Applications of Convolutional Neural Networks

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Outline

Introduction

Concepts

- Deep Learning is a machine learning technique that teaches computers to do tasks that would normally require human intelligence.
- DL architecture or methods use neural networks which are often referred to as deep neural networks due to the number of hidden layers in the neural network
- DL uses artificial neural networks, algorithms inspired by the human brain, to learn from large amounts of data. It is a key technology behind driverless cars, medical research (example, cancer cell detection), industrial automation (improving safety around heavy machinery), and electronics (that is, home devices that can respond to voice, e.g. Alexa)

Introduction Cont'd

Types of Deep Learning Architectures

- Recurrent Neural Networks (RNN)
- Convolutional Neural Networks (CNN)
- Deep Stacking Networks (DSN)
- Deep Belief Networks (DBN)

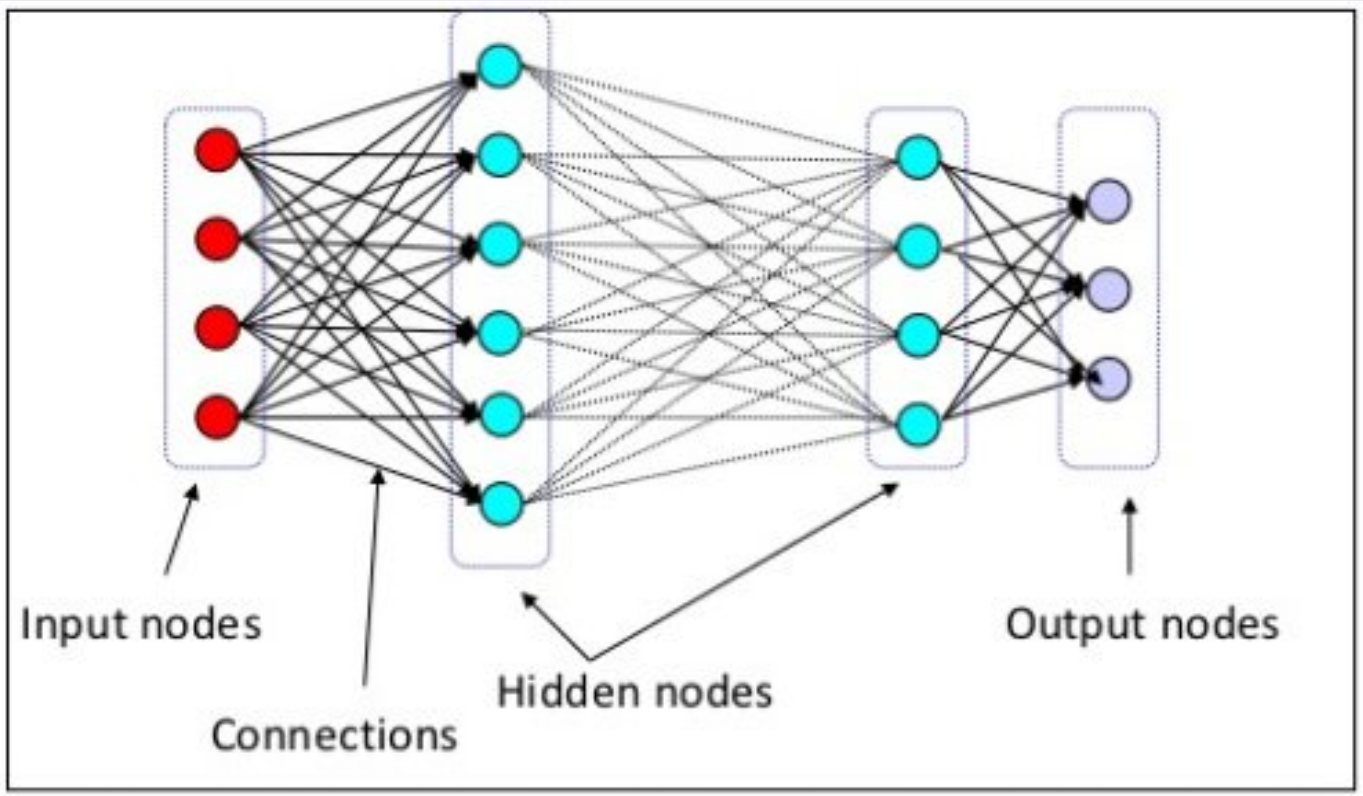
Introduction Cont'd

Overview of CNN Architecture

- CNN is a multilayer neural network that was biologically inspired by the animal visual cortex
- They are trainable multistage architectures with each stage consisting of multiple layers
- CNN convolves learned features with input data, uses 2D convolutional layers, making it well suited to process 2D data, such as images
- The image is divided into receptive fields that feed into a convolutional layer, which then extracts features from the input image.

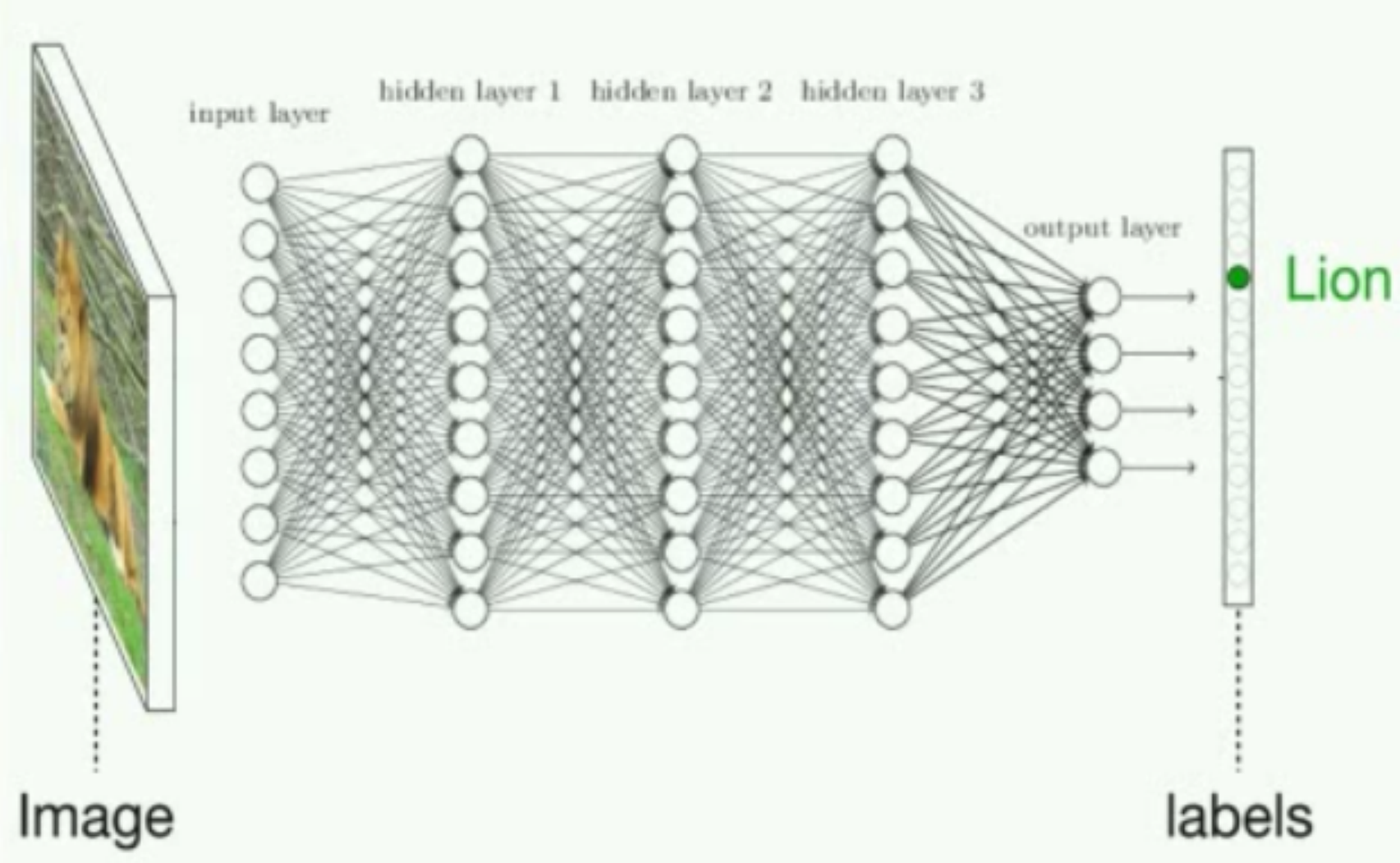
Introduction Cont'd

An example of a CNN



Introduction Cont'd

An example of a CNN of an Image



Introduction Cont'd

Overview of CNN Architecture Cont'd

- The input and output of each stage are sets of arrays called feature maps
- The output stage represents features extracted from all locations on the input
- Each stage consists of a convolution layer, non-linearity layer and a pooling layer
- CNNs work by extracting features directly from images
- They learn to detect different features of an image by using tens/hundreds of hidden layers
- Each layer has its function (example, the first hidden layer could learn how to detect edges, etc.)

Outline

Applications of CNN

Computer Vision

- CNNs are employed to identify the hierarchy or conceptual structure of an image.
- A full image is not fed directly into the neural network as one grid, instead,
- The image is broken down into overlapping image tiles are each fed into a small neural network

Applications of CNN

Computer Vision

In computer vision, CNN is used in the following for;

- Face Recognition
- Scene Labelling
- Image Classification
- Action Recognition
- Human Pose Estimation
- Document Analysis

Applications of CNN

Face Recognition

Faces represent a complex, multi-dimensional visual stimulus. Problems that constitute face recognition are;

- Identifying all faces in a picture
- Focussing on each face despite bad lighting of different pose
- Identifying unique faces
- Comparing identified features to existing database and determining the person's name

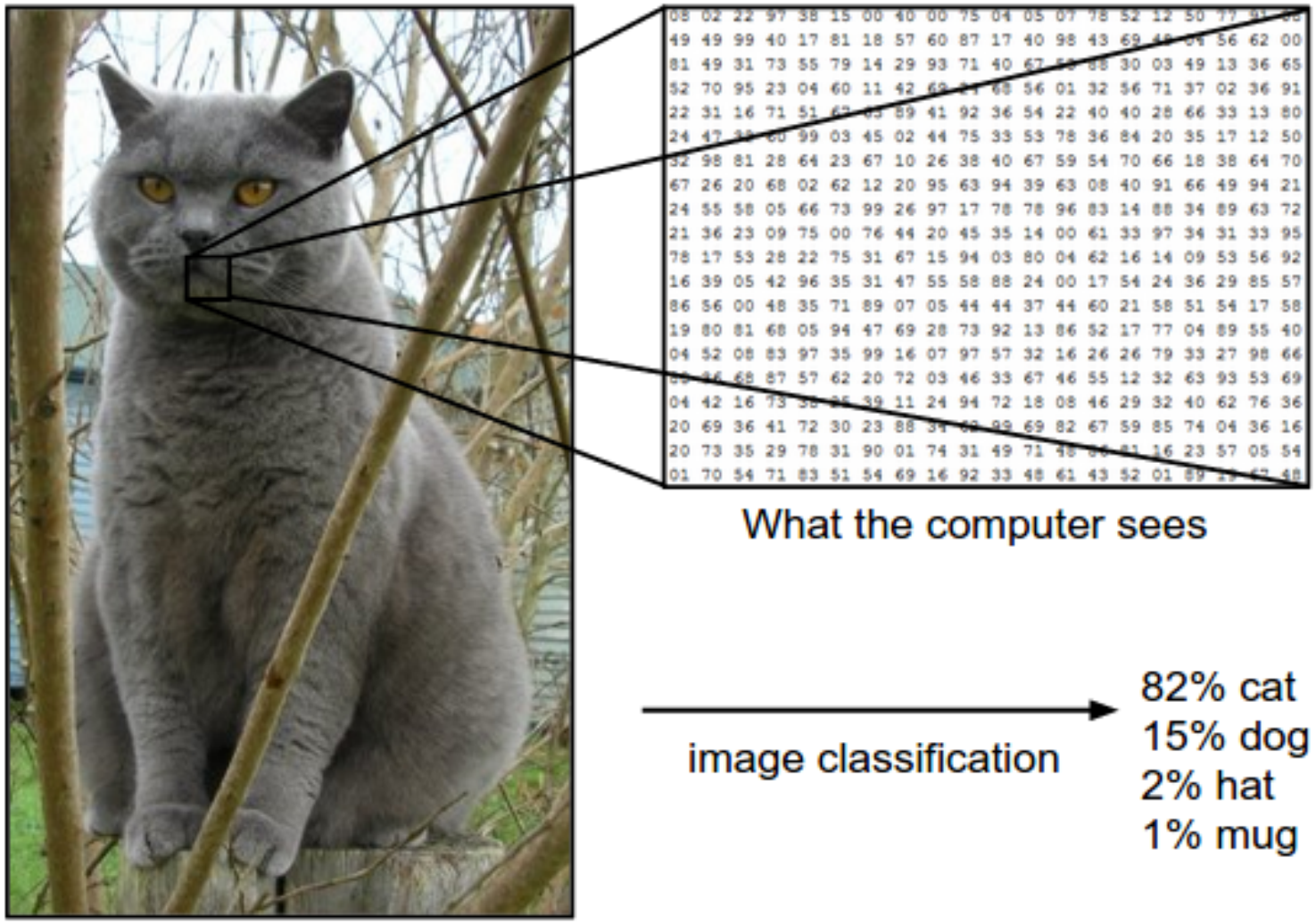
Applications of CNN

Image Classification

- Image Classification is the task of assigning an input image from a set of categories (example of set of categories can be dog, cat, mug, hat).
- Compared with other models, CNNs achieve better classification accuracy on large scale datasets due to their capability of joint feature and classifier learning.

Applications of CNN

An example of Image Classification



Applications of CNN

Natural Language Processing

Traditionally, CNN's have been applied primarily in the field of Computer Vision. In recent times, they have been used for important tasks in Natural Language Processing such as;

- Speech Recognition
- Text Classification

Applications of CNN

Speech Recognition

The use of CNNs in recent times have been seen to provide better results over Deep Neural Networks. CNNs have been found to improve accuracy in the following areas and hence giving it an advantage over other architectures of DL;

- Noise Robustness
- Distant Speech Recognition
- Low-footprint models

Applications of CNN

Text Classification

- Text Classification is an example of supervised machine learning task since a labelled dataset containing text documents and their labels is used for train a classifier
- The goal of Text Classification is to automatically classify text documents into one or more defined categories
- Some examples of text classification are; detecting spam and non-spam emails, categorization of news articles into defined topics

Outline

Summary

Summary

In comparision with other traditional methods, Convolutional Neural Networks;

- Give better accuracy
- Boost performance

In areas of Computer Vision and NLP, CNN is better than other DL methods.

THANK YOU