NPTEL ONLINE CERTIFICATION COURSES

Course Name: Deep Learning
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Topic

Lecture 35: Cross Correlation

CONCEPTS COVERED

Concepts Covered:

❑ CNN

    ❑ Convolution

    ❑ Linear Time Invariant (LTI) System

    ❑ Linear Shift Invariant (LSI) System
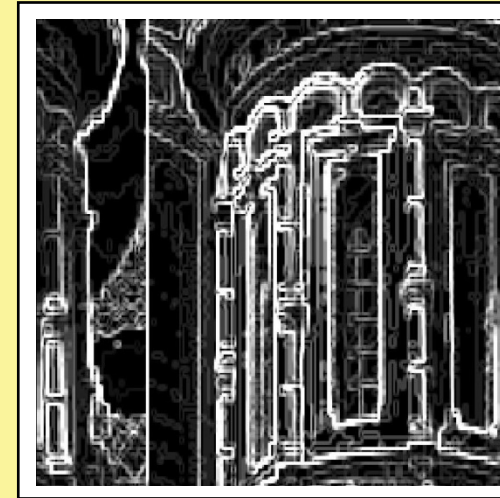
❑ Cross Correlation

Convolution

Convolution

Convolution
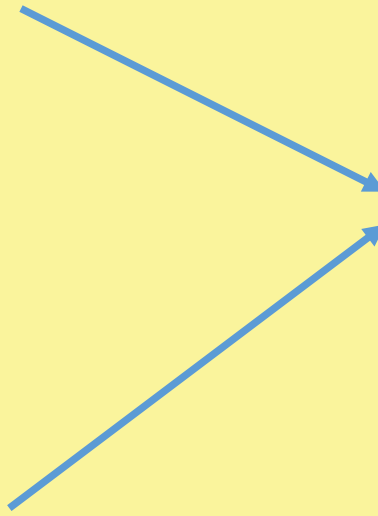
Convolution

Input Image

Kernel

Feature Map
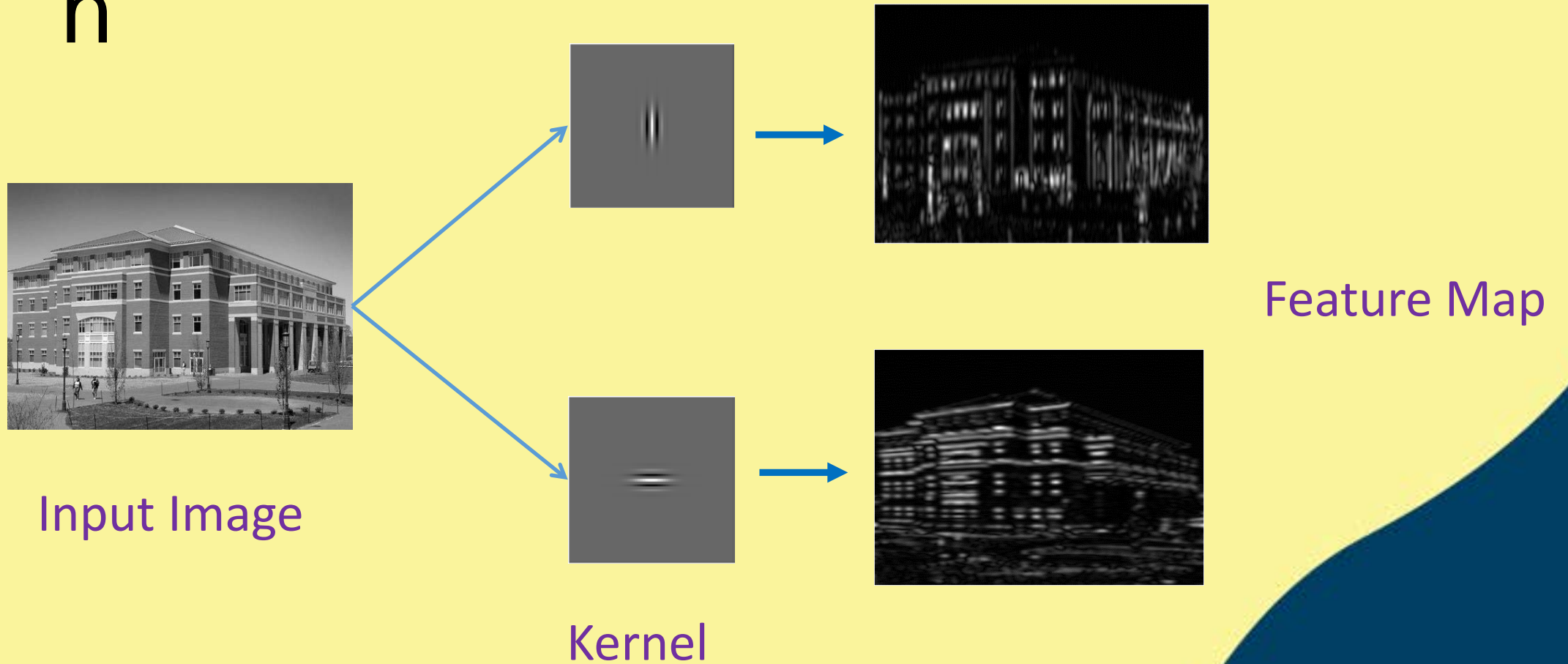
Cross Correlation

Cross Correlation

1	1	1	1	1	1
1	20	2	2	2	1
1	2	3	3	2	1
1	2	3	3	2	1
1	2	2	2	2	1
1	1	1	1	1	1

g

3	3	2
3	3	2
2	2	2

f

47	54	56	20	18	12
54	87	94	40	34	21
56	90	107	54	44	24
20	40	54	56	44	24
18	34	43	44	37	22
12	21	24	24	22	15

C_{fg}

Normalized Cross Correlation

$$\dfrac{C_{fg}}{\left[\sum_u \sum_v g^2(x+u, y=v)\right]^{\frac{1}{2}}}$$

Cross Correlation

$$\left[\sum_{u} \sum_{v} g^2(x+u, y+v) \right]^{\frac{1}{2}}$$

20.07	20.19	20.30	3.87	3.46	2.64
20.19	20.54	20.80	6.08	5.09	3.46
20.27	20.76	21.26	7.48	6.08	3.87
3.87	5.91	7.48	7.48	6.08	3.87
3.46	5.09	6.08	6.08	5.09	3.46
2.64	3.46	3.87	3.87	3.46	2.64

Cross Correlation

$$C_{fg} \Big/ \left[\sum_u \sum_v g^2(x+u, y=v) \right]^{\frac{1}{2}}$$

1	1	1	1	1	1
1	20	2	2	2	1
1	2	3	3	2	1
1	2	3	3	2	1
1	2	2	2	2	1
1	1	1	1	1	1

2.34	2.67	2.75	5.16	5.2	4.54
2.67	4.2	4.51	6.5	6.67	6.06
2.76	4.33	5.03	7.2	7.23	6.2
5.16	6.76	7.21	7.48	7.23	6.2
5.2	6.67	7.07	7.23	7.26	6.35
4.54	6.06	6.20	6.20	6.35	5.68

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Thank you