objects and their relationships to other objects in the image. They use templates or object models to determine what is in the image. Structural methods can be used to detect objects with fuzzy boundaries and classify objects by type.

10. Many image recognition methods use criteria that are not strictly justified for solving a specific task, or serious limitations are imposed on them (Hausdorff measure for contours, correlation coefficient for brightness values).

Each of these methods has its advantages and disadvantages, and the choice of method depends on the specific task of recognition.

Conclusions

In recent years, as digital systems increasingly replace analog image processing systems, it is crucial to have knowledge of modern computer methods for describing and processing images. There are many different approaches to solving this task, including using neural networks, machine learning methods, and computer vision. Image recognition

is the process of identifying and classifying objects in photographs or other types of images. This technology is used in various fields, such as automated image processing, medicine, security, and transportation. One of the most common applications of image recognition is traffic surveillance systems, which can detect traffic violations and crimes such as speeding or running a red light. It is also used in medicine for diagnosing diseases, for example, based on X-rays or brain scans. This technology can help determine the drugs and dosages needed to treat a patient.

REFERENCES:

1. Тропченко А.А., Тропченко А.Ю. Методы вторичной обработки и распознавания изображений. Учебное пособие. – СПб: Университет ИТМО, 2015.

2. Распознавание образов с помощью искусственного интеллекта [Электронный ресурс]. URL: https://habr.com/ru/articles/709432/

3. В.Т. Фисенко, Т.Ю. Фисенко, Компьютерная обработка и распознавание изображений: учеб. пособие. - СПб: СПбГУ ИТМО, 2008.