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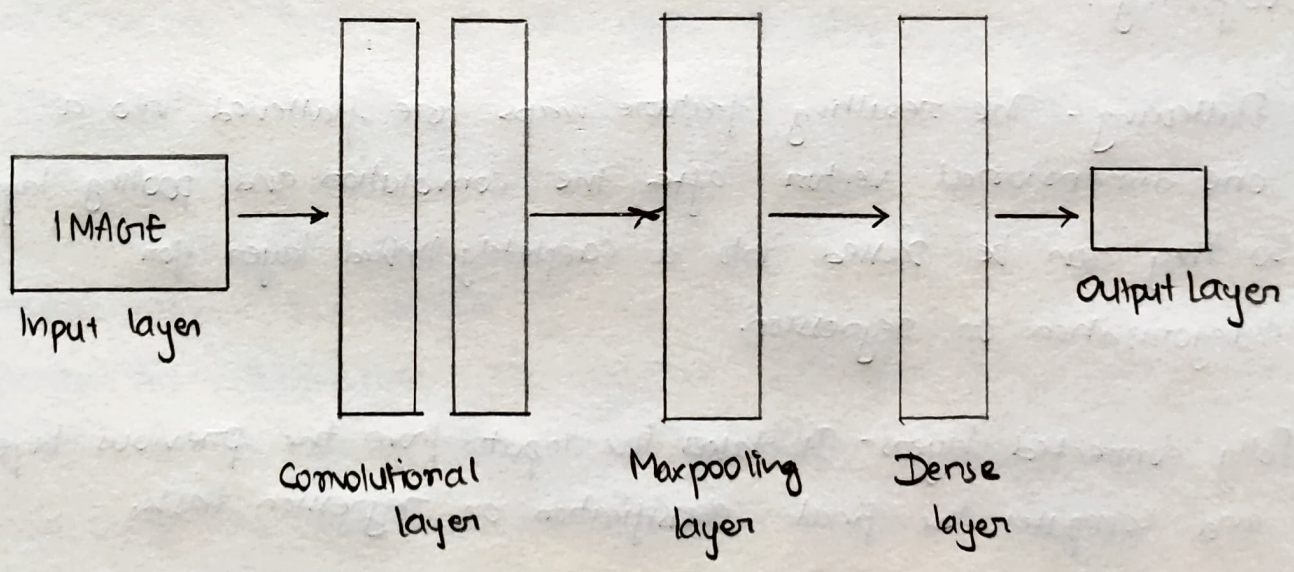
MACHINE LEARNING ITA6016 - Theory Assessment

1) Draw and explain the architecture of convolutional neural network (CNN) also specify the significance of each layer.

- Convolutional Neural Network (CNN) is the extended version of artificial neural networks (ANN) which is predominantly used to extract the feature from the grid-like matrix dataset. For example visual datasets like images or videos where data patterns play an extensive role.

## CNN Architecture -

- Convolutional Neural Network consists of multiple layers like the input layer, Convolutional layer, pooling layer and fully connected layers.




a) Input layers - It's the layer in which we give input to our model. In CNN, generally the input will be an image or a sequence of images. This layer holds the raw input of the image with width 32, height 32, and depth 3.

b) convolutional layers - layer which is used to extract the feature from the input dataset. It applies a set of learnable filters known as the kernels to the input images. The filters/kernels are smaller matrices usually 2×3, 3×3 or 5×5 shape.
The output of this layer is returned as feature maps

c) Activation layer: By adding an activation function to the output of the preceding layer, activation layers adds non-linearity to the network. It will apply an element-wise activation function to the output of the convolutional layer.

d) pooling layer: This layer is periodically inserted in the convnets and its main function is to reduce the size of volume which makes the computation fast reduces memory and also prevents overfitting.

e) Flattening - The resulting feature maps are flattened into a one dimensional vector after the convolution and pooling layers so they can be passed into a completely linked layer for categorization or regression.

f) Fully connected layers - It takes the input from the previous layer and computes the final classification or regression task.

g) Output layer - The output from the fully connected layers is then fed into a logistic function for classification tasks like sigmoid or softmax which converts the output of each class into the probability score of each class.

2) How reinforcement learning algorithm differs from other learning methods. Discuss any one of the learning algorithm with an example.

- Reinforcement learning (RL) is a type of machine learning algorithm that differs from other learning methods, such as supervised learning and unsupervised learning, in the way it learns from the data and interacts with its environment. The fundamental distinction lies in the nature of the learning signal and the feedback the algorithm receives during training.

Reinforcement learning operates differently. It involves an agent interacting with an environment, making observations and taking actions to maximize a cumulative reward signal. The agent learns by trial and error, receiving feedback from the environment in the form of rewards or penalties based on its actions.

Example- consider training an RL agent to play a game, like an autonomous car trying to learn to drive. The agent starts in a specific state and through interactions with the environment, it receives rewards or penalties based on its performance. The reward might be positive if the car stays on the road and reaches the destination, or negative if it goes off-road or hits obstacles. The RL agent's objective is to learn a policy that maximizes the cumulative rewards over time, leading to successful driving behavior.