

## A brief understanding of Convolutional Neural Network (CNN) and DEEP CNN

Do you use Facebook? Have your friends automatically tagged photos on your wallpaper? Do you know Facebook uses Convolutional Neural Networks (CNN) for automatic tagging algorithms? Today, we are going to discuss the Convolutional Neural network and its procedure and applications.

Convolutional Neural Networks (CNN) are special kinds of Multilayer neurons having learnable weights and biases. The three objectives of CNN are to classify visual context, identify and recognize objects within their boundary, and gather recognized objects into clusters.

In today's time, CNN is widely used in deep learning in different fields. The discovery of CNN is considered a great blessing to humankind and scientific progress in information technology for solving real-world problems. CNN is used in computer vision such as image classification, image segmentation, face recognition, image and objects detections, etc. For instance, Amazon uses CNN for its products recommendation to Customers, google for search engine through among users' photos, Pinterest for their home feed personalization and Instagram for their search infrastructures, and even sentiment analysis in Facebook.

We, human beings, our brains classify visual pictures based on their identifiable features. For example – usually four legs or trunks in elephants, flying wings in birds, etc. However, Computer classifies images by looking for lower levels such as edges, and curves and then building up more abstract concepts through series of convolutional layers.

What I see

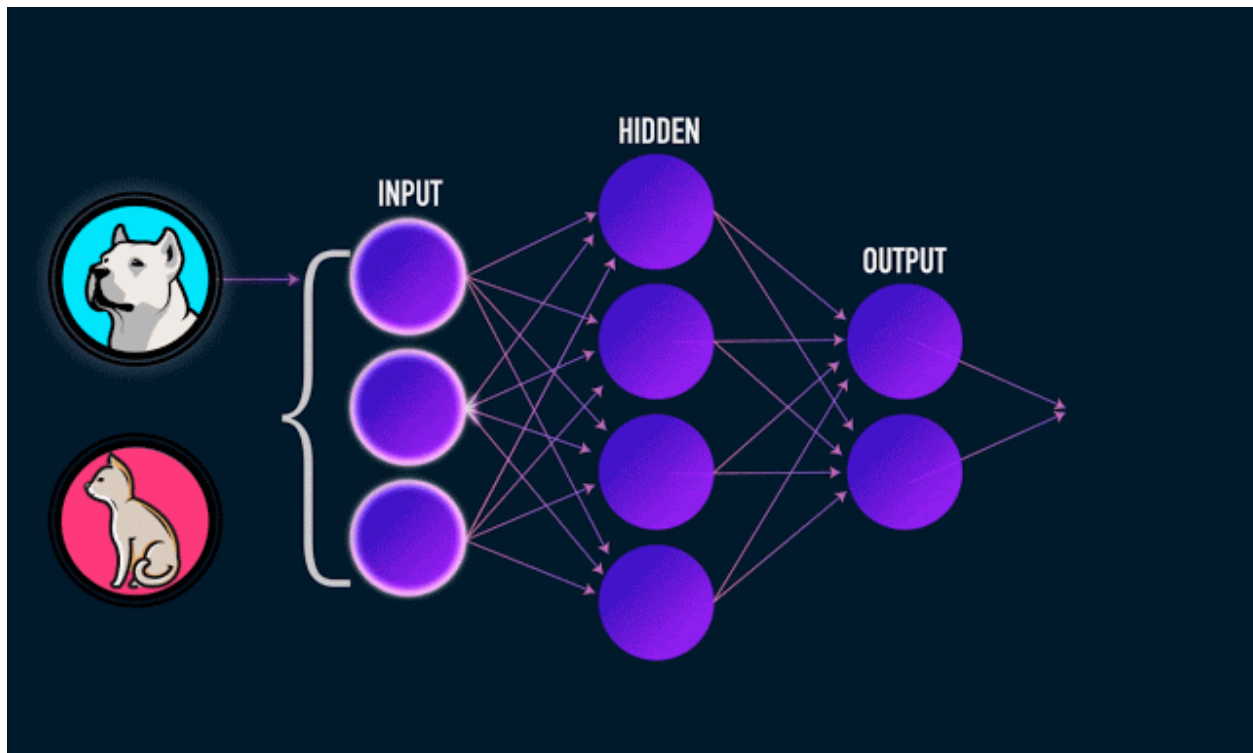


What a computer sees

08	02	22	97	38	15	00	40	00	75	04	05	07	78	52	12	50	77	91	08
49	49	99	40	17	81	18	57	40	87	17	40	98	43	49	45	04	56	42	00
81	49	31	73	55	79	14	29	93	71	40	67	53	88	30	03	49	13	36	45
52	70	95	23	04	40	11	42	49	24	68	56	01	32	56	71	37	02	36	91
22	31	16	71	51	47	43	89	41	92	36	54	22	40	40	28	46	33	13	80
24	47	32	40	99	03	45	02	44	75	33	53	78	34	84	20	35	17	12	50
32	98	81	28	44	23	67	10	26	38	40	67	59	54	70	46	18	38	44	70
47	24	20	48	02	42	12	20	95	43	94	39	43	08	40	91	46	49	94	21
24	55	58	05	44	73	99	24	97	17	78	78	94	83	14	88	34	89	43	72
21	34	23	09	75	00	74	44	20	45	35	14	00	41	33	97	34	31	33	95
78	17	53	28	22	75	31	47	15	94	03	80	04	42	14	09	53	54	92	
16	39	05	42	94	35	31	47	55	58	88	24	00	17	54	24	34	29	85	57
84	54	00	48	35	71	89	07	05	44	44	37	44	40	21	58	51	54	17	58
19	80	81	48	05	94	47	49	28	73	92	13	84	52	17	77	04	89	55	40
04	52	08	83	97	35	99	14	07	97	57	32	14	24	26	79	33	27	98	46
88	34	48	87	57	42	20	72	03	44	33	47	44	55	12	32	43	93	53	49
04	42	14	73	38	25	39	11	24	94	72	18	08	46	29	32	40	42	74	34
20	49	34	41	72	30	23	88	34	42	99	49	82	47	59	85	74	04	34	14
20	73	35	29	78	31	90	01	74	31	49	71	48	84	81	14	23	57	05	54
01	70	54	71	83	51	54	49	14	92	33	48	41	43	52	01	89	19	47	48

Fig 1: Elephant picture with its array (Source:medium.com)

In CNN, image classification takes an input image, processes it, and classifies it under certain categories. It sees an input image as an array of pixels where it depends on the image resolution.



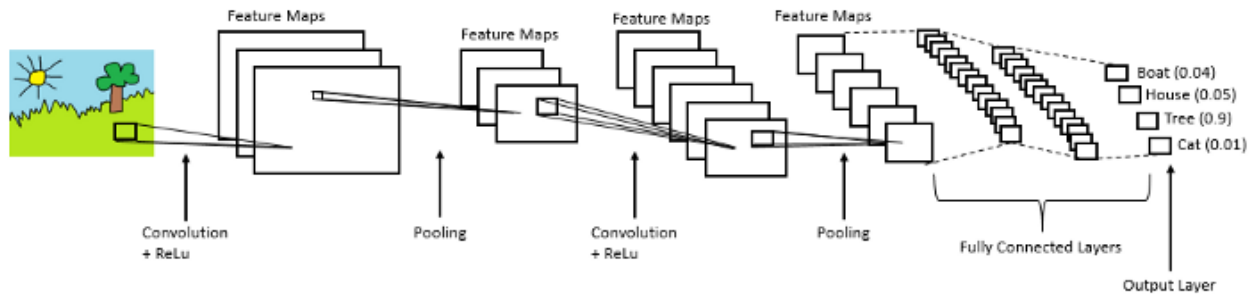
Caption: The illustration of how a neural network recognizes a dog in an image.

(Source: TowardsDataScience.com)

According to Image resolution, it will see height(h)  $\times$  width(w)  $\times$  dimension(d). Let's consider, we have a color JPG image having size 500 $\times$ 500. The size of the array will be 500 $\times$ 500 $\times$ 3. Where, height =500, width=500 and RGB value=3. The computer is assigned a value from 0 to 255 to each of their numbers. It describes the intensity of pixels at each point. We gave the computer this array of numbers which describes the possibility of the image being a certain class. (For example- 0.80 for elephant, 0.05 for House, 0.04 for Boat, 0.01 for cat 0.9 for tree etc.)

In CNN models to train and test, each input image will pass through a series of convolution layers with filters, Pooling, fully connected layers, and finally apply SoftMax function to classify an object with probabilistic values between 0 and 1.

The following figure shows a complete flow of CNN to process an image and classifies the object based on values.



Caption: Complete CNN architecture (Source: medium.com)

Today, we are going to see image classification demo on Deep-CNN. Deep CNN is software designed by Deep mind Creation Company which is one of the AI, Machine Learning Company in Nepal. Deep-CNN works under CNN Principle. Deep CNN uses deep learning model analyzes the inputted visual pixel image, extracts their features and detects respective image with their classification. The cloud API classify the images with different classes with different accuracy. Finally, The API will send the result to our devices. We can also use our own model.

Deep-CNN has classified input image with their probability of being respective image which we can see below.



Caption: Image classification on Deep-CNN using API (Source: deep-cnn.com)

In above result, Deep-CNN has identified and predicted our input image with the 40% probability to be daisy flower, around 15% icket fence, 8% birdhouse and 5% pinwheel. Furthermore, you can also upload your image on deep-CNN page and will get your result.