
NOTEBOOK

Amazon Go

Just walk Out Shopping



Learn

#1

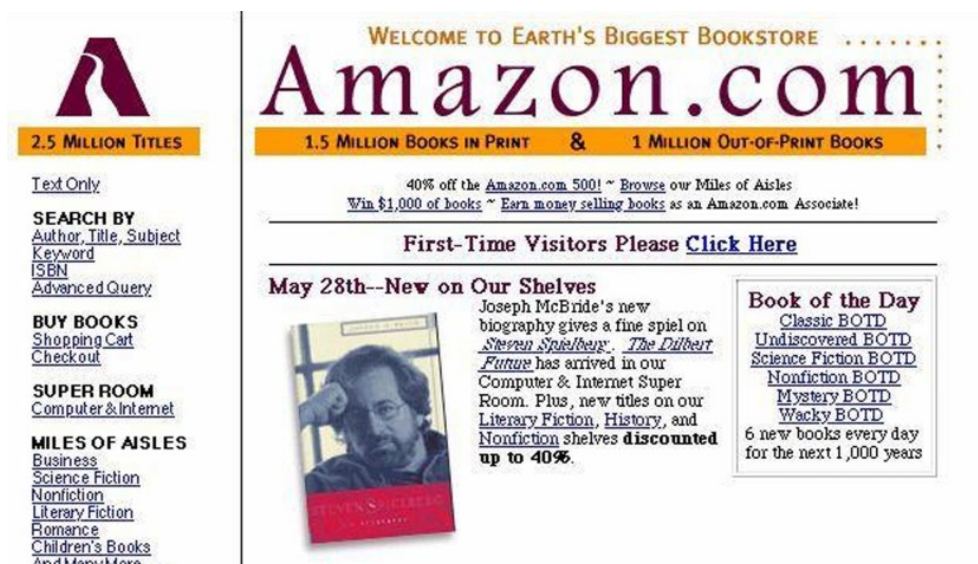
Introduction



Amazon.com, Inc. is an American multinational technology company that focuses on e-commerce, cloud computing, digital streaming, and artificial intelligence. The year was '94 and Bezos was working diligently on Wall Street. At 30 years old, he began to see the internet revolution take place, and made the decision to quit his job and start an internet company.

"The wake-up call was finding this startling statistic that web usage in the spring of 1994 was growing at 2,300 percent a year. You know, things just don't grow that fast. It's highly unusual, and that started me thinking, "What kind of business plan might make sense in the context of that growth?"

After making a list of the 'top 20' products that he could potentially sell on the internet, he decided on books because of their low cost and universal demand. It turns out, it was just the beginning.....



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#2

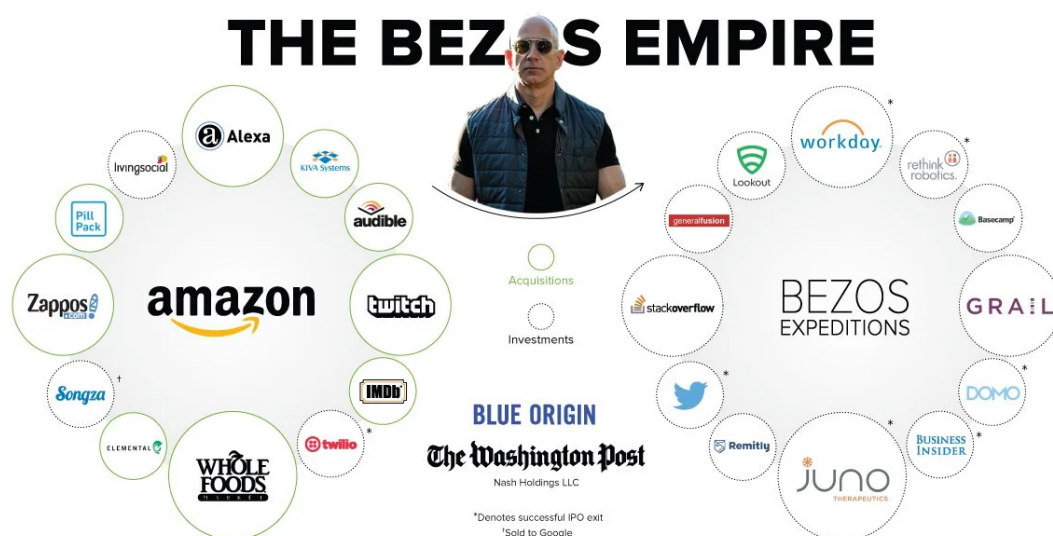
The BEZOS Empire

With a fortune largely tied to his 79 million Amazon shares, the net worth of Jeff Bezos has continued to rise.

Most recently, the Amazon founder was even able to surpass Bill Gates on the global wealth leaderboard with \$137 billion to his name – however, this ascent to the very top may be extremely short-lived.

The obvious centerpiece to the Jeff Bezos Empire is the 16% ownership stake in Amazon.com.

However, beyond that, there is a wide variety of other investments and acquisitions that Jeff Bezos has made through Amazon or his other investment vehicles. These range from household names to more secretive endeavors and are worth looking at to truly understand his assets and fortune.



#3

Just Walk Out Shopping



Amazon has been opening physical Amazon Go convenience stores and Amazon Go Grocery stores across the US and it has now launched a UK store, branded Amazon Fresh.

All have one thing in common - unlike most shops, there are no registers or cashiers. You walk in, pick out what you want, and walk out. Amazon calls it a 'just walk out' shopping experience.



Amazon described the original Amazon Go store as "a new kind of store with no checkout required". The first Amazon Go in Seattle was basically a small convenience store with roughly 1,800 square feet of retail space and it's this small format that is replicated elsewhere.

When you shop at one of these stores, you never have to wait in line. The store works with an Amazon Go app for iOS or Android: You enter, take the products you want and, thanks to the app, just leave again. The app is linked to your Amazon account for billing.

#Extra

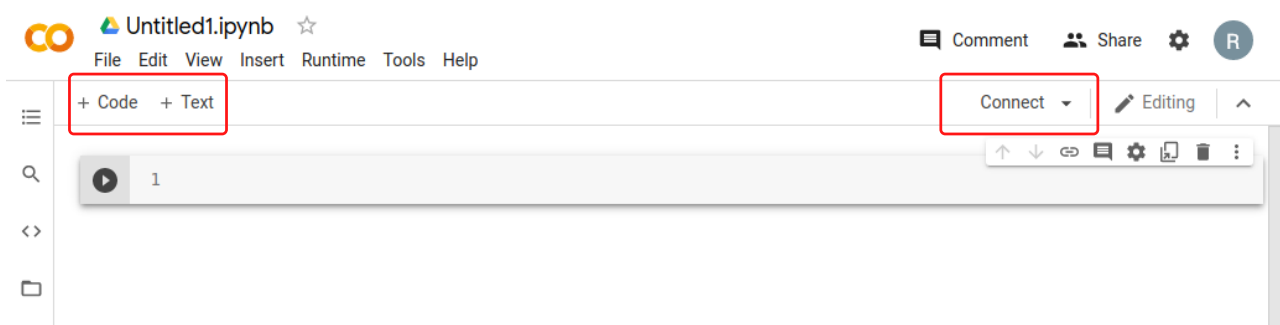
Introduction to Colab



Nearly all machine learning and deep learning algorithms require good hardware. What if ... you don't have good hardware? Should you drop your dream to be a data scientist? No, there's an alternative. Let us introduce you to Colab.

Colab is a service provided by Google which lets you access a virtual machine hosted on Google servers. These virtual machines have dual-core Xeon processors, with 12GB of RAM. You can even use GPU for your neural networks. Colab is an interactive Python notebook (ipynb), which means that with writing Python code, you can also write normal text, include images.

To create a new Colab notebook, just go to "<https://colab.research.google.com>", and create a new notebook. You will get something like below



You can connect to runtime by clicking the "Connect" button in the right corner. You can add a new Code cell, or text cell using respective buttons in the toolbar.

#Extra

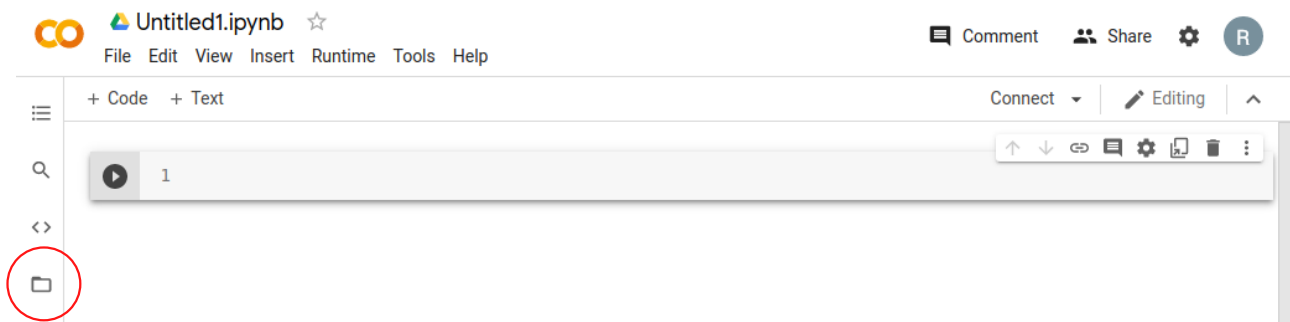
Introduction to Colab



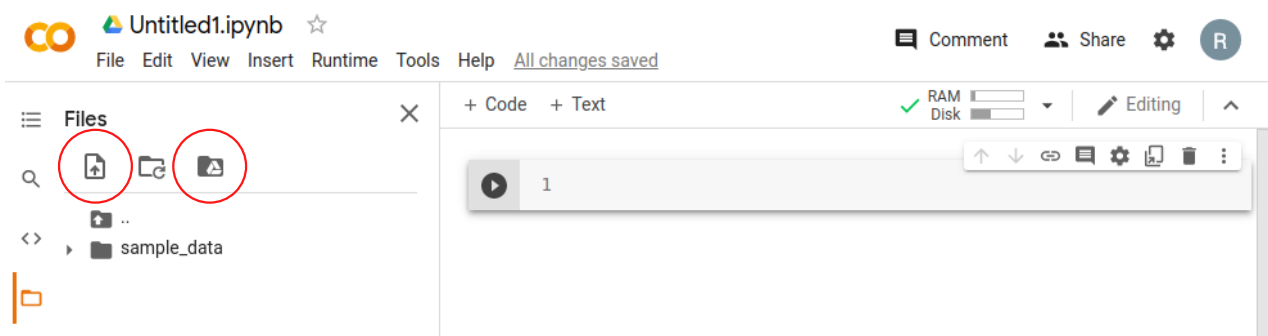
Uploading files

Sometimes you need to use a file from your PC. For that, you can upload the required files to google colab. Colab provides 100 GB in a colab session. If you want to access some files from your drive, you can even do so by connecting the drive to colab.

To upload something, open file pane from left toolbar.



Now, just upload the file using first button, and you can also mount google drive using last button



#4

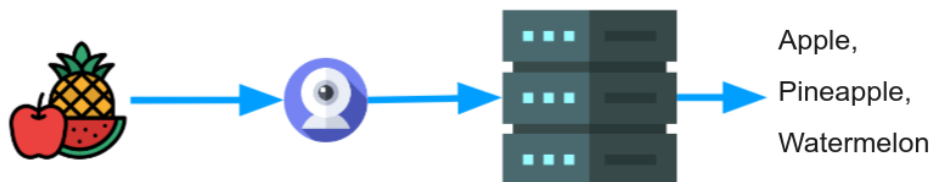
How does it works?

Amazon Go's checkout-free shopping experience is made possible by the same types of technologies used in self-driving cars and they are:

1. Computer Vision
2. Sensor Fusion
3. Deep Learning

Computer Vision

Computer Vision is a field of study that seeks to develop techniques to help computers "see" and understand the content of digital images such as photographs and videos. For example, we can use a trained computer to identify fruits. The images will be captured by a digital camera and fed to our trained computer. Our trained computer will use either machine learning or deep learning to identify fruits in those images.



Computer Vision has three objectives:

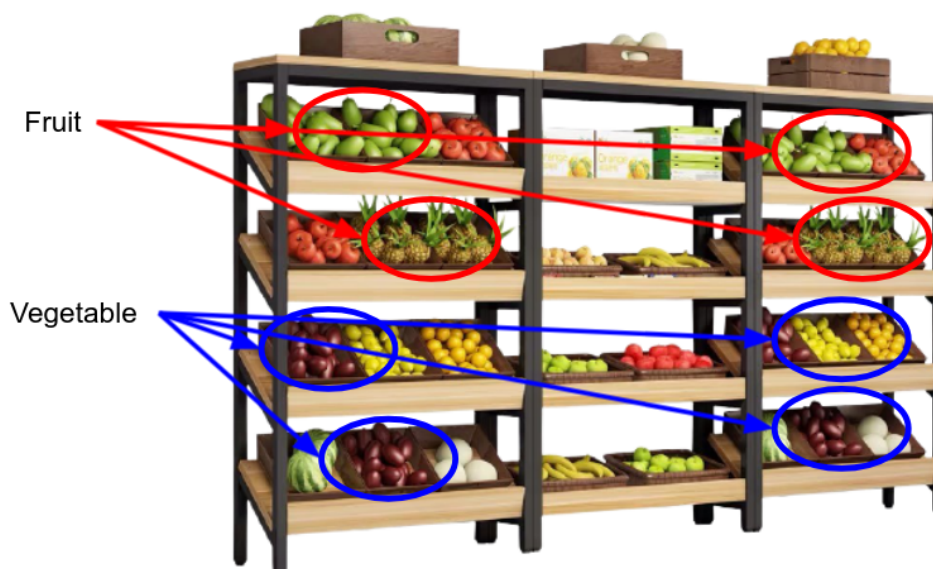
1. Object Classification
2. Object Identification
3. Object Tracking

#4.1

Computer Vision

Object Classification

Object classification is related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class in digital images and videos. Imagine we have an image of vegetables and fruits on a shelf. Now, our algorithm will classify each object into fruit or vegetable.



Object Identification

Object identification refers to identifying the unique characteristics of an object. Instead of classifying objects into fruit and vegetable only, the algorithm tries to find which fruit or vegetable is present in our image.

#4.1

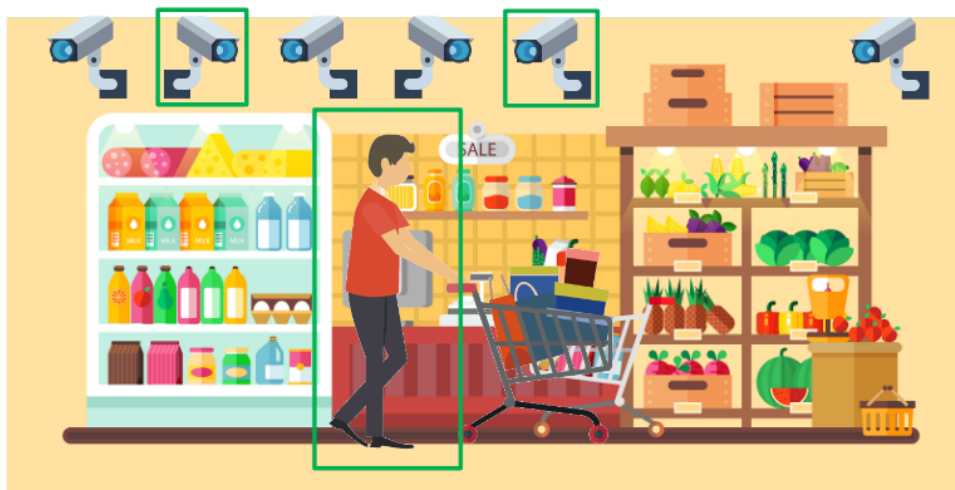
Computer Vision

Object Tracking

Videos are just a bunch of images. If we pass each image to our computer vision algorithm, then our algorithm might think that each person in all images are different, but they are not.

Like in following sceneraio, two cameras can see the same person, but wach camera will identify the same person as different person if object tracking is not used.

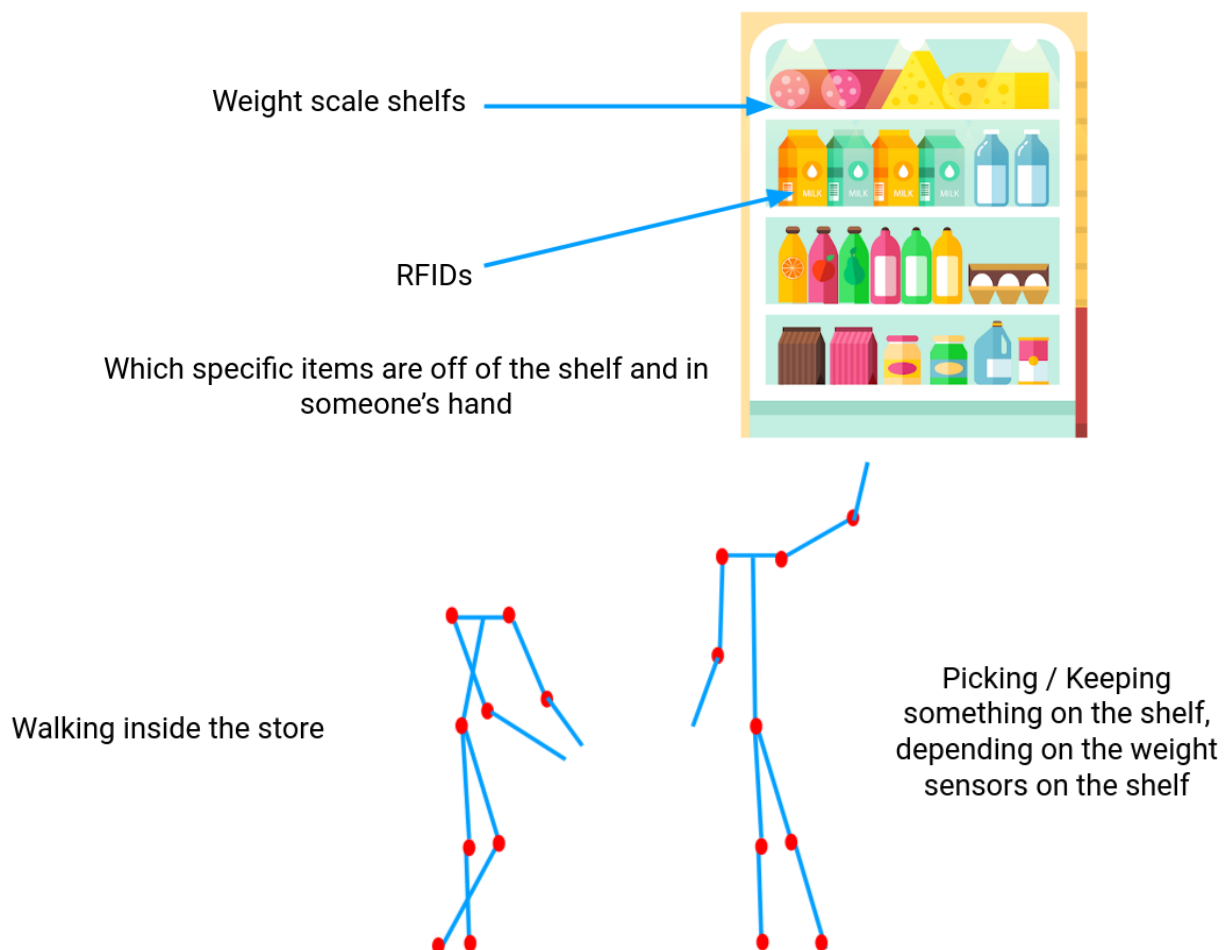
Thus with object tracking we can track each object in frame so that the same person doesn't get registered as new person.



#4.2

Sensor Fusion

Just the way self driven cars are loaded with sensors to make it learn how to drive, Amazon Go stores use cameras to track a user's action in the store. The amazon Go stores use a system of cameras, sensors and/or RFID readers to identify shoppers and the items they've chosen. Signals and data from all these sensors are fed computers to identify customer interactions.



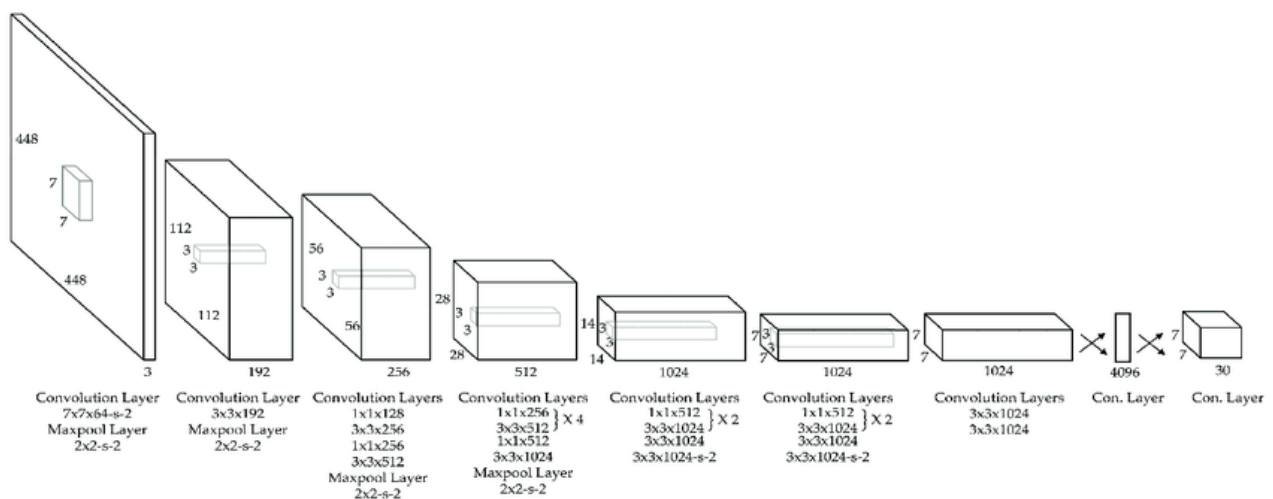
For example, if computer vision detects that a customer is going to place or pick an item, then it will trigger the smart shelves with weight and RFID sensors to find whether customer is picking an item or placing back an item.

#4.3

Computer Vision - YOLO

YOLO or You Only Look Once is a convolution neural network that can locate and classify objects in a picture. Before YOLO there were other convolution networks that can perform the same task, but they were extremely slow. Thus they can't be used on cars with autopilot. Also, earlier networks first locate the object, then classify it. But YOLO as the name suggests an image is used only once to locate and classify it.

The following picture shows yolo architecture.



Amazon Go stores use YOLO to locate, and track humans in a store. After locating human in frames, the frames is fed to another computer vision algorithm that will estimate pose of human and find wether human is picking ow walking in the store.

We can either create it in TensorFlow or PyTorch and train on a dataset, but it will take days to get trained or we can use a pre-trained network. We can even train a pre-trained network on a new dataset as per our use, this is known as transfer learning.

#5

How to use YOLO in python:

Import required libraries (cv2, numpy)

```
import cv2  
import numpy
```

Download trained yolo network

```
!git clone https://github.com/ultralytics/yolov3
```

Download required libraries

```
%cd yolov3/  
%pip install -r requirements.txt
```

Inference

```
!python detect.py --source 'car.jpg'
```

We can pass even a video, or any other picture



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