

Understanding Dropout in Neural Networks

Introduction Dropout is a regularization technique used in neural networks to prevent overfitting during training. Overfitting occurs when a model learns not only the general patterns in the training data but also the noise and irrelevant details. Dropout addresses this by randomly "dropping out" or deactivating neurons during each training iteration.

What is Dropout? Dropout is a simple yet effective method to improve the generalization of a neural network. During each forward pass of training, dropout randomly sets a fraction of the neuron outputs to zero. This ensures that no single neuron becomes overly dependent on any specific features, forcing the network to distribute learning across various neurons.

How Dropout Works

1. Training Phase:

- A dropout rate, denoted as " p ," is defined, which represents the probability of dropping a neuron. For example, a dropout rate of 0.2 means 20% of the neurons are randomly set to zero during training.
- The remaining active neurons are scaled by a factor of $\frac{1}{1-p}$ to maintain the overall contribution of the layer.

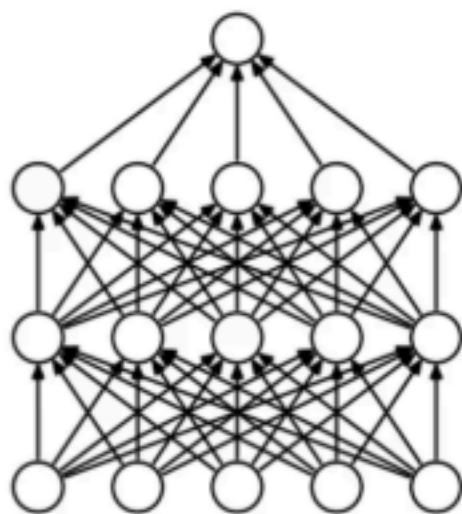
2. Testing Phase:

- During testing or inference, dropout is not applied. All neurons are active, and their outputs are scaled by $1-p$ to balance the effect.

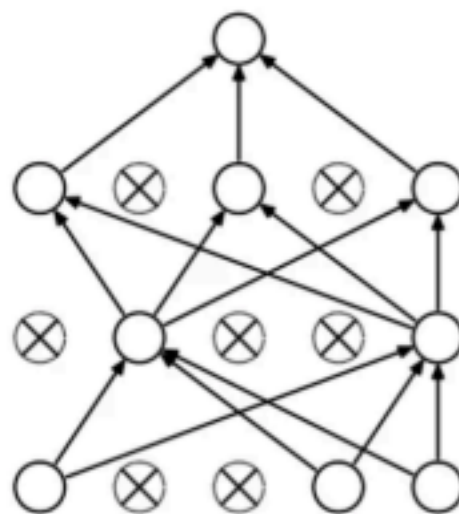
Why Use Dropout? Dropout helps in:

- Reducing overfitting by introducing randomness.
- Encouraging redundancy in feature learning.
- Improving model robustness by ensuring the network does not rely on specific neurons.

`dropout_NN.ipynb`



(a) Standard Neural Net



(b) After applying dropout.

Fig: Dropout Layer Representation