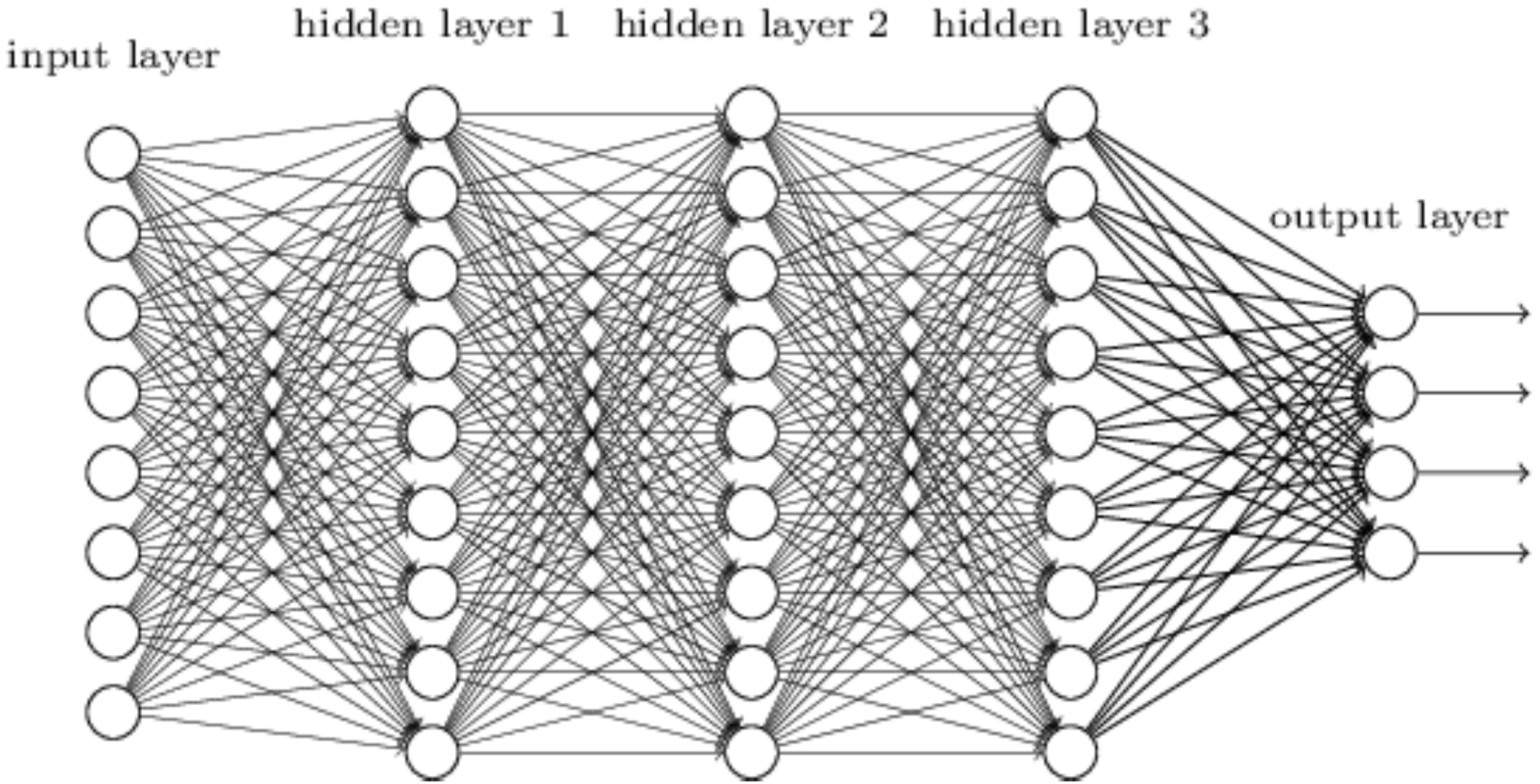
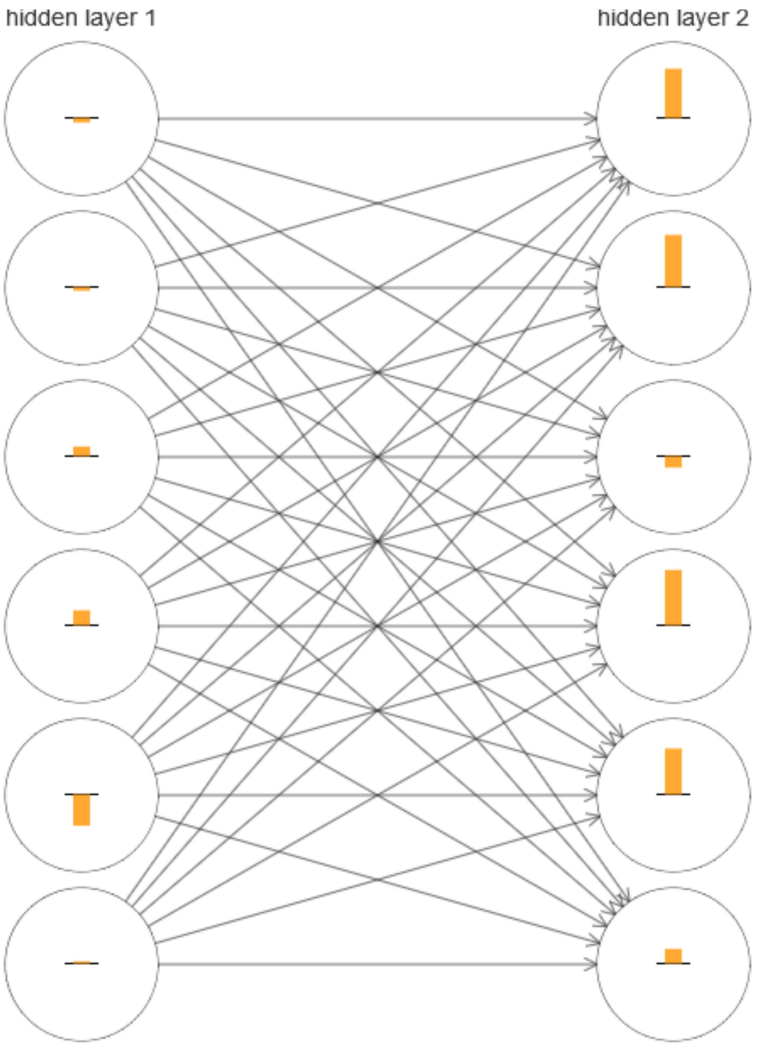
Réseaux à convolution
Réseaux de neurones profonds

- Limites de la BP
- Spécialisation
- Indépendance à la position
- Conservation du gradient
- Max pooling

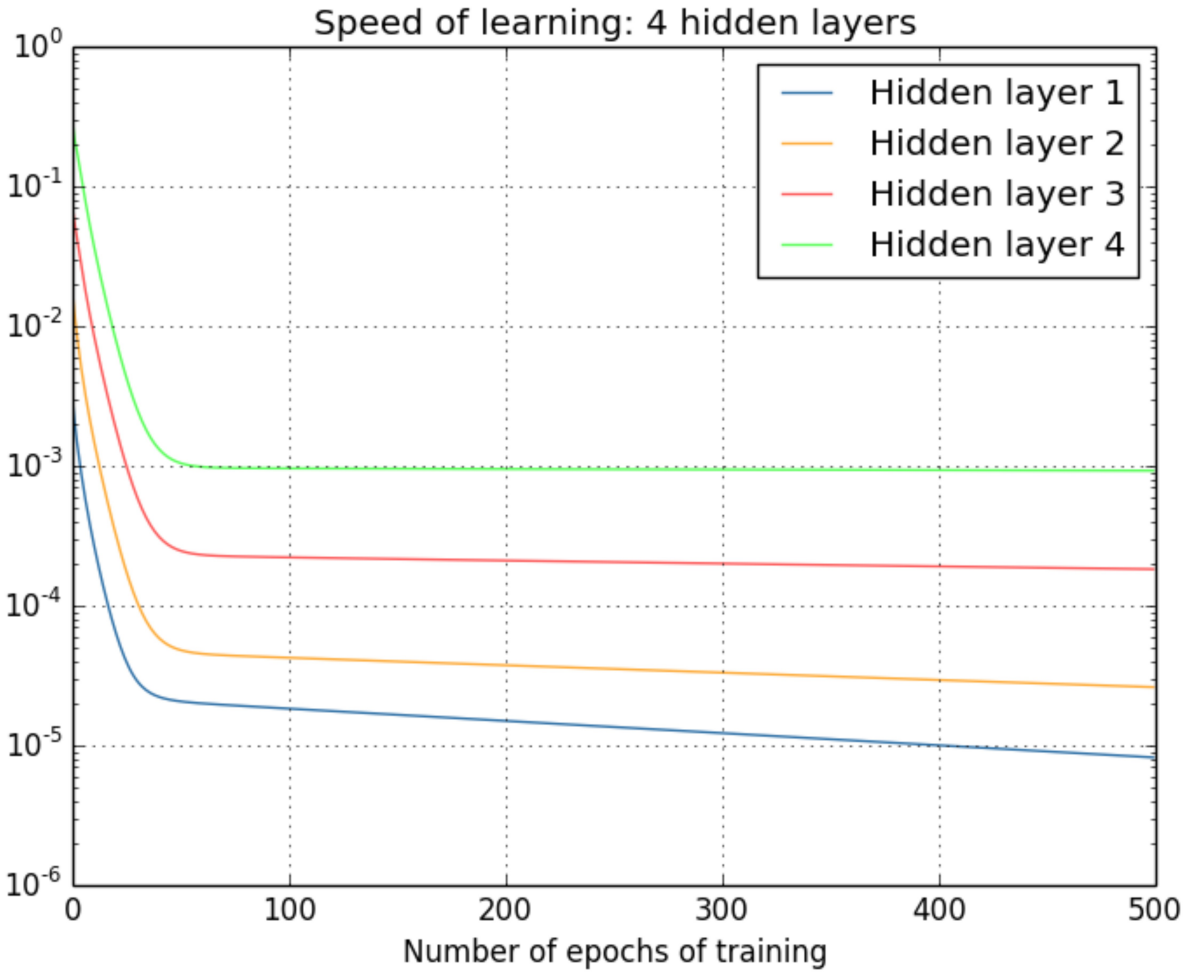
neuralnetworksanddeeplearning.com/chap6.html



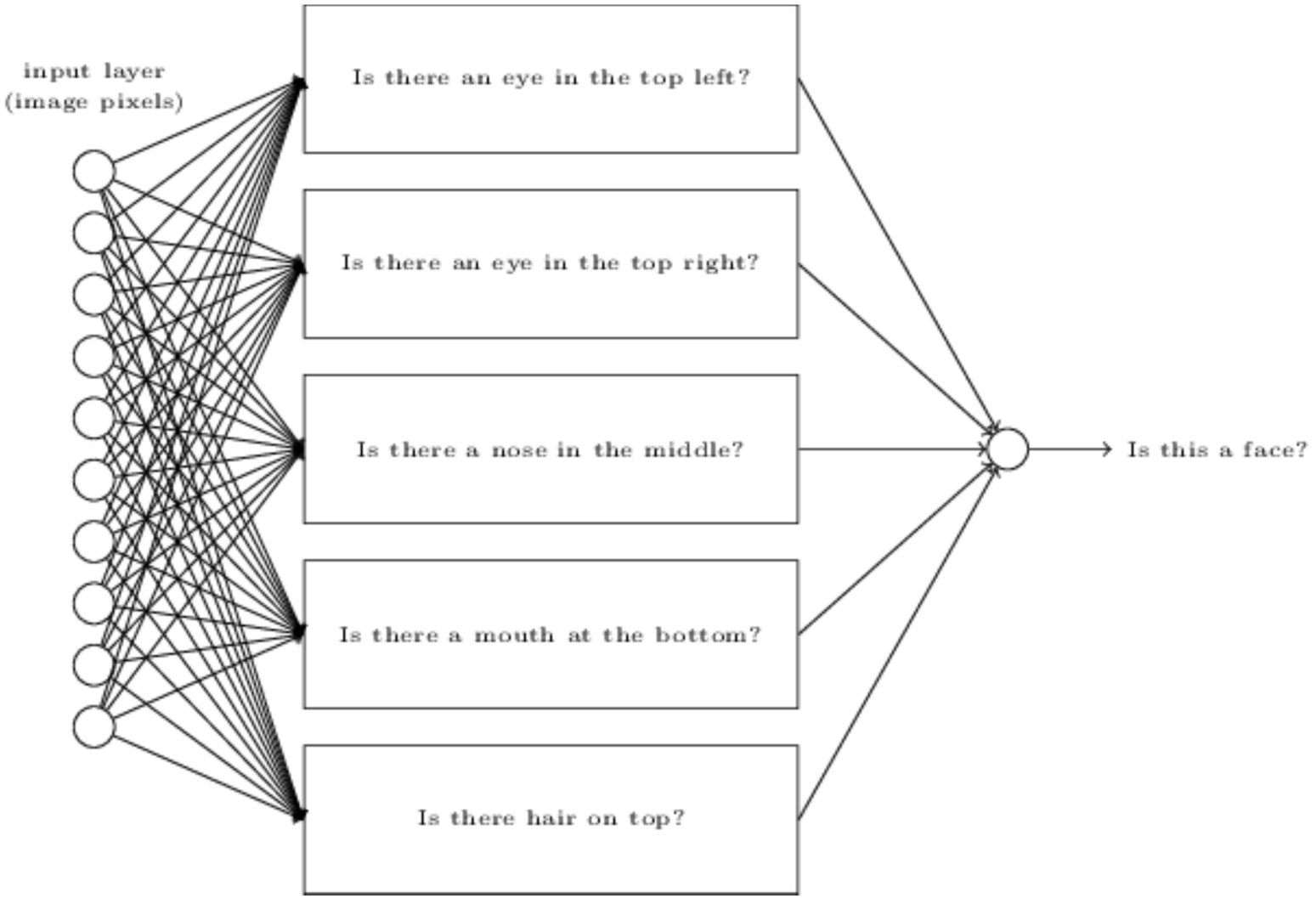
Disparition du gradient



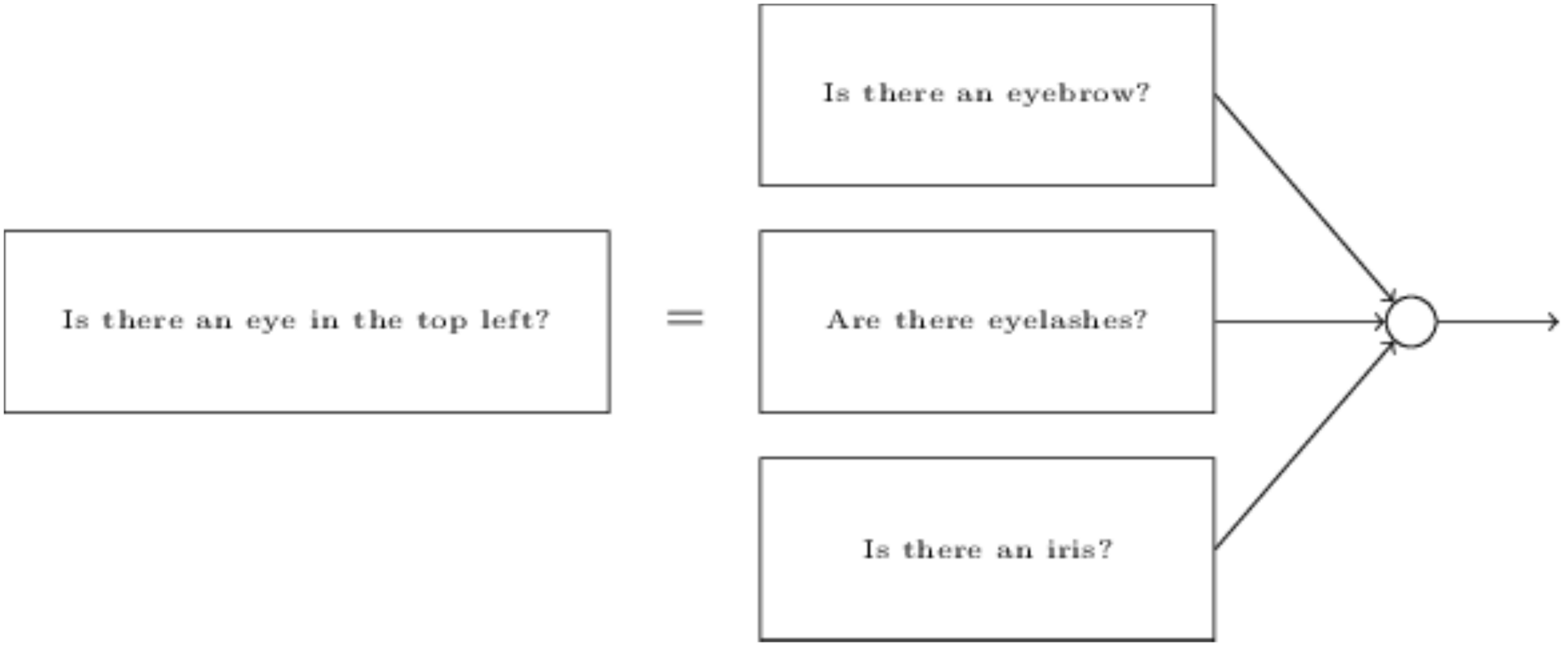
Vitesse d'apprentissage par couche



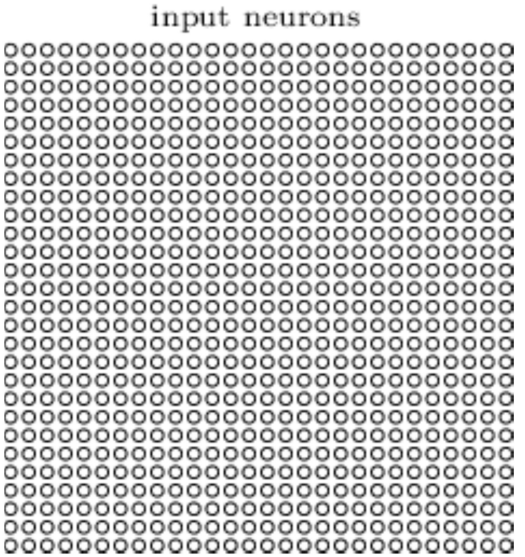
Spécialisation



Hiérarchie de spécialisations

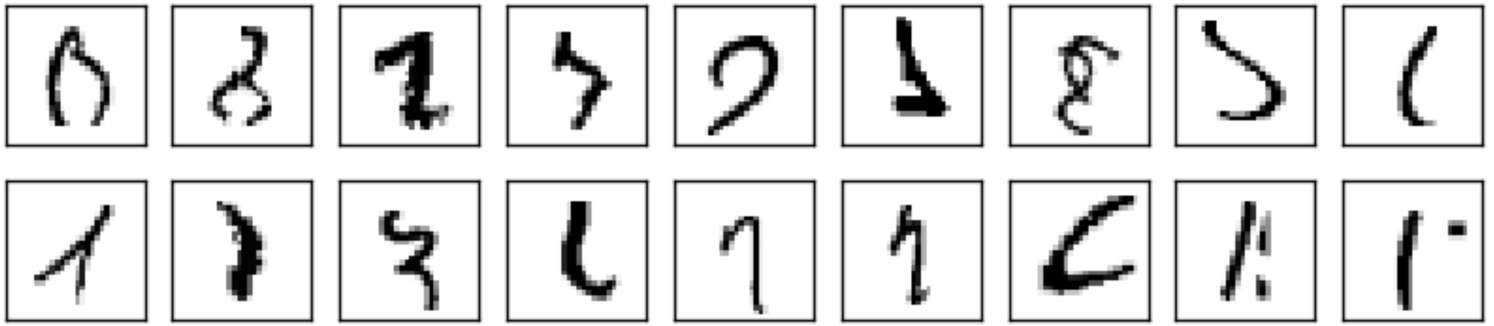


MNIST : 50 000 exemples (BA)

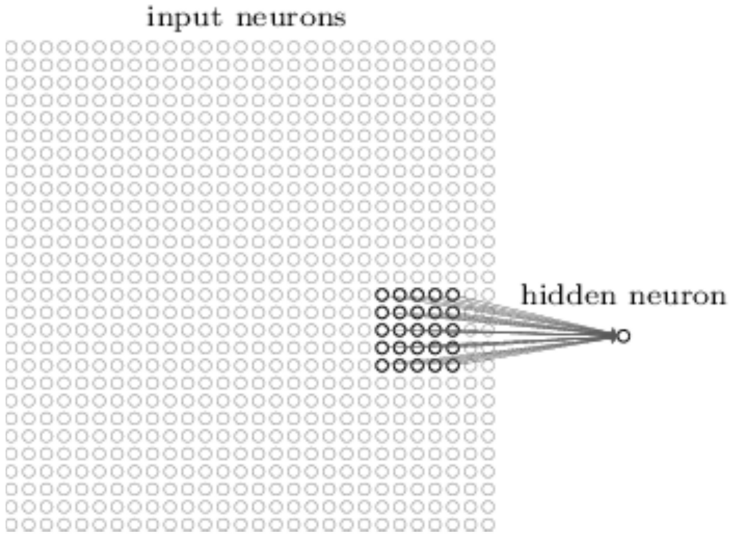


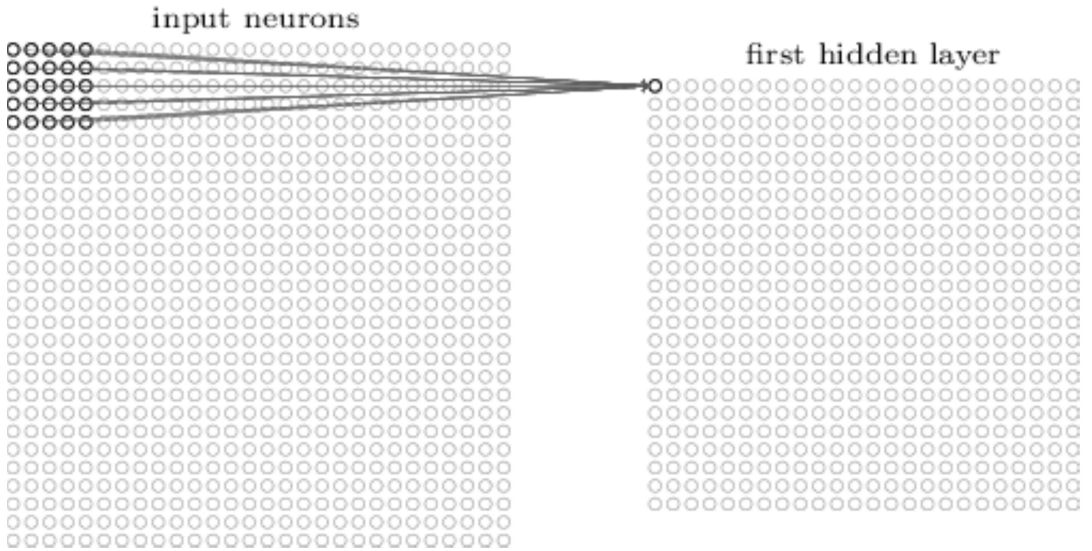
28 x 28 = 784 N

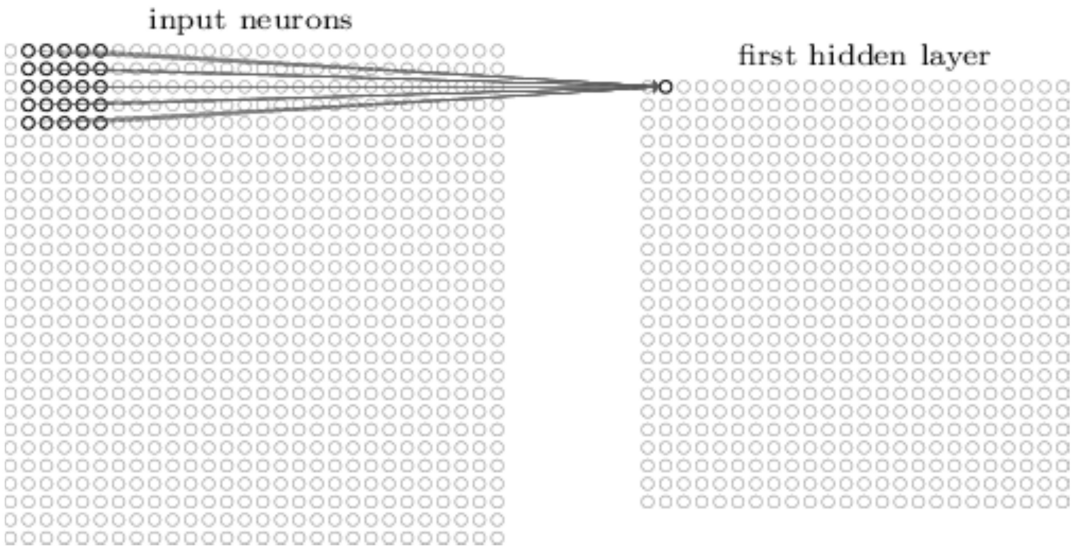
Quelques exemples de la base...



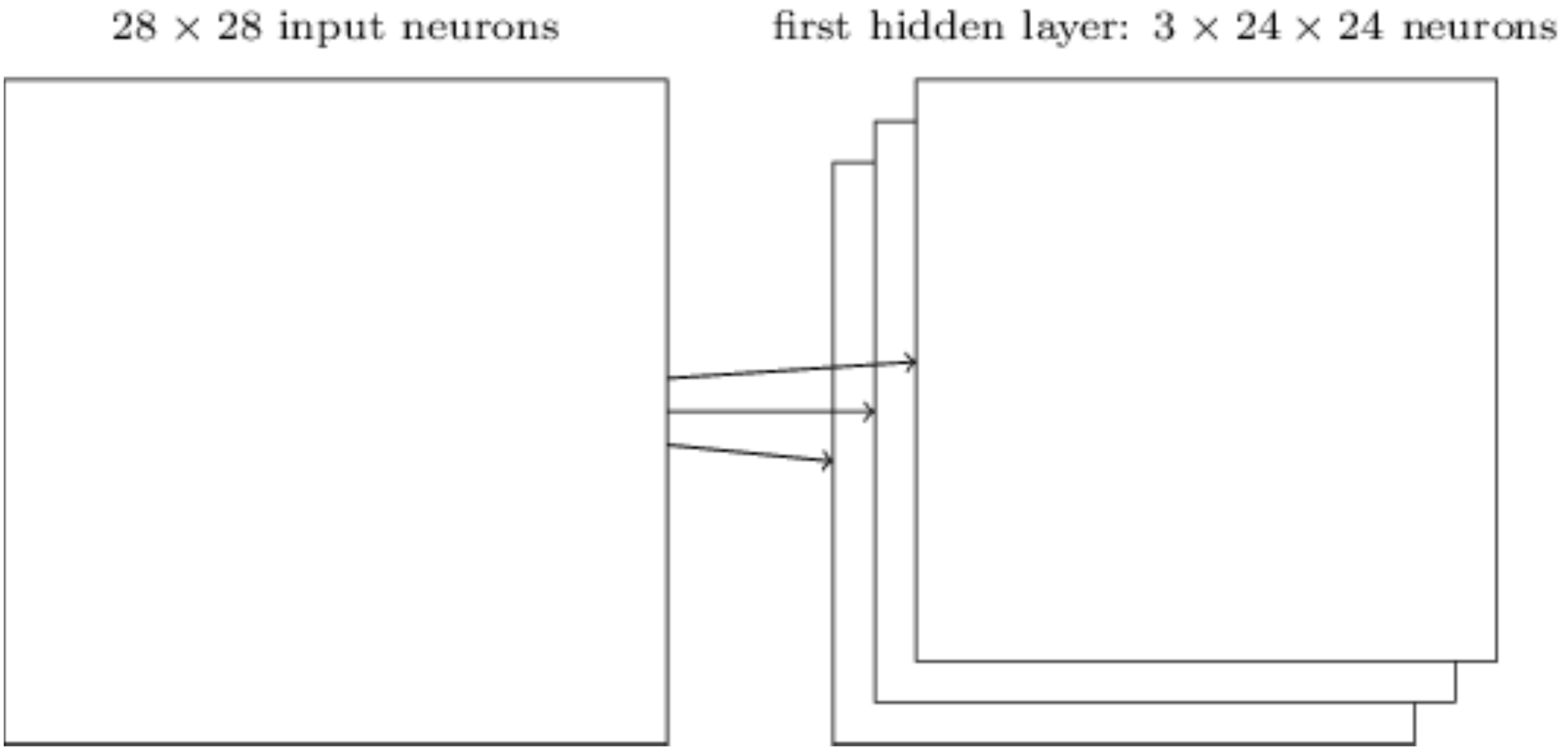
1ère couche cachée
(local receptor fields 5 x 5)





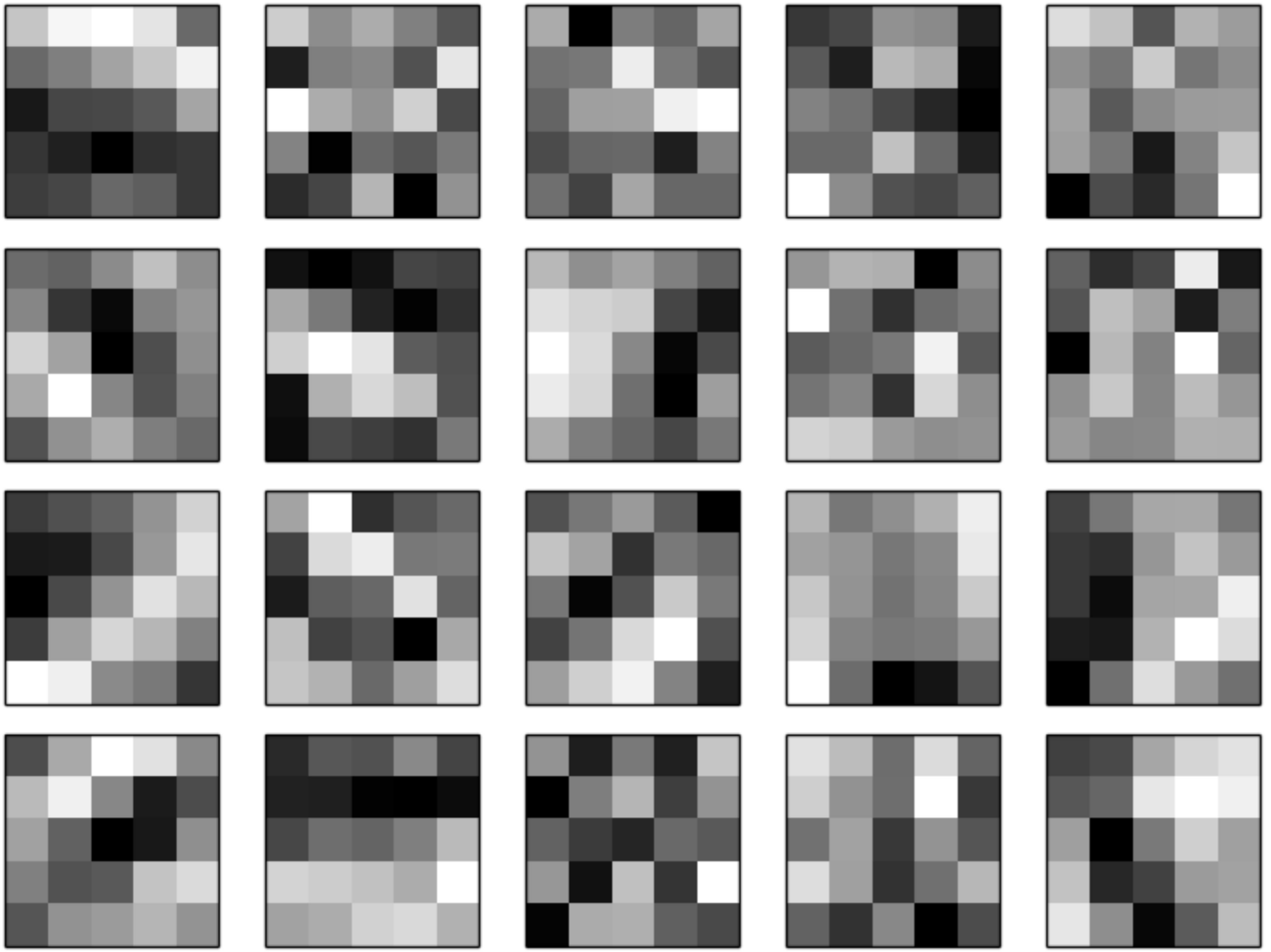


Multiples 1ères couches cachées
les mêmes poids pour toutes les couches

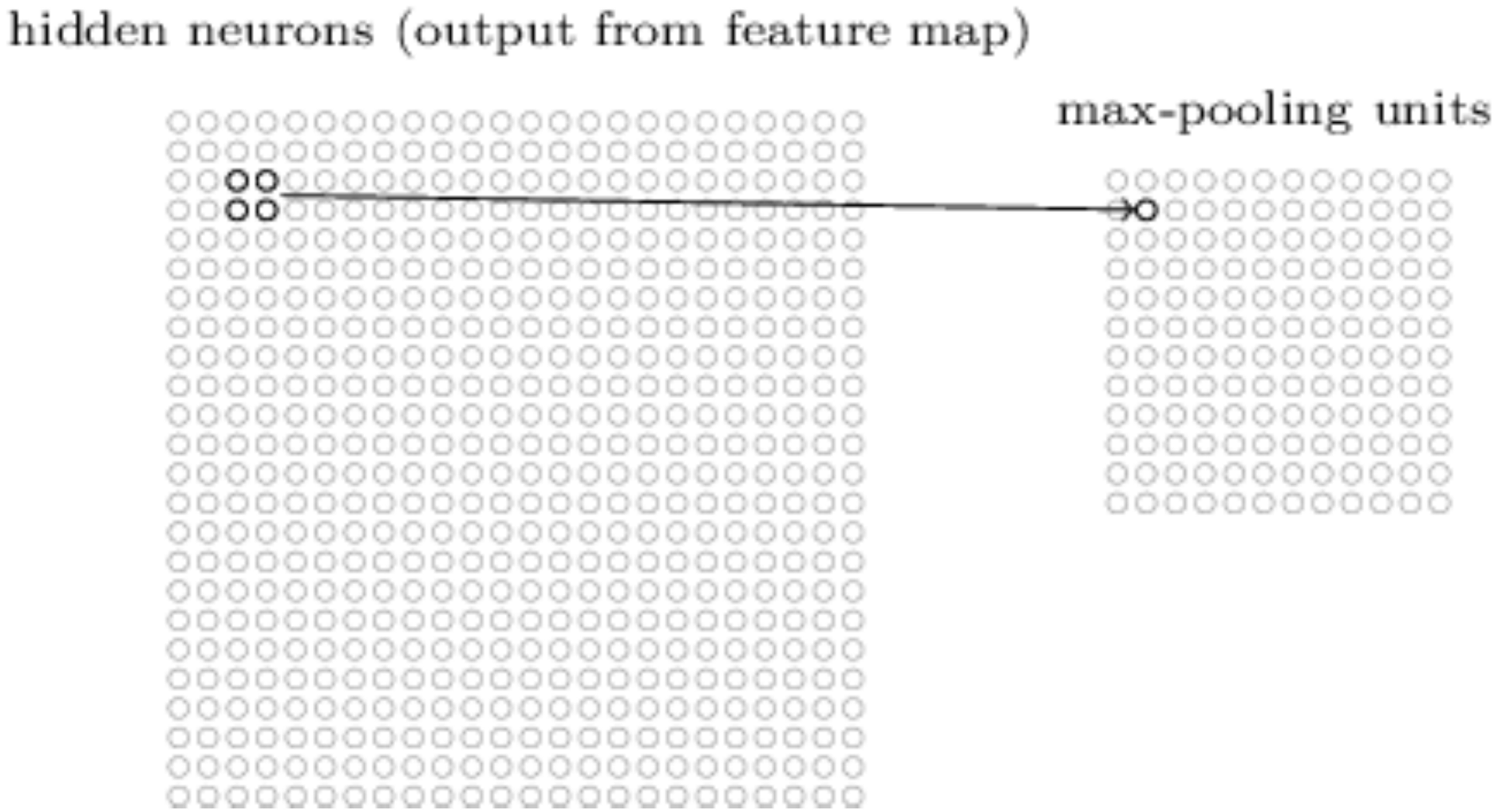


Les 20 premières couches

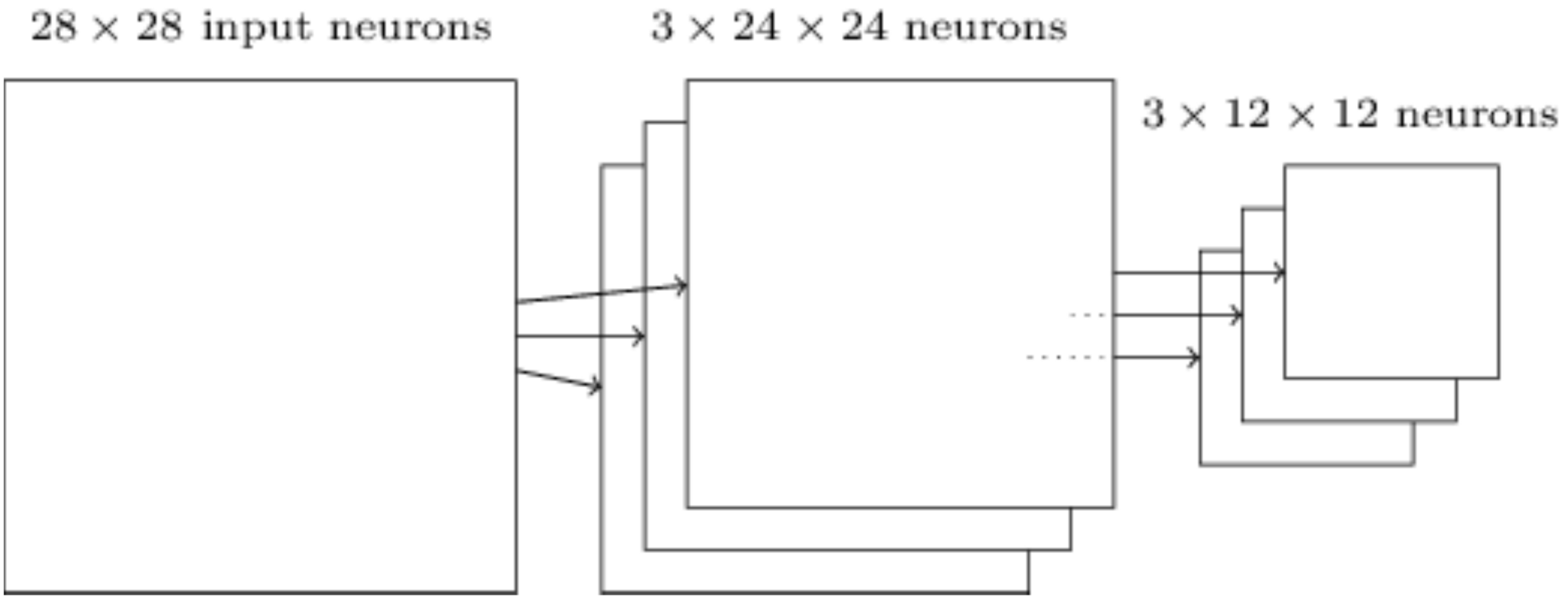
20 feature maps (26 x 20 = 520 poids)



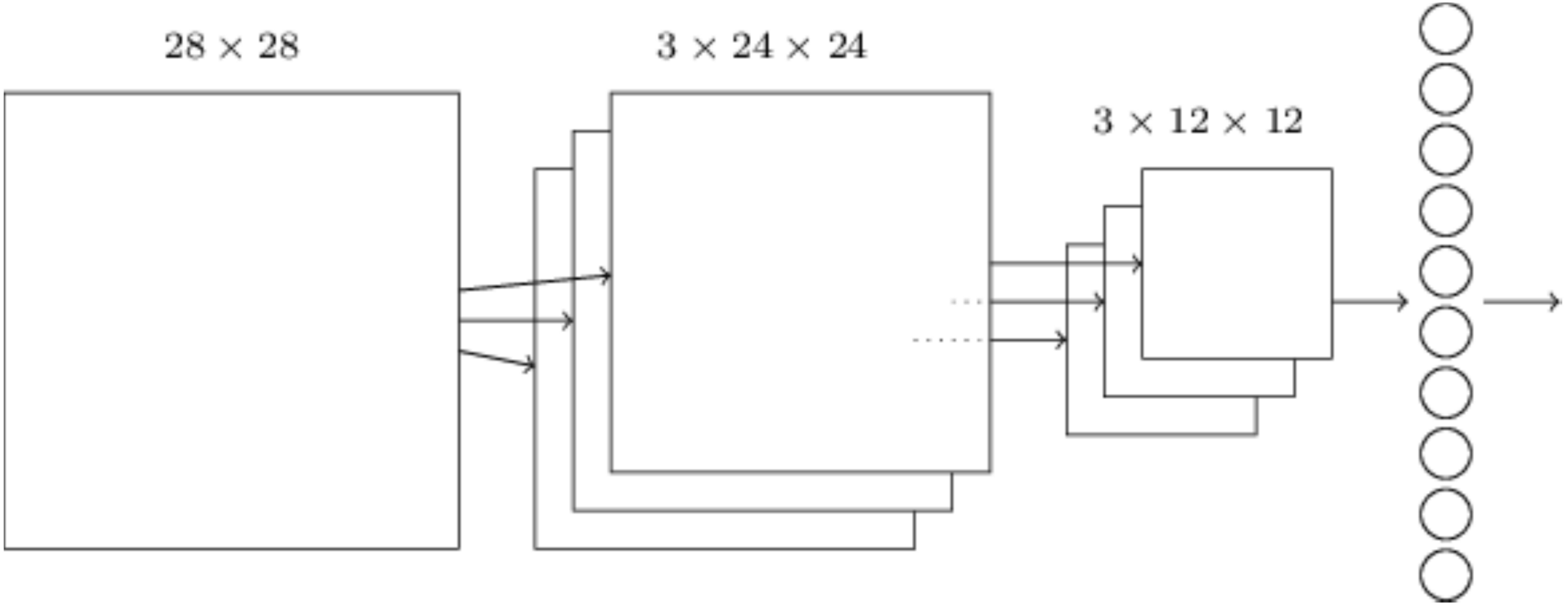
Seconde couche



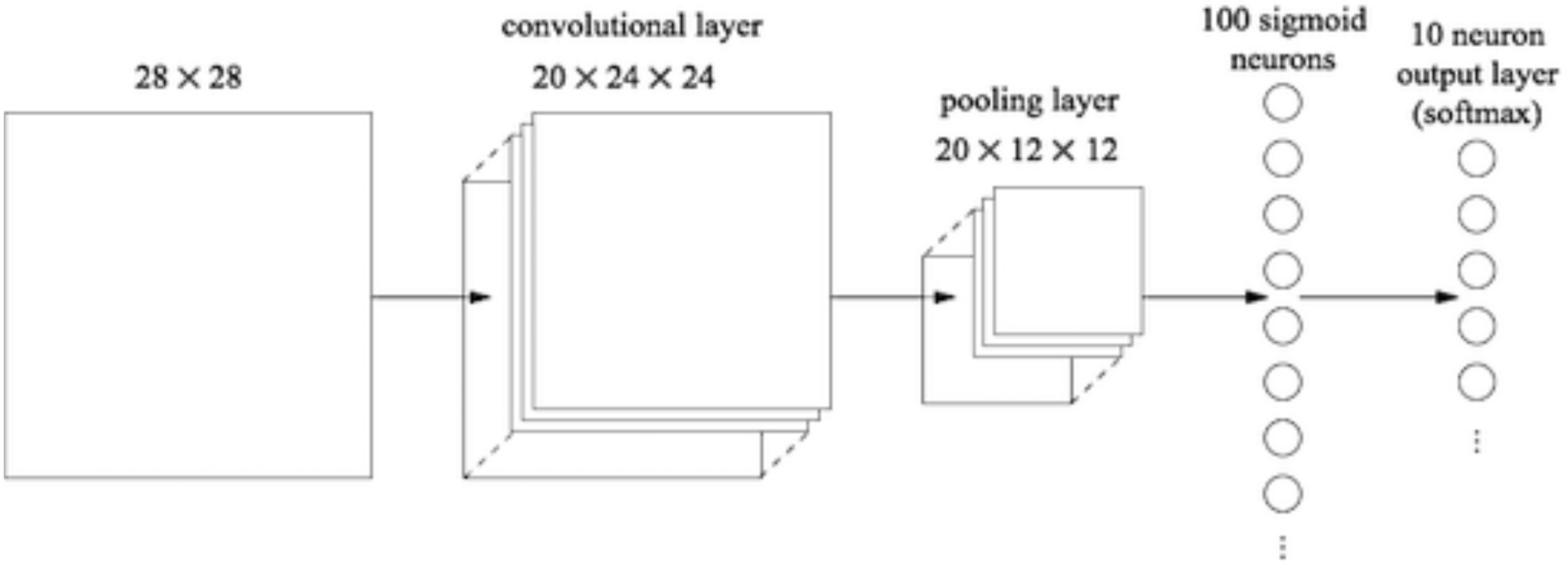
2ème couche complète



3ème couche

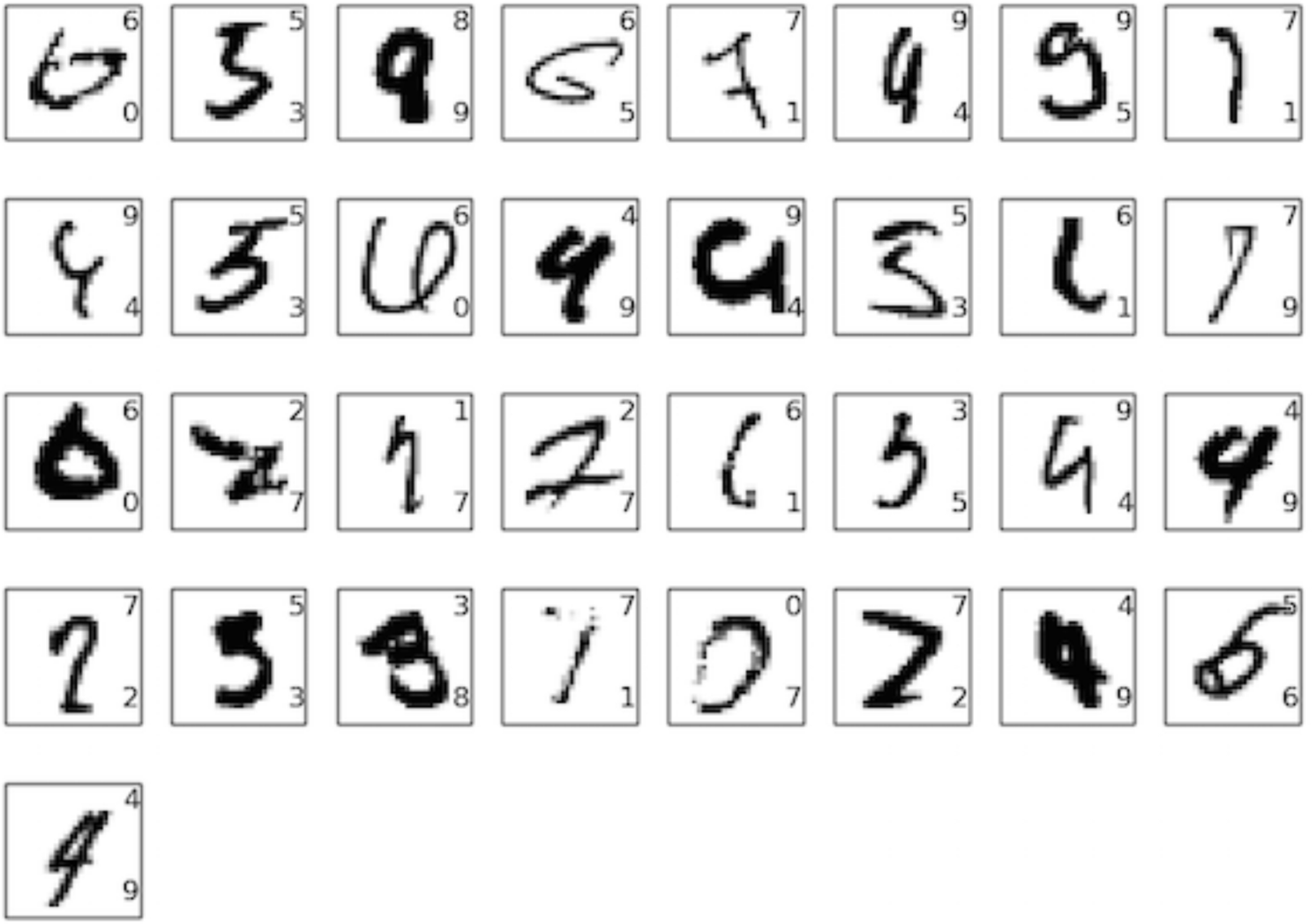


Réseau à convolution complet

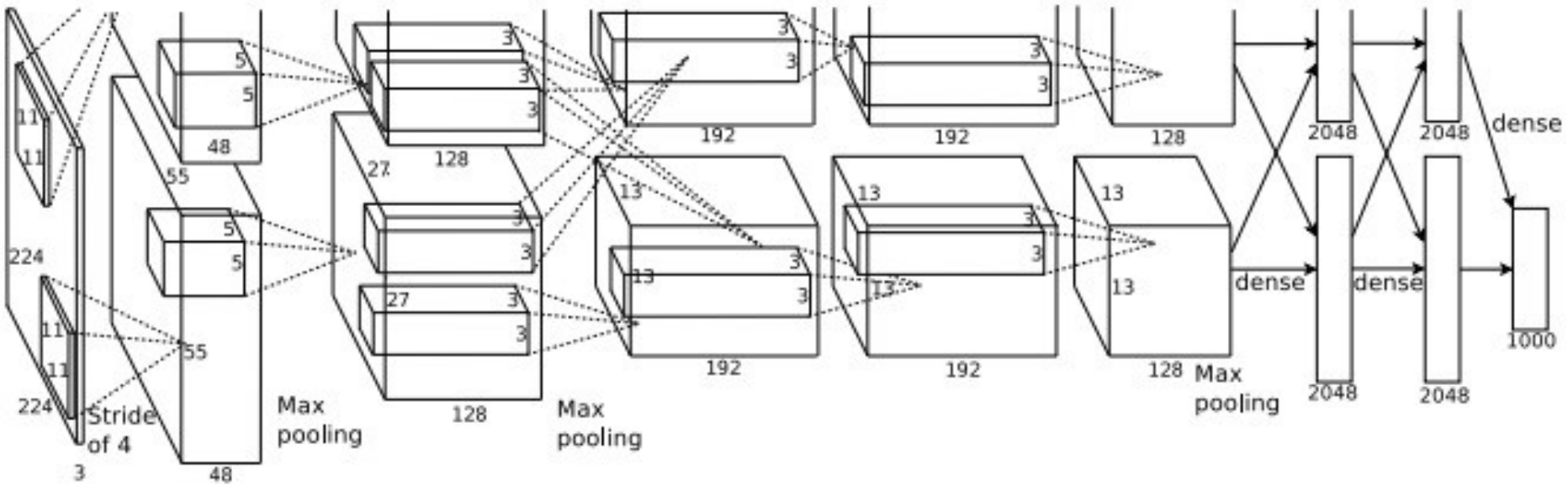


BT : 10 000 exemples, 33 errreurs

99,67% de réussite, 40 it., alpha = 10^{-3}



Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). "Imagenet classification with deep convolutional neural networks". In *Advances in neural information processing systems* (pp. 1097-1105).



1.2 million high-resolution images into the 1000 different classes. On the test data, top-1 error rate: 37.5% ; top-5 error rate : 17.0%

60 million parameters, 650,000 neurons, five convolutional layers, some of which are followed by max-pooling layers, and three fully-connected layers with a final 1000-way softmax (distribution which sums to 1).

Réseaux multicouches (en force)

Ciresan, D. C., Meier, U., Gambardella, L. M., & Schmidhuber, J. "Deep Big Simple Neural Nets Excel on Handwritten Digit Recognition", 2010.

Couches cachées : 2,500, 2,000, 1,500, 1,000 et 500 neurones.

Alpha : 10^{-6}