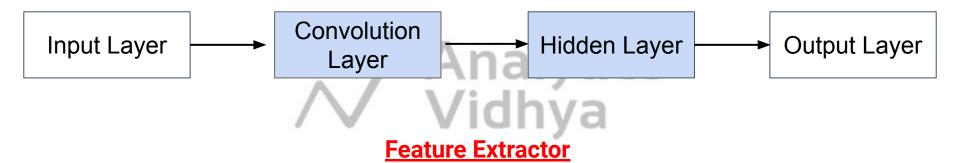
Parameter Sharing and Local Connectivity



Convolutional Neural Network





Convolution Operation in CNN

-1	0	1
-1	0	1
-1	0	1

3 X 3

36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

Analy Vidhy

-24	-22	-14	12	35	33
-23	-23	-13	14	39	32
-22	-23	-11	18	41	31
-22	-23	-6	22	41	29
-20	-19	0	25	40	26
-18	-15	4	27	37	23
-15	-10	9	28	36	23
-13	-7	13	29	34	23
-8	-3	18	29	33	25
-2	2	20	28	32	25
5	8	23	28	30	23

13 X 8 11 X 6

Convolution Operation in CNN

Local Connectivity

Parameter Sharing
Analytics
Vidhya







36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

Analyti Vidhya

-24	19		34	753
	12	133	100	20
1	-		- 1	*
4	- 1			
				45
				n
			-	-
- 40	- 49	93	- 44	33
-	- 10		- 30	- 55
- 1	- 13	2.	- 3	10
				-
1				
	7	- 1	- 1	- 1
	la la			0



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

Analyti Vidhya

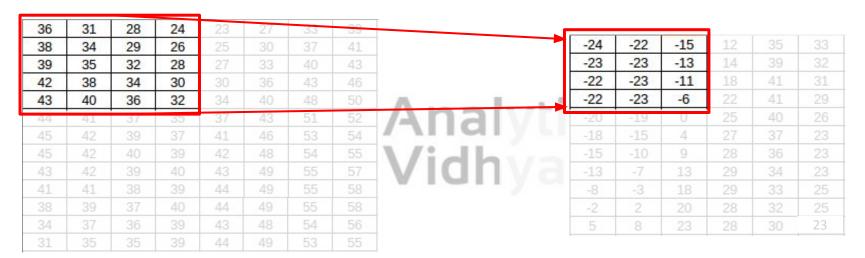
-24	-22	80		
		(2)	1	
		- 1	7	
		- 0	- 3	
		- 07		
		92		
		- 6		
		Ü		



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

	24	- 22	[-1 4		
				3	
				33	
A I:					
Anaivti					
,					
Vidhyo					
Vidhya		9		3 .	
,		ì		9	
•				(d) - 1	
•					

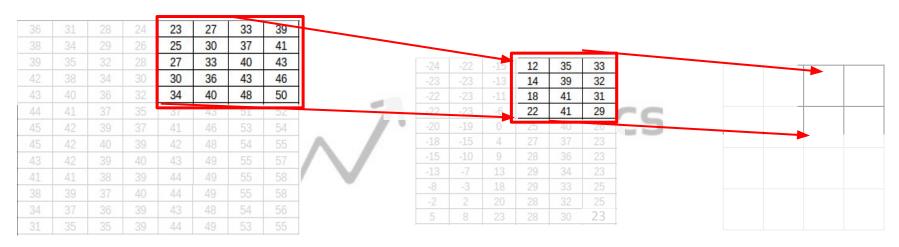






5	31	28	24	23	27	33	39						
8	34	29	26	25	30	37	41	-24	-22	-15	12	35	
9		32	28	27	33	40	43	-23	-23	-13	14	39	
12		34	30	30	36	43	46	-22	-23	-11	18	41	
13	40		32	34	40	48	50	-22	-23	-6	22	41	
14	41	37	35	37	43	51	52	-20	-19	0	25	40	
15	42	39	37	41	46	53	54	-18	-15	4	27	37	
15	42	40	39	42	48	54	55	-15	-10	9	28		
43	42	39	40	43	49	55	57	-13	-7	13	29	34	
41	41		39	44	49	55	58	-8	-3	18	29	33	
38	39	37	40	44	49	55	58	-2	2	20	28	32	
34	37		39	43	48	54	56	5	8	23	28	30	
31			39	44	49	53	55						





Image

Feature Map

Conv Layer 1

Feature Map

Conv Layer 2



Each output value takes input from a (small) local group of pixel values from the complete image.

36	31	28	24	23	27	33	39	_						_
	34	29	26	25	30	37	41	DO WEIGH	-24	-22	-15	12	35	
39	35	32	28	27	33	40	43	Maivu	-23	-23	-13	14	39	
42	38	34	30	30	36	43	46	7. 11	-22	-23	-11	18	41	Ī
43	40	36	32	34	40	48	50	(idhya	-22	-23	-6	22	41	
44	41	37	35	37	43	51	52	IGITY	-20	-19	0	25	40	
45	42	39	37	41	46	53	54		-18	-15	4	27	37	
45	42	40	39	42	48	54	55		-15	-10	9	28		
43	42	39	40	43	49	55	57		-13	-7	13	29	34	
41	41		39	44	49	55	58		-8	-3	18	29	33	
	39	37	40	44	49	55	58		-2	2	20	28	32	
34	37	36	39	43	48	54	56		5	8	23	28	30	
31	35	35	30	44	49	53	55	-			-			+

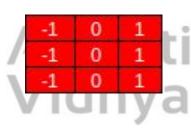
Input Image







36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55



-24	19	2	34	75	
9 10				30	
	Ü	j j			
	- 13				
-	-			-	
		93		33	
				50	
7		2	3	- 22	
		25		30	
	Ü	ĵ		- 0	



36	31	28	24	23	27	33	39
_		10000000	-				-
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

-1	0	1
-1	0	1
-1	0	1

-24	-22		92	345	19
			(4)	2.	- 85
			-	-	-
		+	88	96	
			2	32	
			100		
					J.
		1			
		1	97	- 1	Ja
Ţ			177		Ť



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

-1	0	1
-1	0	1
-1	0	1

-24	-22	-14			
			27		19
			(4)	3	
			S		Ü
			600 600		
			0		
					Jan 1
			9	1	19
			C.	4	4
				_	



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

-1	0	1
-1	0	1
-1	0	1

-24	-22	-14	12	35	33
-23	-23	-13	14	39	32
-22	-23	-11	18	41	31
-22	-23	-6	22	41	29
-20	-19	0	25	40	26
-18	-15	4	27	37	23
-15	-10	9	28	36	23
-13	-7	13	29	34	23
-8	-3	18	29	33	25
-2	2	20	28	32	25
5	8	1		20	

Image



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

-1	0	1
-1	0	1
-1	0	1

-24	-22	-14	12	35	33
-23	-23	-13	14	39	32
-22	-23	-11	18	41	31
-22	-23	-6	22	41	29
-20	-19	0	25	40	26
-18	-15	4	27	37	23
-15	-10	9	28	36	23
-13	-7	13	29	34	23
-8	-3	18	29	33	25
-2	2	20	28	32	25
5	8	23			

Image



36	31	28	24	23	27	33	39
38	34	29	26	25	30	37	41
39	35	32	28	27	33	40	43
42	38	34	30	30	36	43	46
43	40	36	32	34	40	48	50
44	41	37	35	37	43	51	52
45	42	39	37	41	46	53	54
45	42	40	39	42	48	54	55
43	42	39	40	43	49	55	57
41	41	38	39	44	49	55	58
38	39	37	40	44	49	55	58
34	37	36	39	43	48	54	56
31	35	35	39	44	49	53	55

-1	0	1
-1	0	1
-1	0	1

-24	-22	-14	12	35	33
-23	-23	-13	14	39	32
-22	-23	-11	18	41	31
-22	-23	-6	22	41	29
-20	-19	0	25	40	26
-18	-15	4	27	37	23
-15	-10	9	28	36	23
-13	-7	13	29	34	23
-8	-3	18	29	33	25
-2	2	20	28	32	25
5	8	23	28		

Image







Parameter sharing is sharing of filter values by all pixel values of the image to generate a particular feature map.





Local Connectivity & Parameter Sharing

 Local Connectivity: Each output value takes input from a (small) local group of pixel values from the complete image.

 Parameter Sharing: Parameter sharing is sharing of filter values by all pixel values of the image to generate a particular feature map.



Thank You!

