

# Fully Convolutional Neural Networks for Volumetric Medical Image Segmentation

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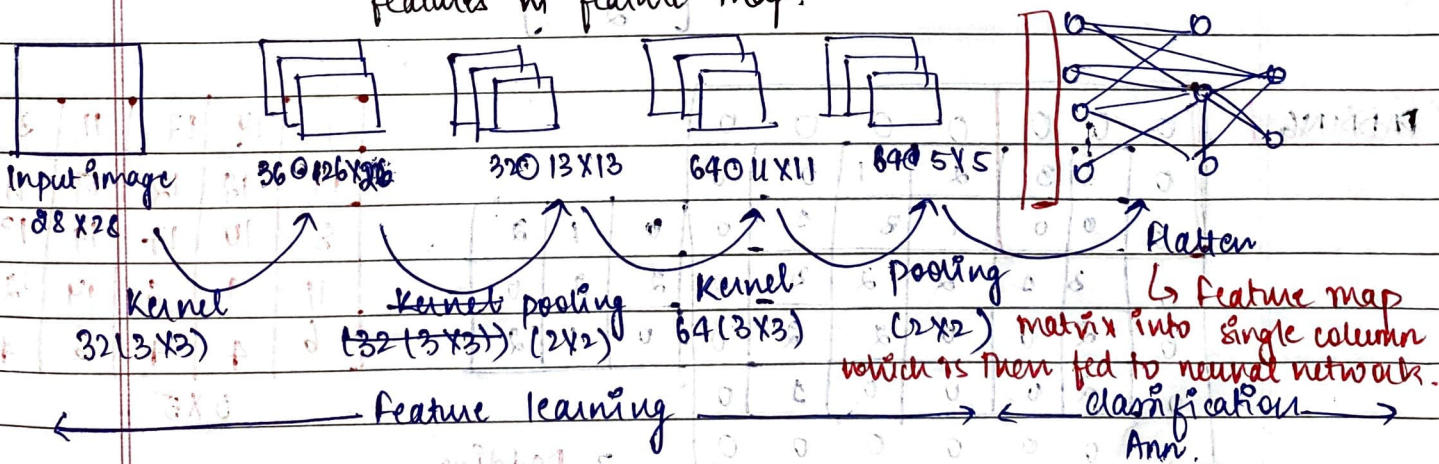
CNN is a type of artificial neural network used in image recognition and processing, specially designed to process pixel data. CNN uses the concept of deep learning.

This paper is purely based on CNN and we propose an approach to 3D image segmentation based on volumetric, fully convolutional neural network.

**Dice coefficient:**  $2 \times \text{the area of overlap}$  divided by the total number of pixels in both the images.

## # Convolutional Neural Network

1. kernel = filter = feature detector : Extract features from images
2. stride : It is a metric that moves over the input data, performs dot product and gets output. It moves on input data by stride value.
3. padding : The amount of movement b/w applications of filter to the input image is referred to as stride.
4. Pooling : Down sample the detection of features in feature map.
5. Flatten : To fix the border effect problem.





# KERNEL

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Dot product

3	3	2	1	0	DP	0	1	2		12	12	17
0	0	1	3	1	DP	2	2	0		10	17	19
3	1	2	2	3		0	1	2		9	6	14
2	0	0	2	2								
2	0	0	0	1								

5x5

3x3

3x3

Input (Dot product)

formula to calculate :

$$O = [i - k] + 1$$

$$= [5 - 3] + 1 = 3$$

deleted

2 kernel concept

## STRIDE

3	3	2	1	0		0	1	2		12	12	7
0	0	1	3	1		2	2	0		10	17	9
3	1	2	2	3		0	1	2		9	6	14
2	0	0	2	2								
2	0	0	0	1								

5x5

3x3

2x2

formula to calculate :

$$O = [i - k] + 1$$

$$= [5 - 3] + 1 = 2$$

## PADDING

0	0	0	0	0	0	0		6	14	17	11	3
0	3	3	2	1	0	0		14	12	12	17	11
0	0	0	1	3	1	0		8	10	17	19	13
0	2	1	2	2	0	0		11	9	6	14	12
0	2	0	0	2	2	0		6	4	4	6	4
0	2	0	0	0	1	0						
0	0	0	0	0	0	0						

5x5

formula =

$$O = [i - k + 2p] + 1$$

stride

$$= [5 - 3 + 2(1)] + 1$$

5

5x5

Padding increases the size of pixel.

Reduce the dimension but with provided preserve all the important features without losing.

## POOLING

6	14	17	11	3
14	12	12	17	11
8	10	17	19	13
11	9	6	14	12
6	4	4	6	4

14	17
11	19

Max pooling  
(2x2)

11.5	14.25
9.5	14.0

Avg. pooling