



NPTEL ONLINE CERTIFICATION COURSES

Course Name: Deep Learning

Faculty Name: Prof. P. K. Biswas

Department : E & ECE, IIT Kharagpur

Topic

Lecture 37: Popular CNN Models

CONCEPTS COVERED

Concepts Covered:

- ❑ CNN

 - ❑ LeNet

 - ❑ AlexNet

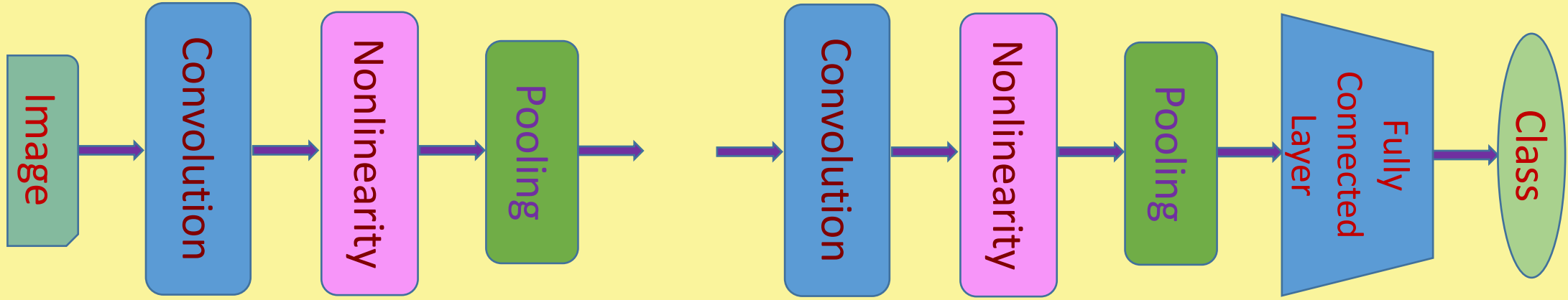
 - ❑ VGG Net

 - ❑ GoogLeNet

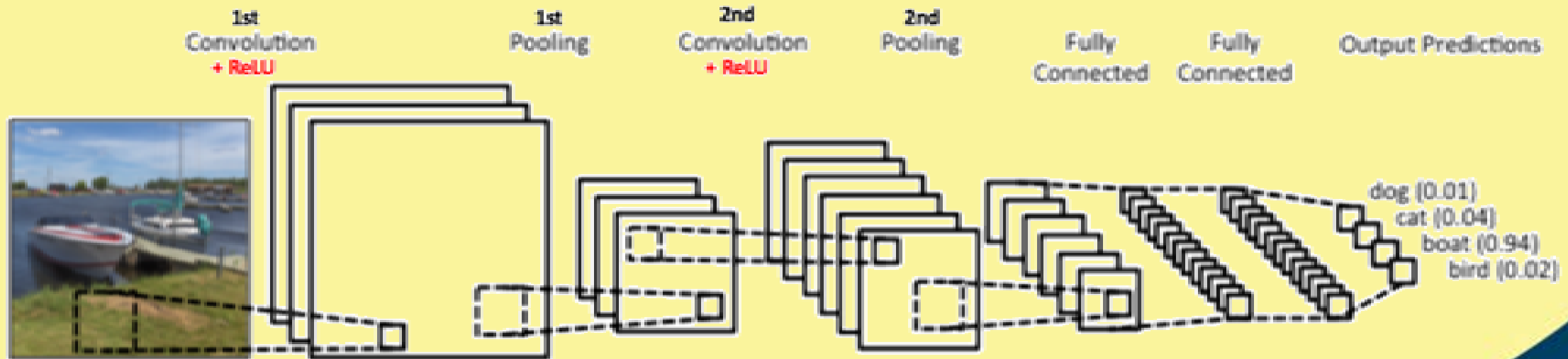
 - ❑ etc.



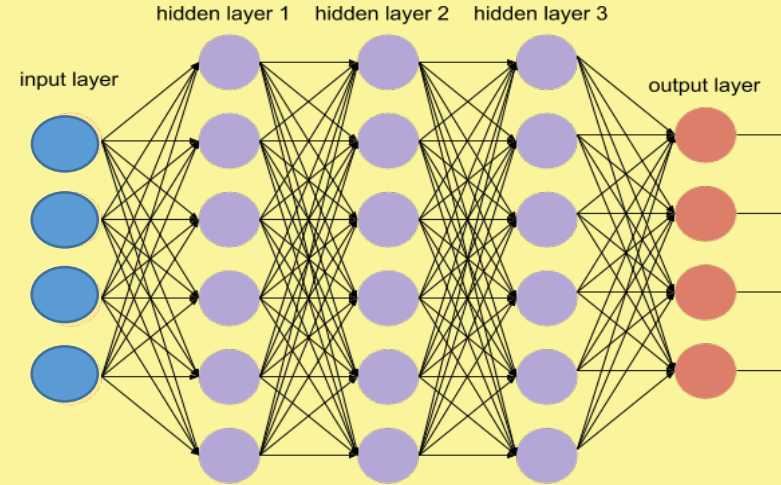
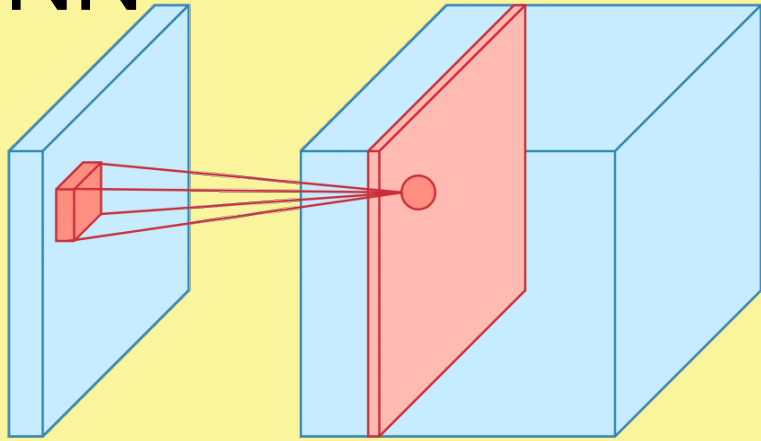
CNN Architecture



CNN Architecture



MLP vs CNN



- ❑ Sparse Connectivity: Every node in the Convolution Layer receives input from a small number of nodes in the previous layer (Receptive Field), needing smaller number of parameters.
- ❑ Parameter Sharing: Each member of the Convolution Kernel is used at every position of the input, dramatically reducing the number of parameters.
- ❑ This makes CNN much more efficient than MLP.



Some popular CNN Models



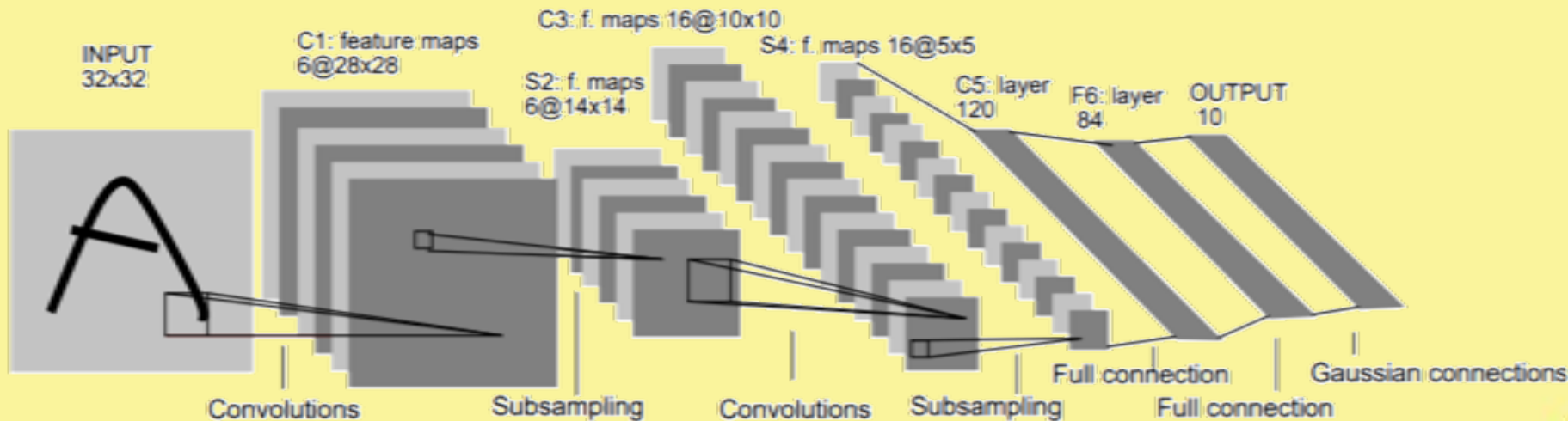
LeNet



LeNet

5

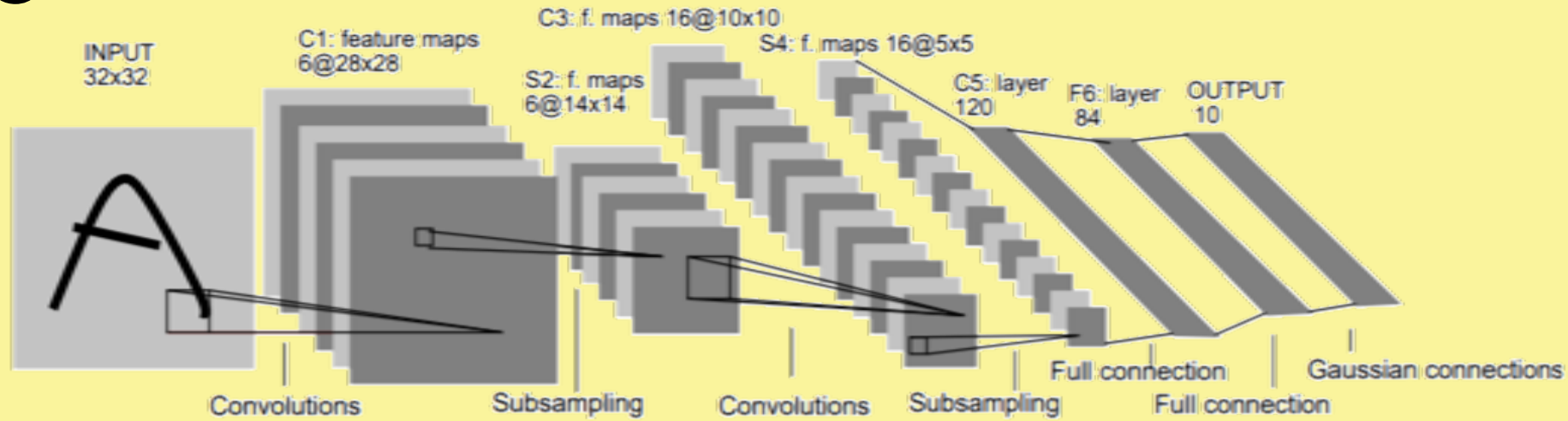
- Proposed by Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner for handwritten and machine-printed character recognition.
- Used by many Banks for recognition of hand written numbers on cheques.
- This architecture achieves an error rate as low as **0.95%** on test data



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet

5



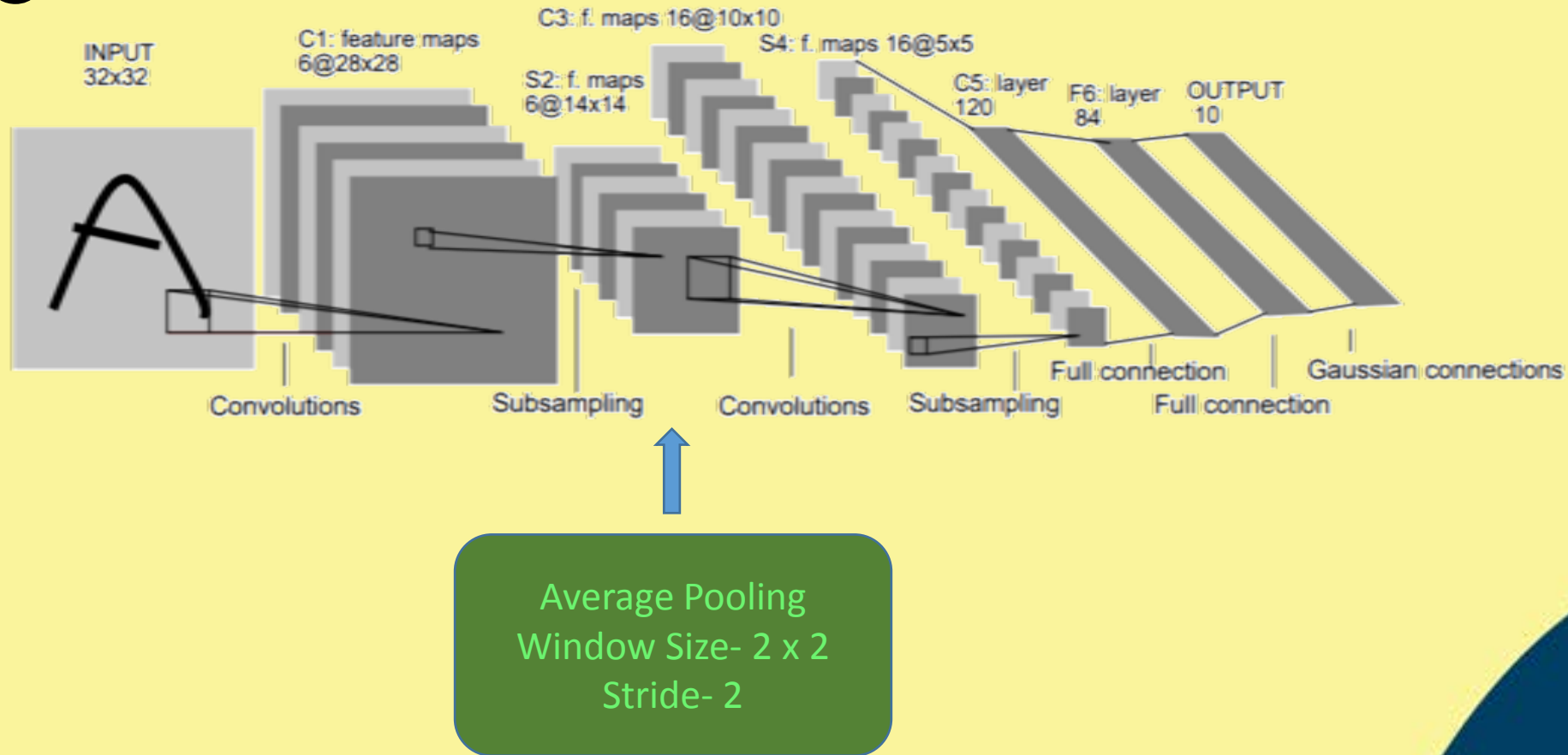
No. of Kernels- 6
Kernel Size- 5 x 5
Stride- 1



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet

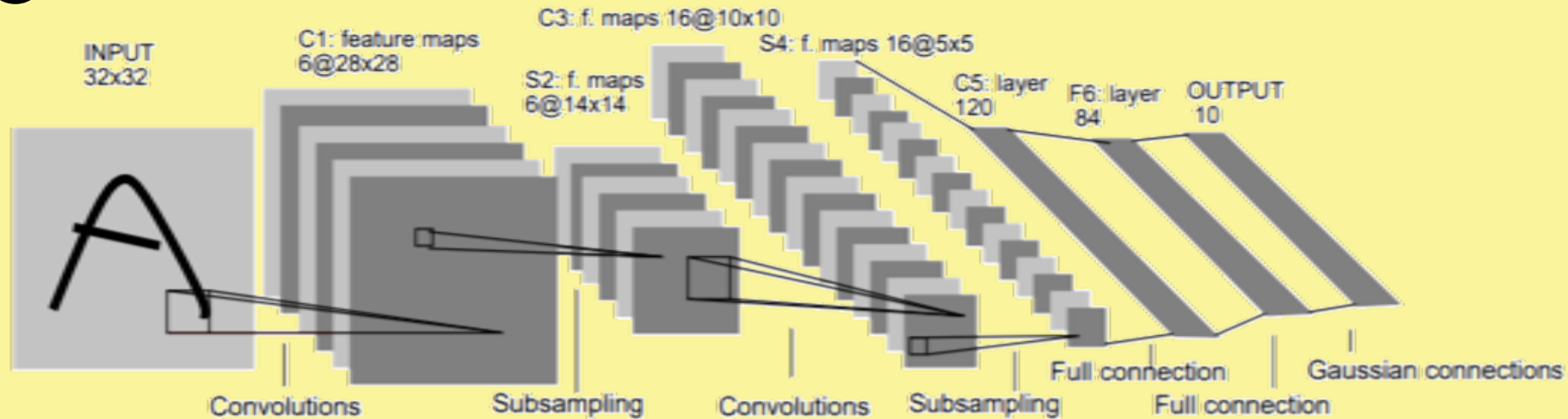
5



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet

5

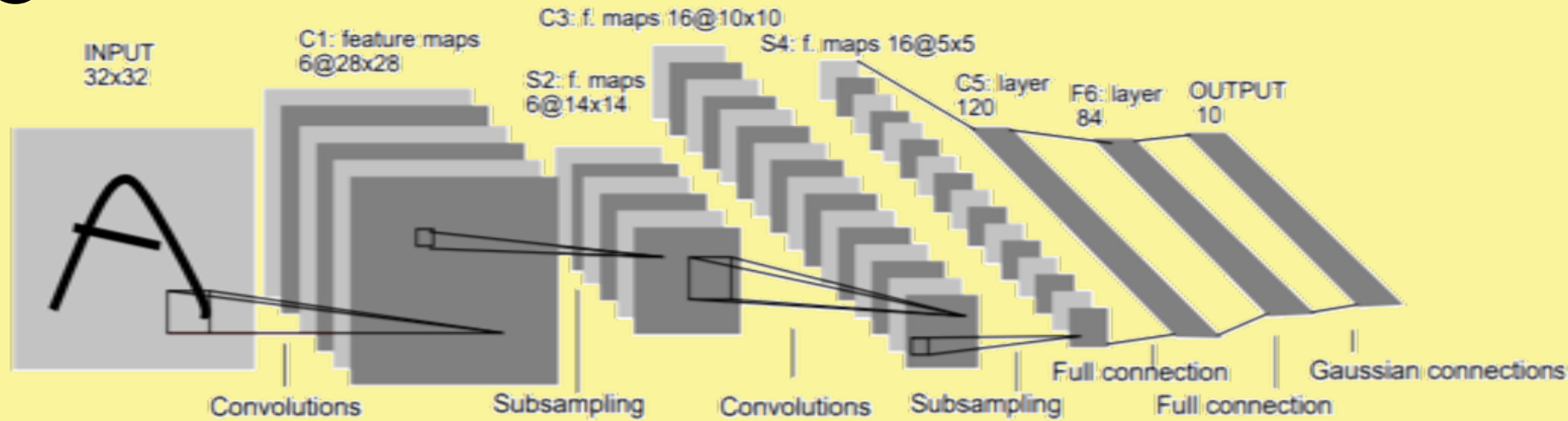


No. of Kernels- 16
Kernel Size- 5 x 5
Stride- 1



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet 5



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	X				X	X	X			X	X	X	X		X	X
1	X	X				X	X	X			X	X	X	X		X
2	X	X	X				X	X	X			X		X	X	X
3		X	X	X			X	X	X	X			X		X	X
4			X	X	X			X	X	X	X		X	X		X
5				X	X	X			X	X	X	X		X	X	X

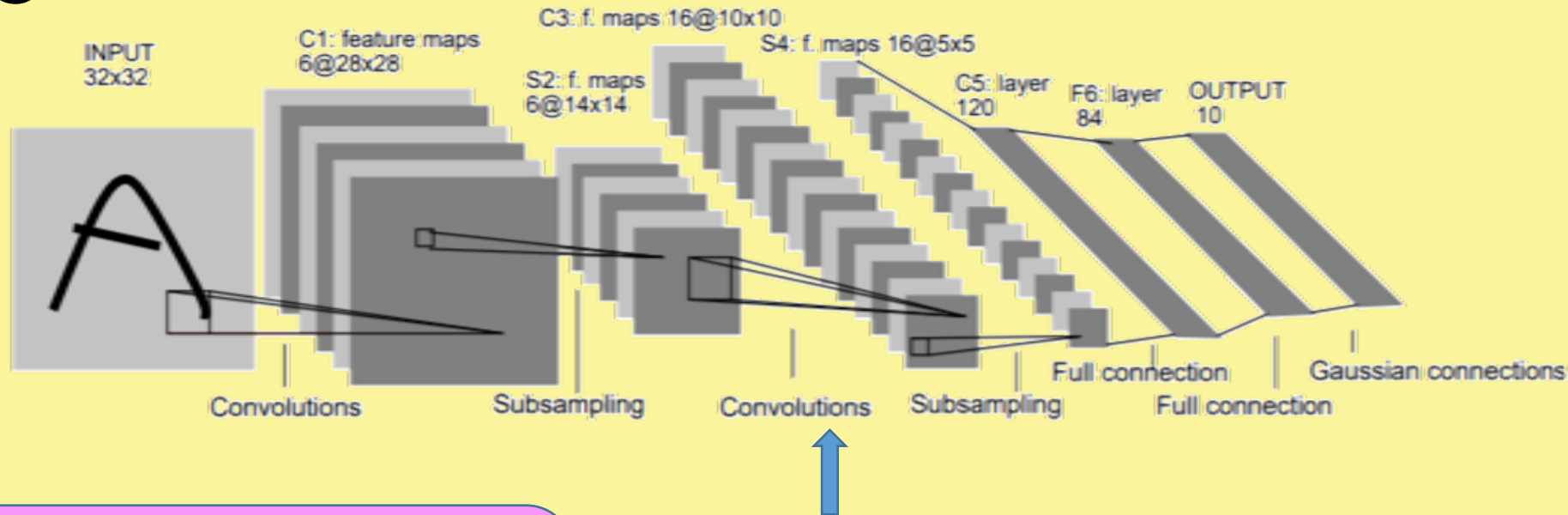
No. of Kernels- 16
Kernel Size- 5 x 5
Stride- 1



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet

5



- *Break the symmetry in the network*
- *Keep number of connections within reasonable bounds.*

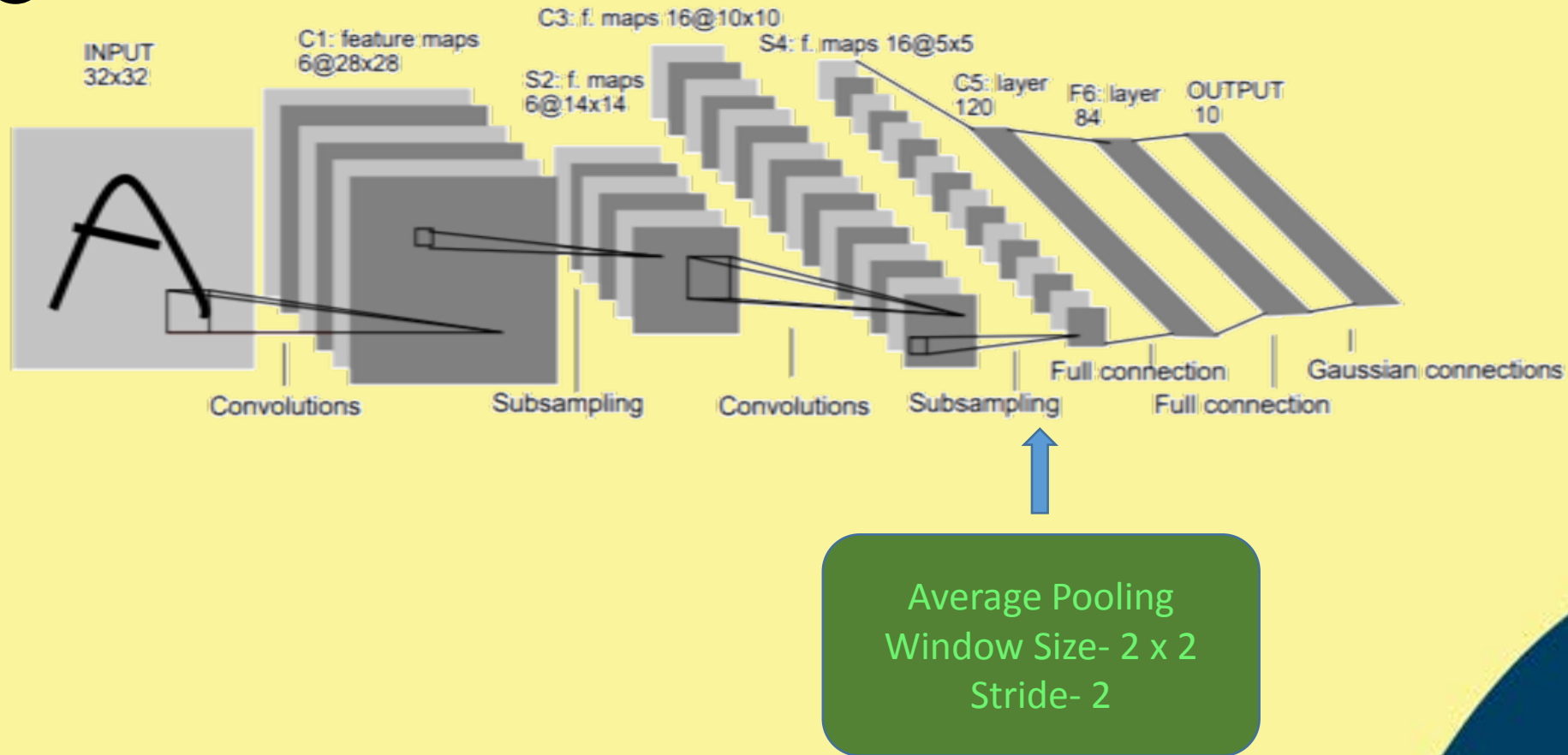
No. of Kernels- 16
Kernel Size- 5 x 5
Stride- 1



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet

5



Yann LeCun, Leon Bottou, Yosuha Bengio and Patrick Haffner, "Gradient –Based Learning Applied to Document Recognition", Proc. IEEE, Nov. 1998

LeNet 5: Summary

Layer		Feature Map	Size	Kernel Size	Stride	Activation
Input	Image	1	32x32	-	-	-
1	Convolution	6	28x28	5x5	1	tanh
2	Average Pooling	6	14x14	2x2	2	tanh
3	Convolution	16	10x10	5x5	1	tanh
4	Average Pooling	16	5x5	2x2	2	tanh
5	Convolution	120	1x1	5x5	1	tanh
6	FC	-	84	-	-	tanh
Output	FC	-	10	-	-	softmax



IMAGENET Large Scale Visual Recognition Challenge (ILSVRC)



<https://engmrk.com/lenet-5-a-classic-cnn-architecture/>

ILSVR

C

- IMAGENET Large Scale Visual Recognition Challenge.
- Evaluates algorithms for Object Detection and Image Classification on large image database.
- Helps researchers to review state of the art Machine Learning techniques for object detection across a wider variety of objects.
- Monitor the progress of computer vision for large scale image indexing for retrieval and annotation.
- Database contains large number of Images from 1000 categories.
- More than 1000 images in every category.



ILSVRC

- Every year of the challenge the forum also organizes a workshop at one of the premier computer vision conferences.
- The purpose of the workshop is to disseminate the new findings of the challenge.
- Contestants with the most successful and innovative techniques are invited to present their work.





NPTEL ONLINE CERTIFICATION COURSES

*Thank
you*

