Improving Deep Neural Networks

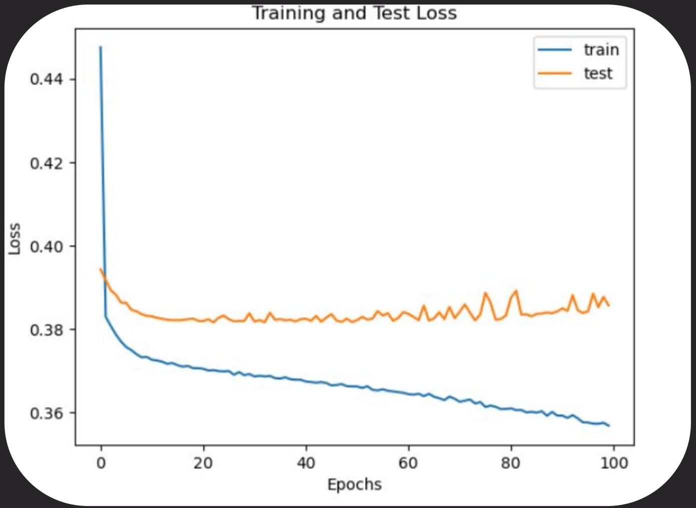
Video 5: How to fix an Overfitting Model ?

Analytics Vidhya

In air

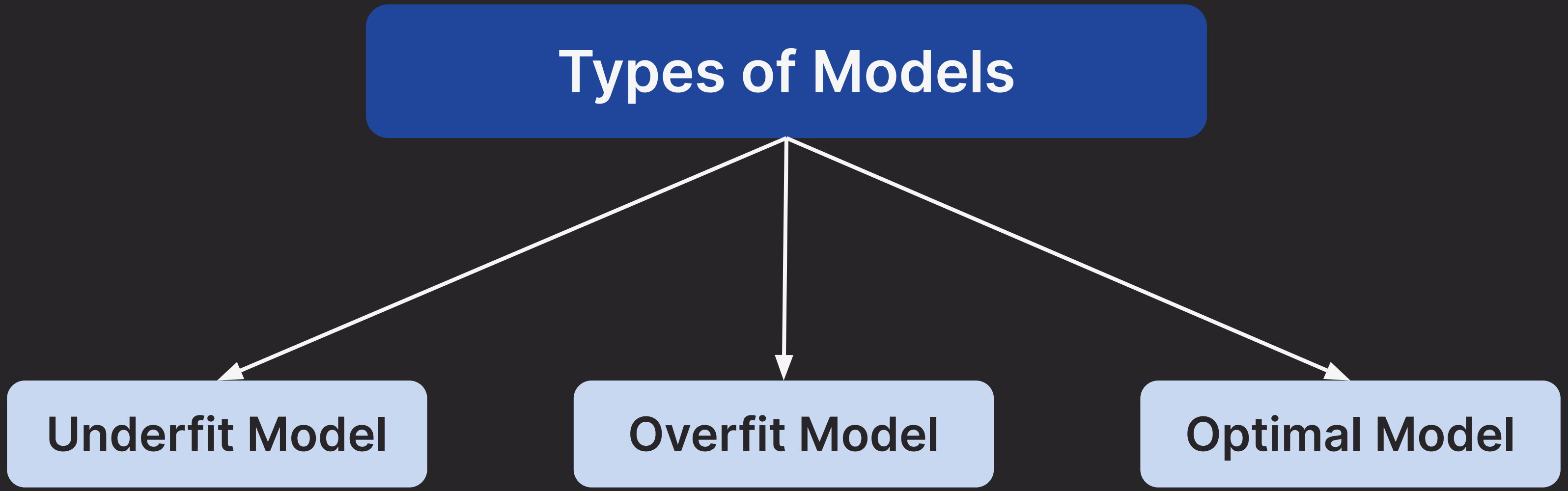
Overfitting

A machine learning model performs well on training data but poorly on new data



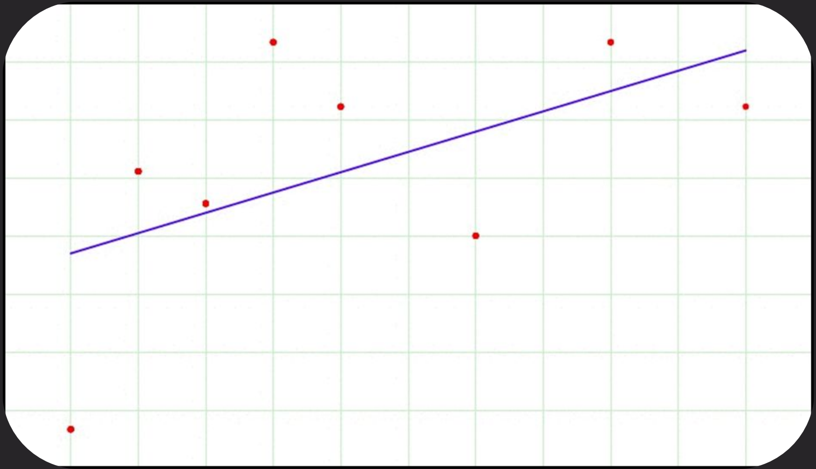
Overfitting in the Zeta Analytics Plot

Deep learning: capacity to learn intricate patterns from datasets


Analytics Vidhya
Types of Models
Underfit Model
Overfit Model
Optimal Model

Underfit Model

- Performs poorly on both the train and test data.

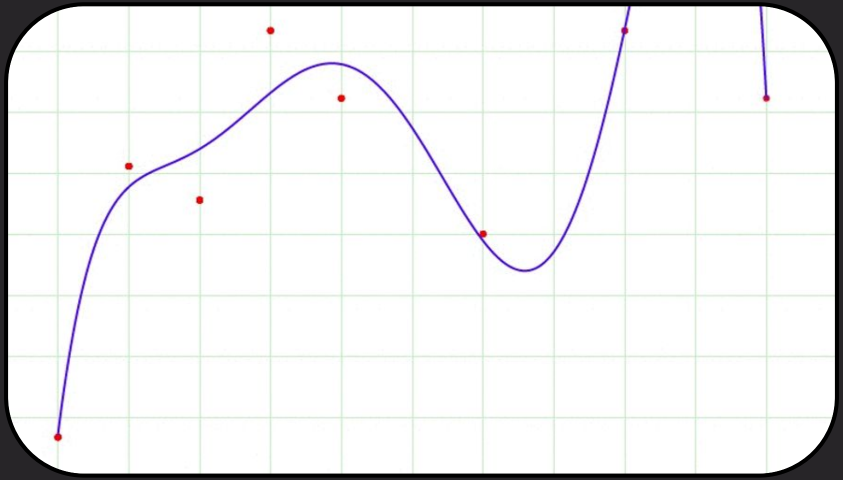


Overfit Model

- Performs well on the train data but poorly on the test data.

Optimal Model

- Performs well on both the train data and test data



Analytics Vidhya

How do you overcome overfitting in deep learning ?

Techniques to overcome Overfitting

Analytics Vidhya

Reducing the complexity

Using regularization techniques

Adding more data to train set

Early stopping technique

Techniques to overcome Overfitting

Reducing the complexity

Using regularization techniques

Adding more data to train set

Early stopping technique

Reducing the complexity: Drawback

- Model may not capture nuances from complex datasets with lesser layers.

Reducing the complexity: Strategy

General Strategy:

- Maximize data capture, even at the risk of complex model with overfitting

Techniques to overcome Overfitting

Reducing the complexity

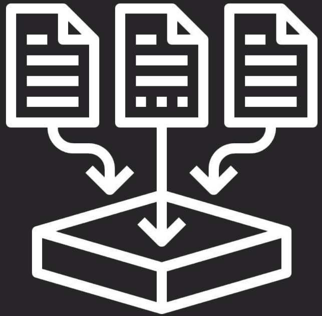
Using regularization techniques

Adding more data to train set

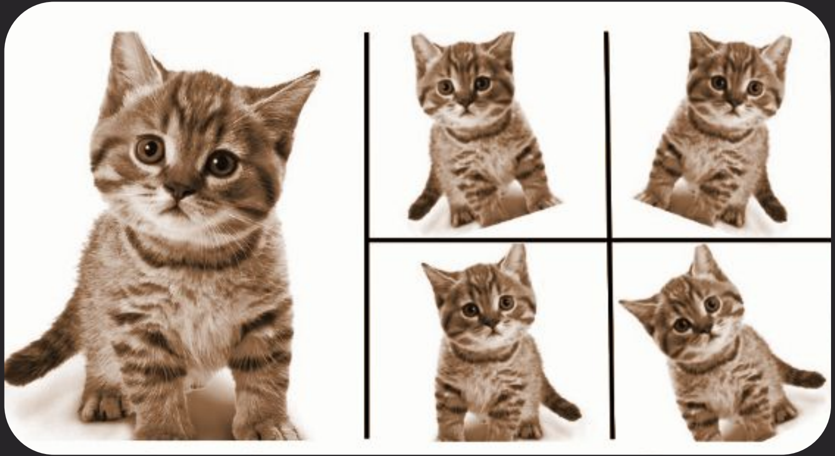
Early stopping technique

Adding more data to train set

More relevant data better model quality!



Data Augmentation



Data Augmentation

This method generates synthetic data resembling the current dataset.

Techniques to overcome Overfitting

Reducing the complexity

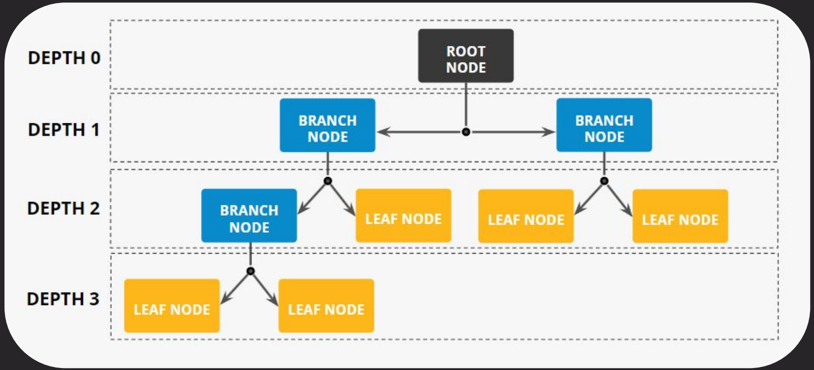
Using regularization techniques

Adding more data to train set

Early stopping technique

Regularization

Regularization is a technique that reduces the complexity of the model.



- Reducing max depth in decision tree
- L1 and L2 penalties in linear models

Regularization Technique: L2 Penalty

- The L2 penalty is a popular regularization solution for deep learning networks.

$$loss + \left(\sum_{i=1}^{N} ||w^{[i]}||^2\right)\frac{\lambda}{2m}$$

N = number of layers

$w^{[i]}$ = Weight matrix of the i^{th} layer

m = number of inputs

λ = regularization parameter

Regularization Technique: L2 Penalty

$$loss + \left(\sum_{i=1}^{N} ||w^{[i]}||^2\right)\frac{\lambda}{2m}$$

- Adding weight values ensures that they do not increase unconditionally.
- In Pytorch, L2 regularization is applied through '**weight decay**'.

Regularization Technique: L2 Penalty

Weight Decay

Default value: 10^{-5}

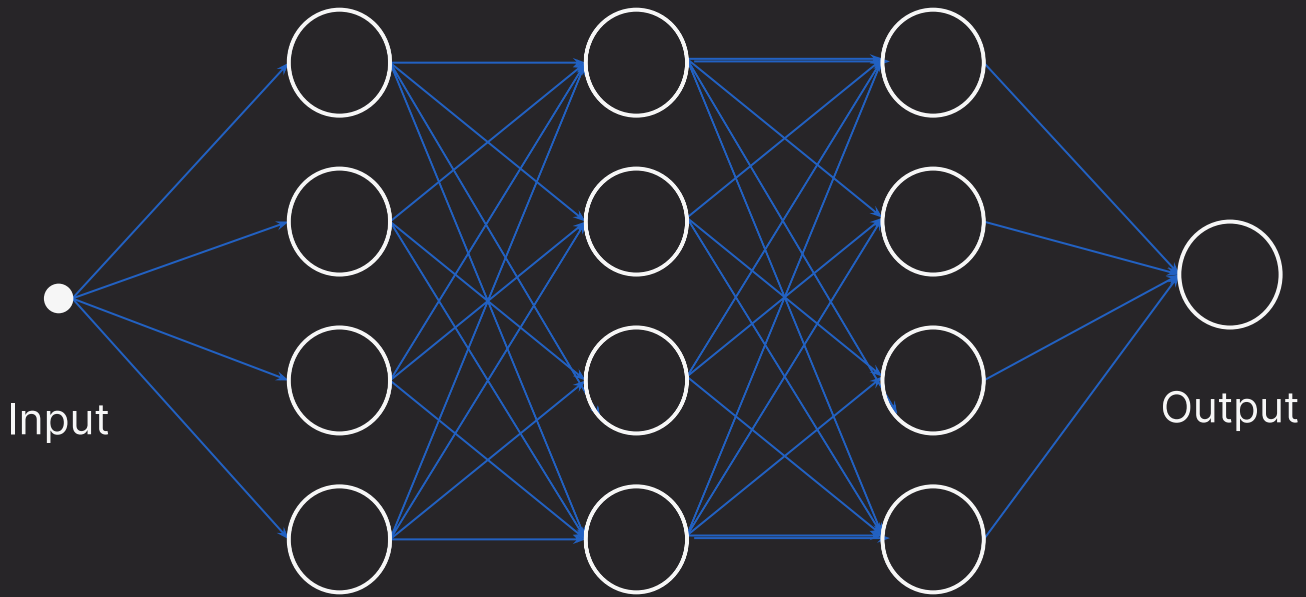
Regularization Technique: L1 Penalty

L1 penalties **reduce the weights to absolute zero.**

Regularization Technique: Dropout

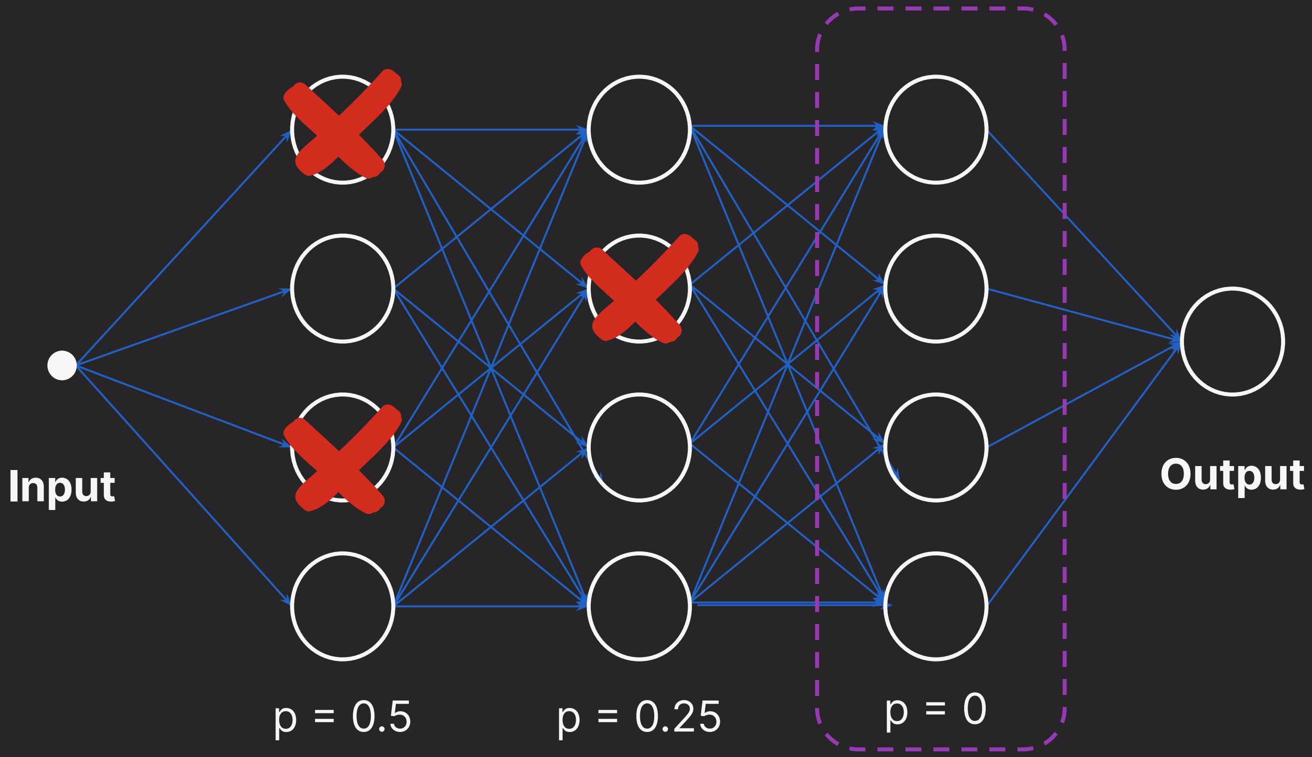
- Different versions of model architecture by turning weights to 0.
- **p = probability of a neuron being deactivated or turned off.**

Regularization Technique: Dropout

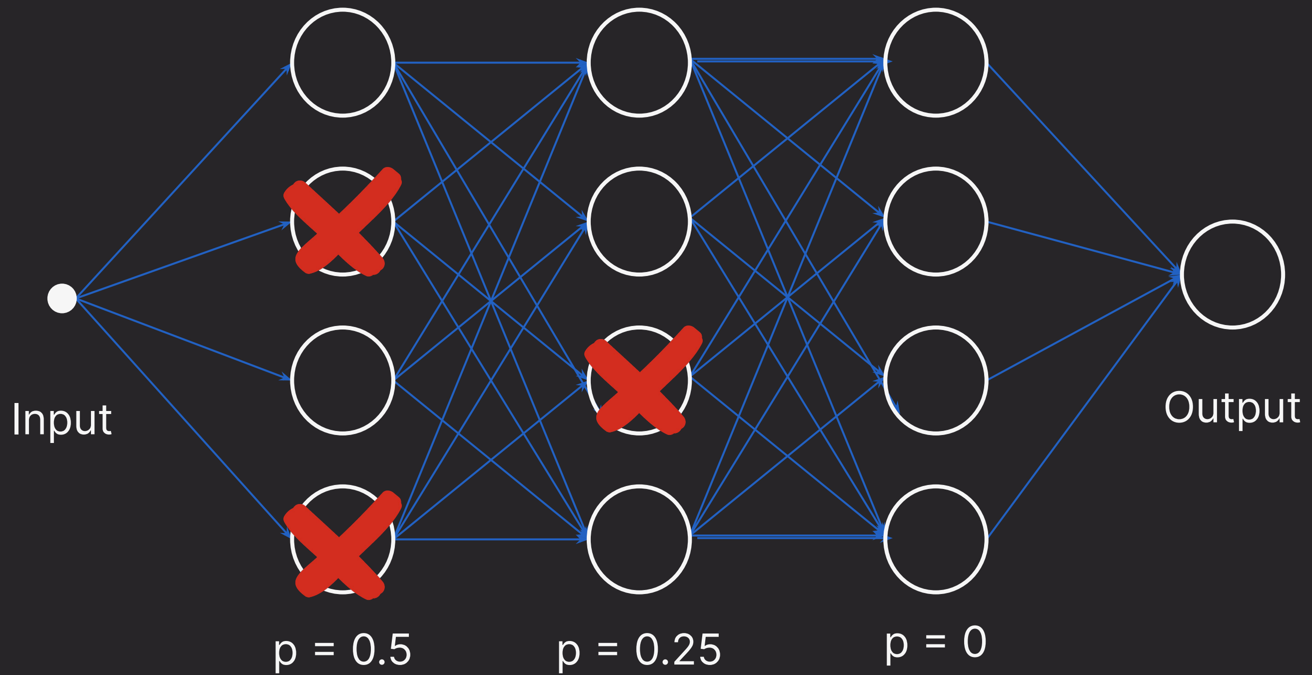


p = probability of a neuron being deactivated or turned off.

Regularization Technique: Dropout



Regularization Technique: Dropout



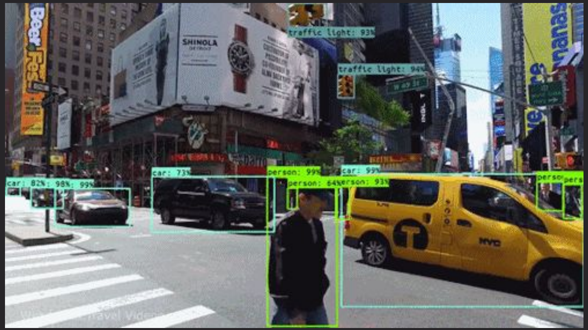
Analytics Vidhya

Regularization Technique: Dropout

- Proven to reduce Overfitting.
- Prevents dependency on any single neuron, encouraging a more robust learning process.

	A	B	C	D	E	F
1	Page_traffic	Unit_price	**Units_sold**	Segment	1_Star_Ra	2_Star_Ra
2	5835	22.21438918	**2071**	Skincare	99	72
3	1881	11.87077827	**681**	Skincare	118	73
4	2477	27.64571429	**875**	Makeup	108	85
5	4087	16.89684814	**1396**	Makeup	82	64
6	1446	16.35766423	**822**	Hair Care	29	24
7	2875	19.55812036	**1213**	Skincare	62	55
8	4688	22.30575256	**1269**	Makeup	0	0
9	3947	14.01656805	**845**	Makeup	43	29
10	5503	23.75960867	**1431**	Skincare	35	33
11	4131	27.84563758	**1043**	Skincare	0	0
12	1935	21.13953488	**817**	Makeup	91	69

Structured Datasets



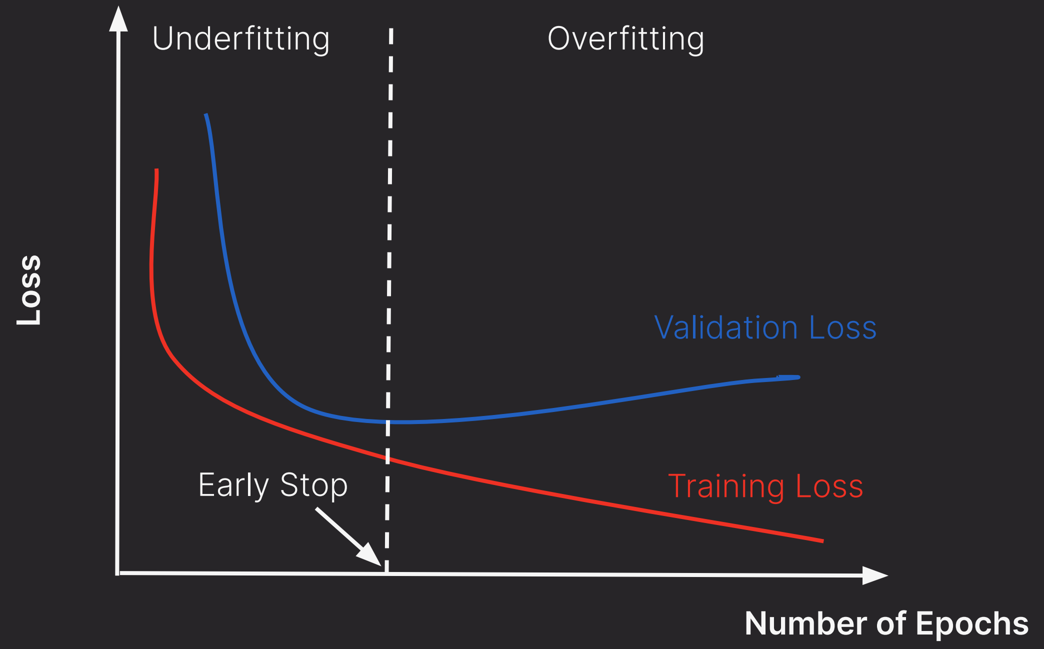
Computer Vision

Analytics Vidhya

Regularization Technique: Early Stopping

- Stop the training process before the model starts learning the noise.

Regularization Technique: Early Stopping



In air