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Perspective

Convolutional Neural Networks and its Applications

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DESCRIPTION

Neural networks are a subset of machine learning and are the heart of deep learning algorithms. These consist of an input layer, one or more hidden layers, and a node layer that contains an output layer. Each node is connected to another node, with weights and thresholds associated with it. When the output of an individual node exceeds the specified threshold that node wakes up and sends data to the next layer of the network. Otherwise, the data will not be passed to the next layer of the network. Convolutional neural networks differ from other neural networks because they perform well at image, audio or audio signal inputs. There are three main types of layers, including a convolutional layer, a pooling layer, and a fully connected layer. The convolutional layer is the first layer of the convolutional network.

The convolution layer may be followed by other convolution layers or pooling layers, but the fully connected layer is the last layer. At each layer, the complexity of the CNN increases, identifying larger parts of the image. Earlier levels focused on simple features such as colour and edges. As the image progresses through the layers of the CNN, it begins to recognize the larger elements or shapes of the object, eventually identifying the desired object. Layer merging, also known as down sampling, performs dimensionality reduction to reduce the number of parameters in the input. Similar to the convolution layer, the pooling operation sweeps the filter across the input, the difference being that this filter has no weights. Instead, the kernel applies an aggregate function to the value of the received field and fills the output array. The name of the fully connected layer is a good representation of itself. As the pixel values in the input image of a partially connected layer are not directly connected to the output layer. However, in a fully connected layer, each node in the output layer is directly connected to the node in the previous layer. This layer performs classification tasks based on the features extracted by the previous layer and its various filters. The convolutional and pooling layers tend to use the function, but the FC layer typically uses the softmax activation function to properly classify the inputs and generate a probability of 0 to 1.

Convolutional neural networks power image recognition and computer vision tasks. Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs, and based on those inputs, it can take action. This ability to provide recommendations distinguishes it from image recognition tasks. Some common applications of this computer vision today can be seen in:

Marketing

Social media platforms provide suggestions on who might be in photograph that has been posted on a profile, making it easier to tag friends in photo albums.

Healthcare

Computer vision has been incorporated into radiology technology, enabling doctors to better identify cancerous tumors in healthy anatomy.

Automotive

While the age of driverless cars hasn't quite emerged, the underlying technology has started to make its way into automobiles, improving driver and passenger safety through features like lane line detection.

Convolutional neural networks (CNNs) have accomplished astonishing achievements across a variety of domains, including medical research, and an increasing interest has emerged in radiology. Although deep learning has become a dominant method in a variety of complex tasks such as image classification and object detection, it is not a panacea. Being acquainted with key principles and benefits of CNN in addition to boundaries of deep gaining knowledge of is crucial with the intention to leverage it in radiology studies with the aim of enhancing radiologist overall performance and, eventually, patient care.

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