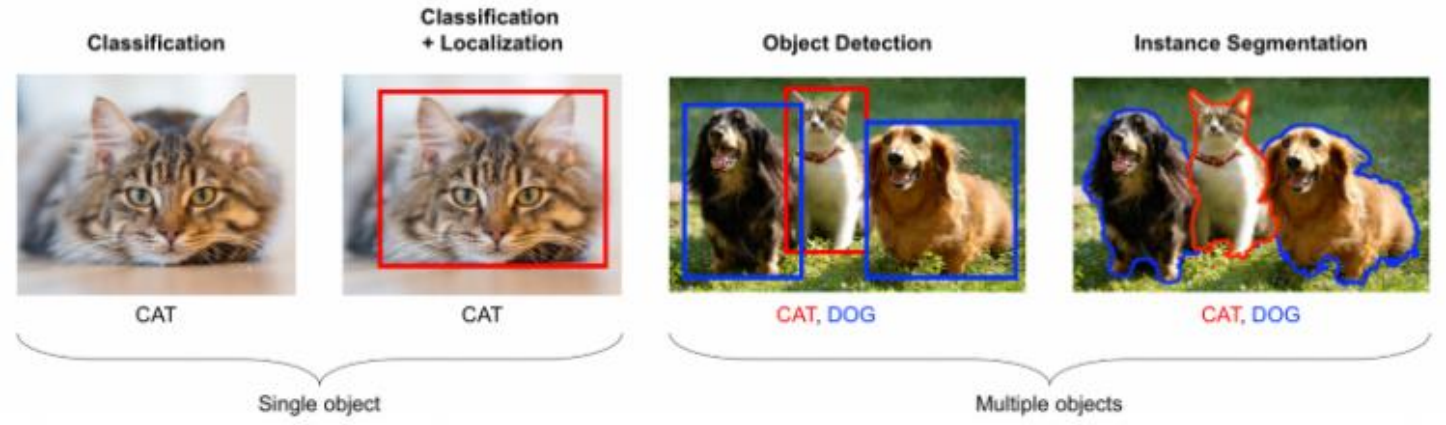
Computer Vision

One of the most powerful and mind-boggling types of AI is computer vision. Something which you've almost surely experienced in number of ways without even knowing.

Computer Vision is a computer science field that focuses on reversing the complexities of the human visual system and enabling computers to see and process objects in images and videos in the same way as humans. With the development of artificial intelligence and innovation in deep education the field has been able to excel in other activities related to acquisition and labeling.

How Does Computer Vision Work?

Computer vision works through visual recognition techniques like Image classification, object detection, Image segmentation, object tracking, optical character recognition, image captioning, etc. A lot of technical terms but understanding them is not tough. Just see the image below and you will understand many of these terminologies.



source:https://www.oreilly.com/library/view/python-advanced-guide

At some point Computer view is about pattern recognition. So, another way to train a computer is to understand visual data to feed it with images, multiple images, thousands, millions if possible labeled, and then submit various software techniques, or algorithms, that allow the computer to hunt patterns on all things related to the labels. But on a computer, this image - like all images - is a pixel array, with numerical values representing the colors red, green, and blue. To train a model with meaningful accuracy especially when you are talking about Deep Learning you would need tens of thousands of pictures, and the more the merrier.

How the pixels look:

H	E	L	L	O
O	P	E	N	F
R	A	M	E	W
O	R	K	S	!

How the pixels are numbered:

0	1	2	3	4
5	6	7	8	9
10	11	12	13	14
15	16	17	18	19

How the pixels are stored in computer memory:

H	E	L	L	O	O	P	E	N	F	R	A	M	E	W	O	R	K	S	!

0 1 2 3...

How to create colors with RGB?

Combine parts of the three primary colors **red**, **green** and **blue**.

Each of the primary colors can have a value in the range from 0 to 255.

R:	255	0	0	0	255
G:	0	255	0	0	255
B:	0	0	255	0	255

https://www.slideshare.net/Presentitude/the-4-important-color-models-for-presentation-design/16-Colors_on_the_color_wheel

Machine learning has provided a unique way to solve computer vision problems. With the advent of machine learning, developers no longer have to incorporate the code into each of their rules in their vision systems. Instead, they organize "features," small applications that can find specific patterns in images. They then used a statistical learning algorithm such as linear regression, logistic regression, decision trees or support vector machines (SVM) to detect patterns and classify images and detect objects in them.

Deep learning provided a fundamentally different approach to doing machine learning. Deep learning relies on neural networks, a general-purpose function that can solve any problem representable through examples. When you provide a neural network with many labeled examples of a specific kind of data, it'll be able to extract common patterns and transform it into a mathematical equation, thanks to availability and advances in hardware and cloud computing resources.

Applications of Computer Vision!

- **In Self-Driving Cars**

  Cameras capture video from different angles around the car, the computer vision software then processes the images in real-time to detect other cars, traffic signs, objects and pedestrians. The self-driving car henceforth can steer its way on the road and safely drive its passengers without hitting obstacles.

- **In Image Transformation**

  GAN (Generative adversarial networks) is an exciting innovation in field of Computer Vision. This involves two Neural nets play against each other, in order to generate new data based on the distribution of the given training data. An application based on this concept, **FACEAPP** with image manipulation tools and various filters trends among the people.

- **In Augmented Reality**

  Using computer vision, AR gear detect objects in real world in order to determine the locations on a device's display to place a virtual object. For instance, computer vision algorithms can help AR applications detect planes such as tabletops, walls and floors.

- **In Healthcare**

  For quite a time now computer-supported medical images are being used for a diagnosis like CT scans, X-rays, etc. Furthermore, recent developments in computer vision technologies allow doctors to understand them better by converting into 3d interactive models and make their interpretation easy.

- **In Developing Social Distancing Tools**

  For the last few months, the world is suffering from pandemic COVID-19. Computer vision plays vital role in this scenario. The social distancing tool is an application of object detection and tracking in real-time. In this case, to check the social distancing violation, each person is detected using a bounding box. The movement of each box in the frame is tracked and the distance between them is calculated. If it detects any violation of the social distancing norm then it highlights those bounding boxes.

Limits of Computer Vision!

Current computer-vision programming systems do a decent job of distinguishing images and making local objects in images, where they are trained with sufficient examples. But at their core, deep learning algorithms enable computer vision applications to look like pixel patterns. They cannot understand what is happening in the pictures.

Unlike humans, computer-vision algorithms need to be thoroughly instructed on the types of objects they must detect. As soon as their environment contains things that deviate from their training examples, they start to act in irrational ways, such as failing to detect emergency vehicles parked in odd locations.

Check the following resources if you want to know more about Computer Vision-

- *Computer Vision using Deep Learning 2.0 Course*
- *Certified Program: Computer Vision for Beginners*
- Getting Started With Neural Networks (Free)
- Convolutional Neural Networks (CNN) from Scratch