卷积神经网络介绍与模仿艺术风格作画

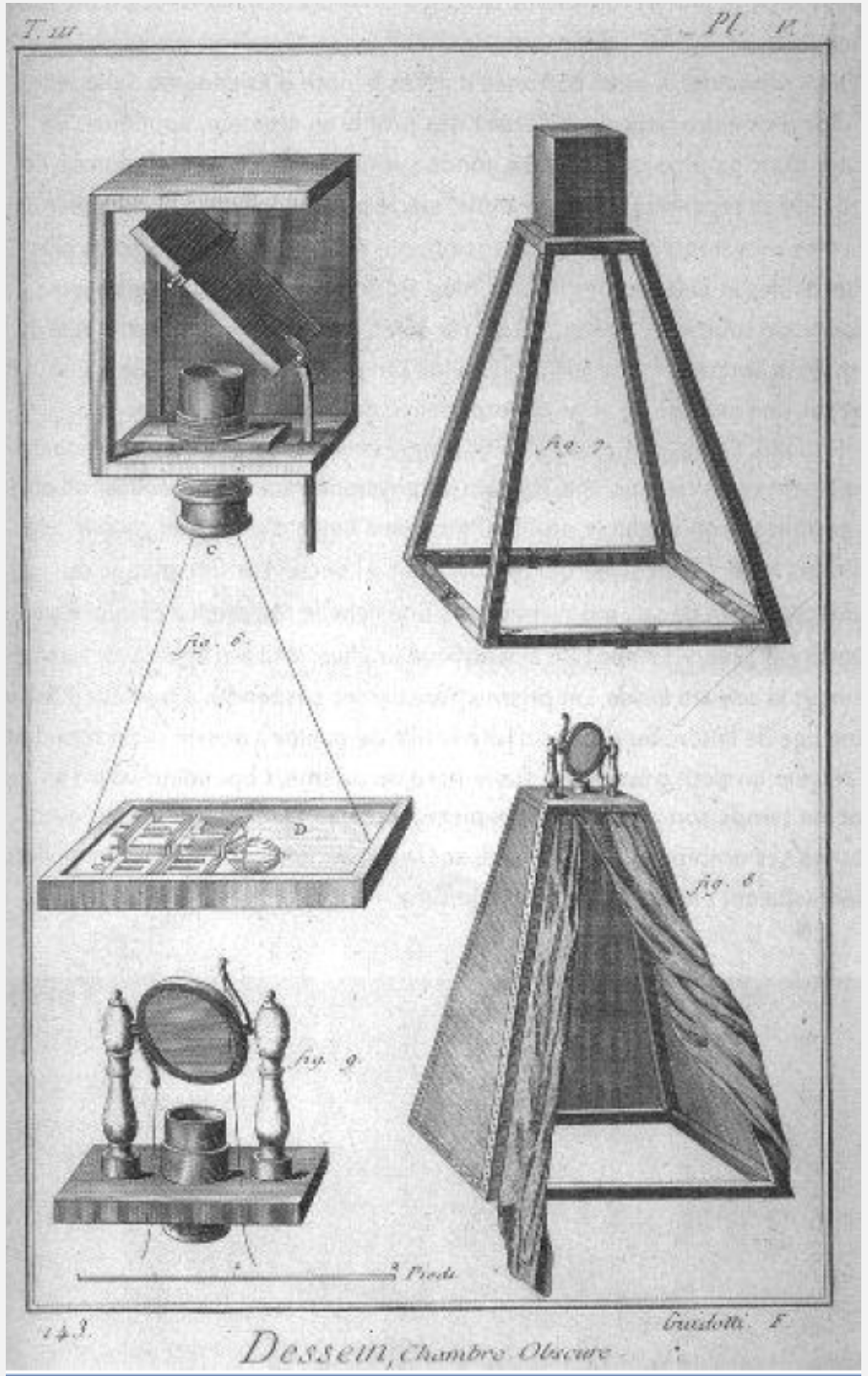
CNN Introduction and A Neural Algorithm of Artistic Style

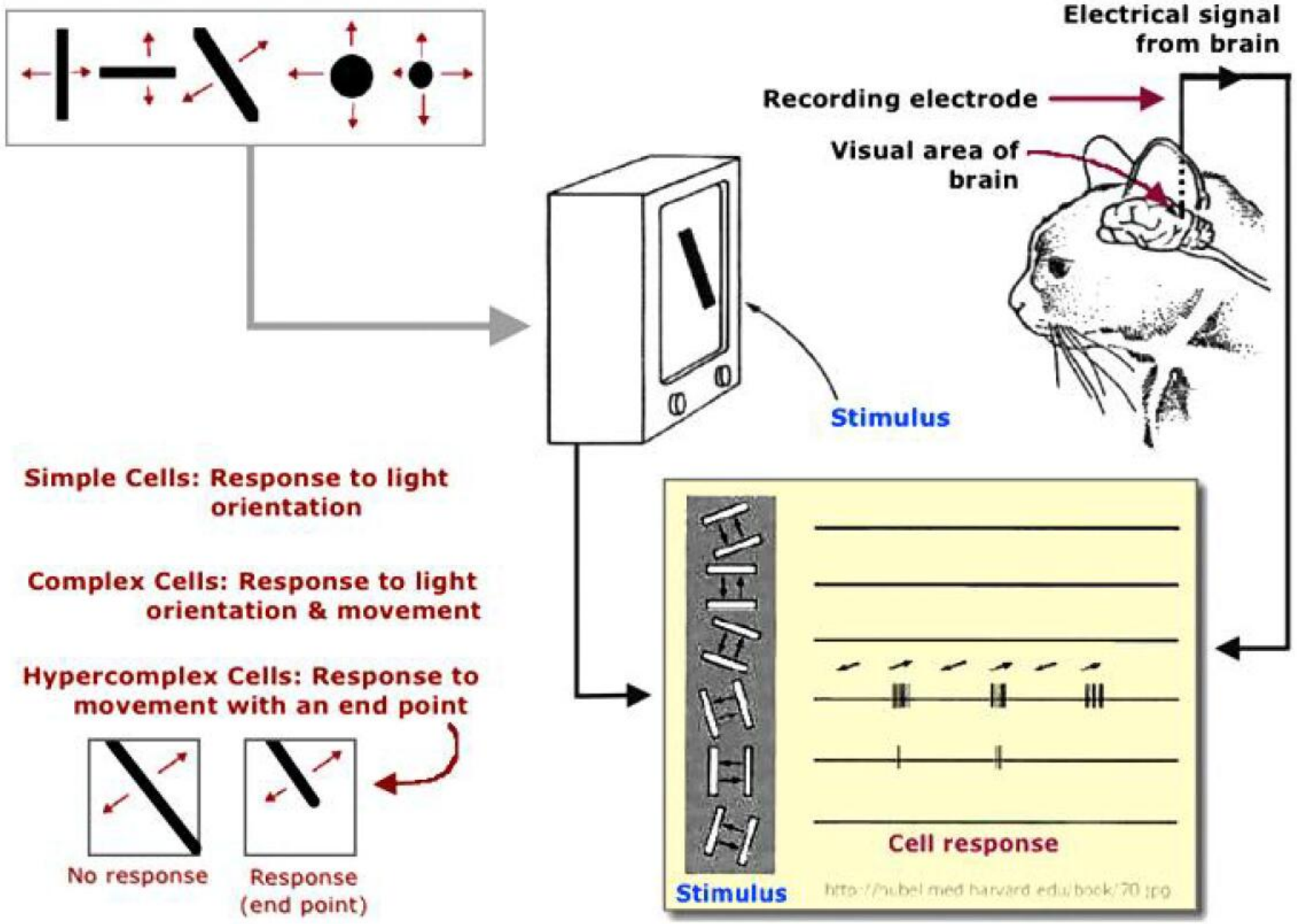
BOSNIA: THE DEAL AND THE DANGER
TIME
EVOLUTION'S BIG BANG
New discoveries show that life as we know it began in an amazing biological frenzy that changed the planet almost overnight
543million years, B.C.

照相暗箱
Camera Obscura

Leonardo da Vinci,

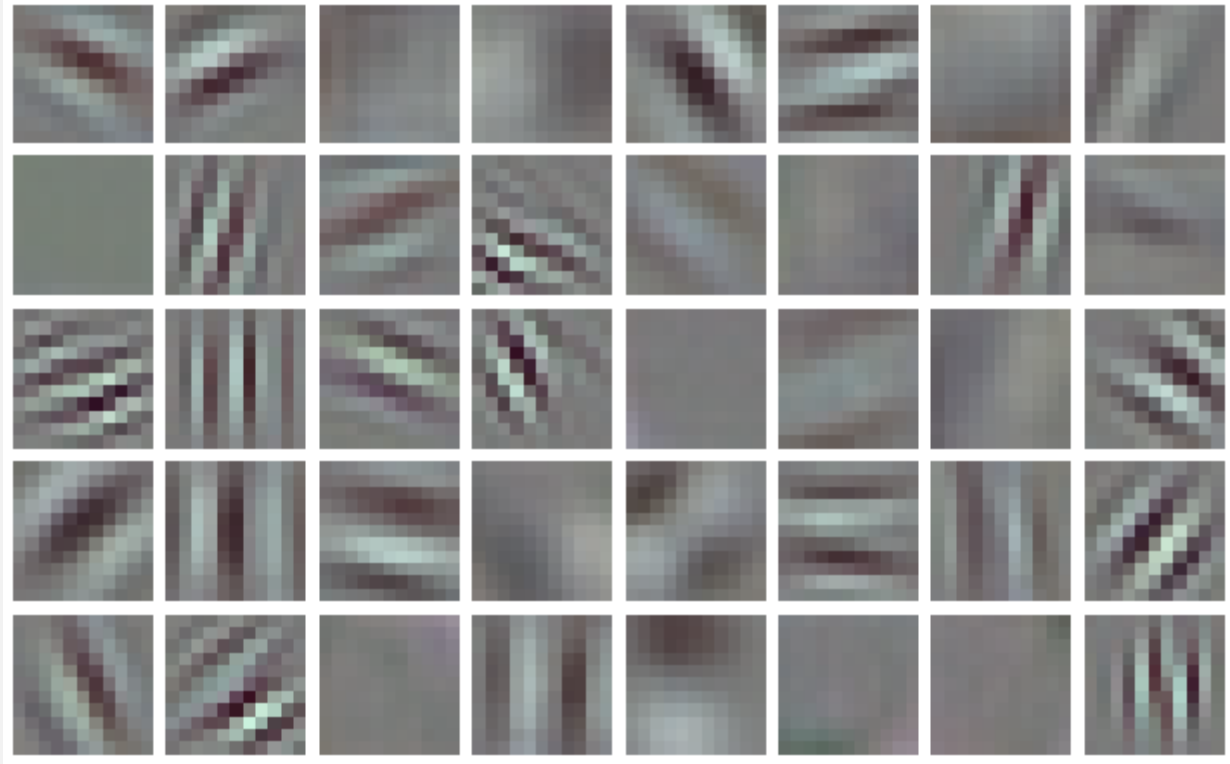
16th Century, A.D.

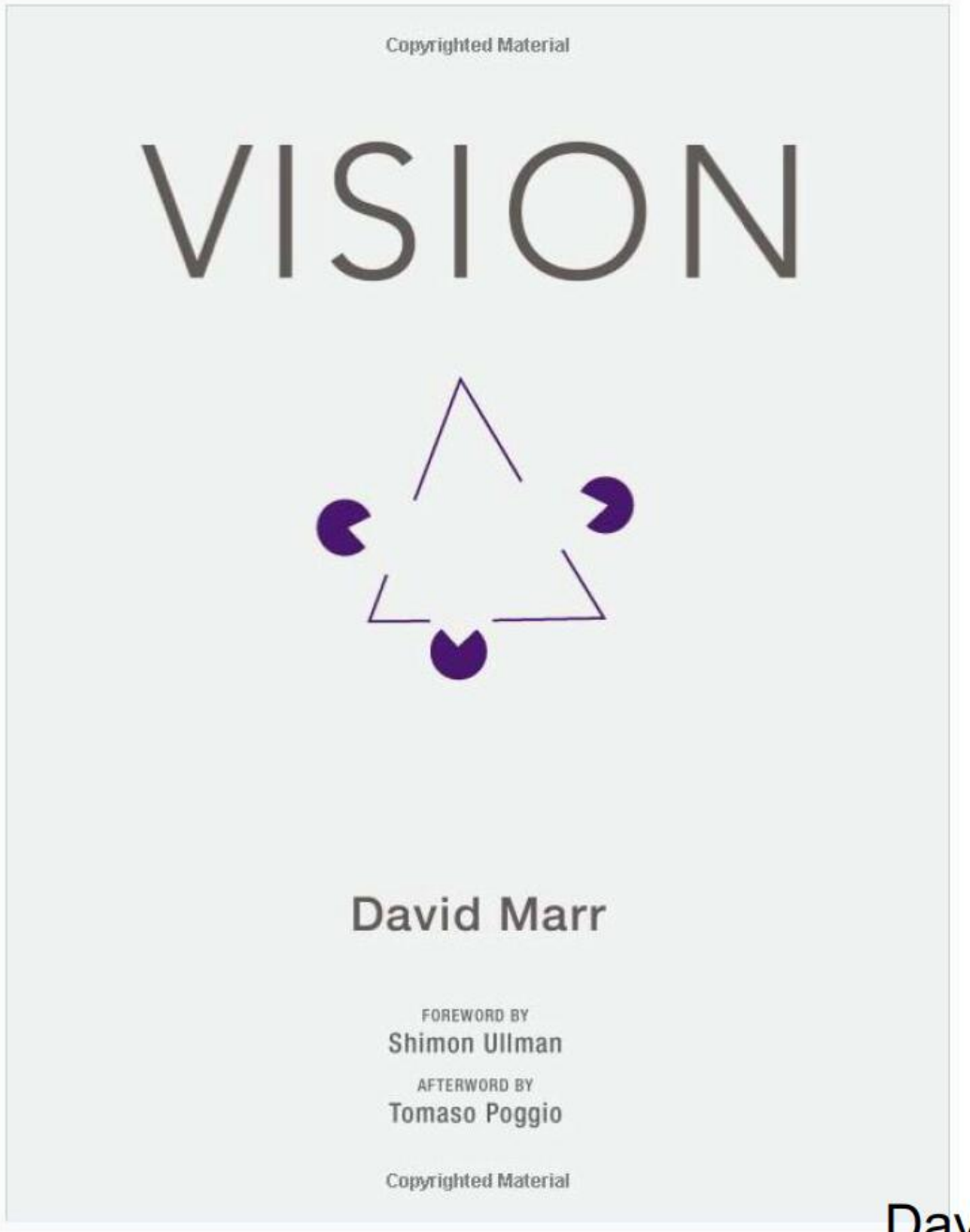




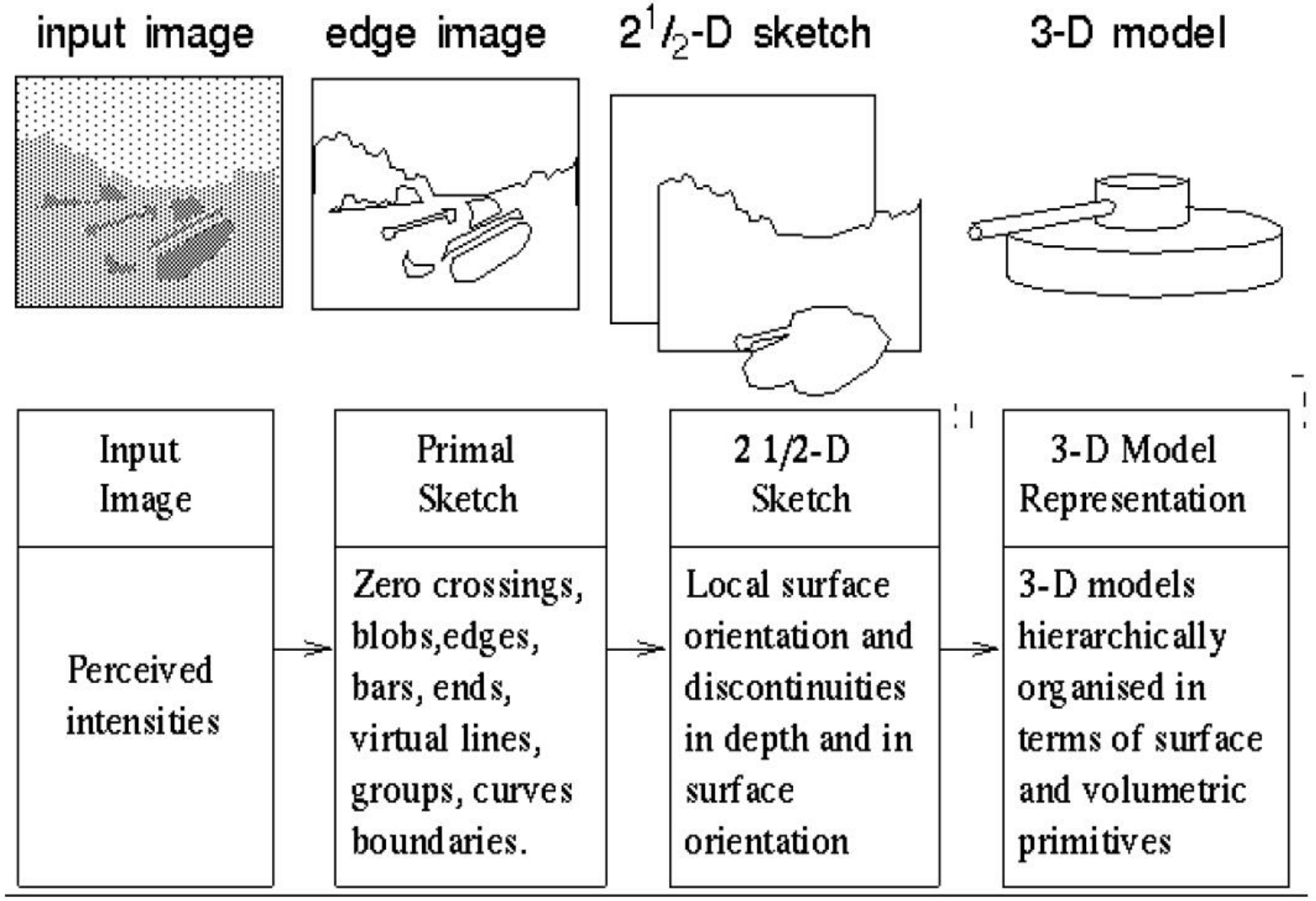
Hubel & Wiesel, 1959

CNN网络第一层产生的边缘信息



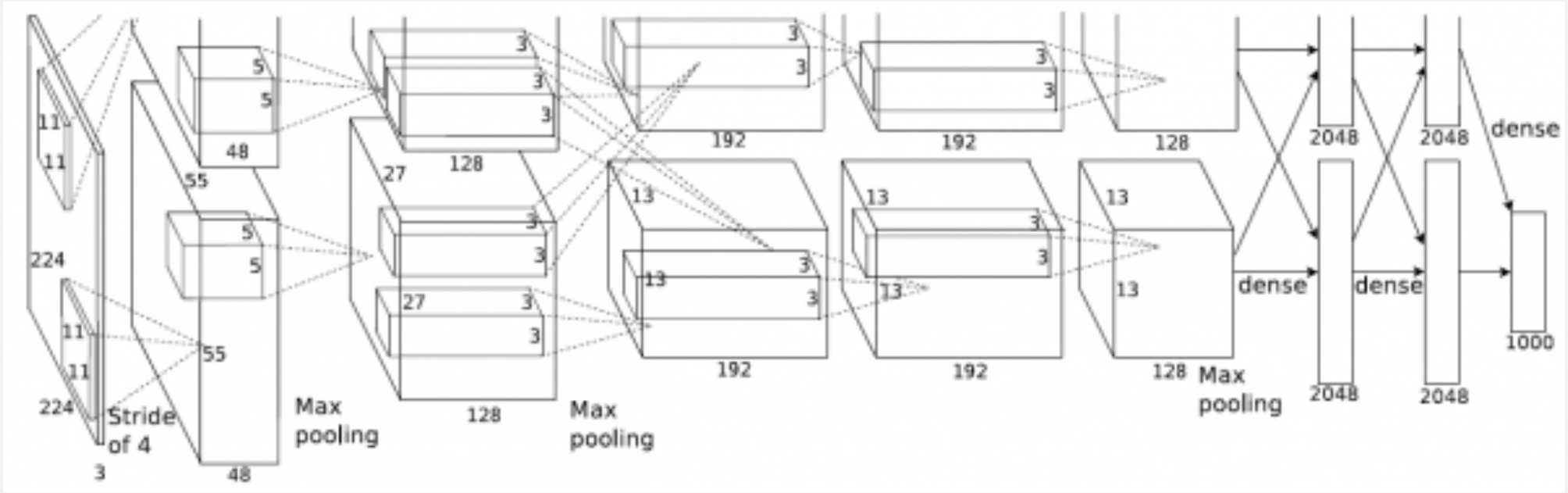


David Marr, 1970s



Stages of Visual Representation, David Marr,

AlexNet



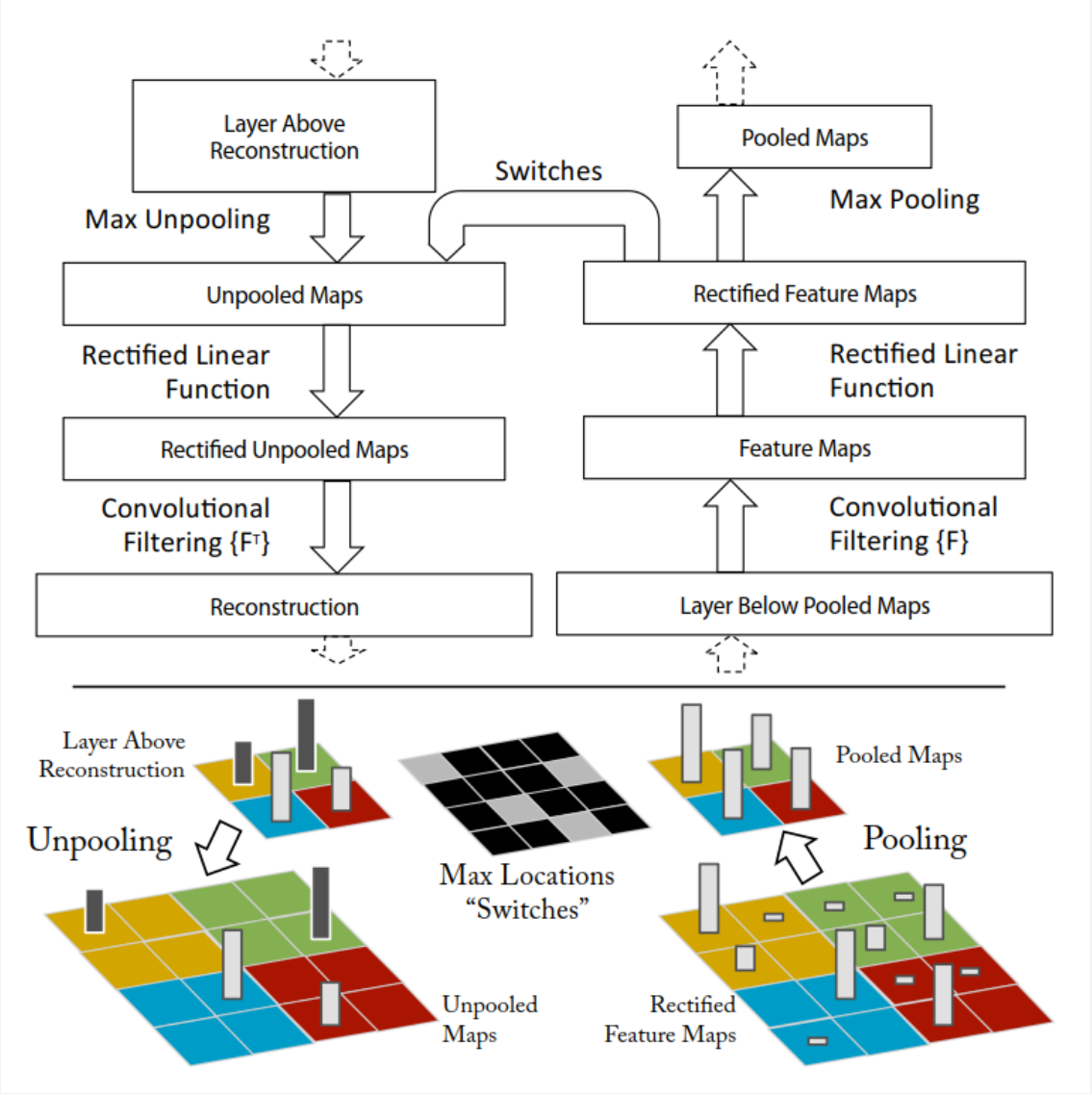
AlexNet由五个卷积层以及三个全连接层组成，获得了2012年的ILSVRC(Imagenet Large Scale Visual Recognition Competition)的冠军。

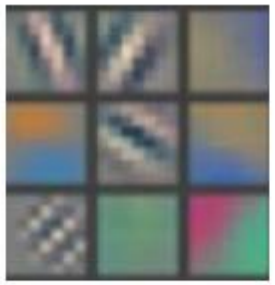
Visualizing and Understanding Convolutional Networks

Matthew D. Zeiler

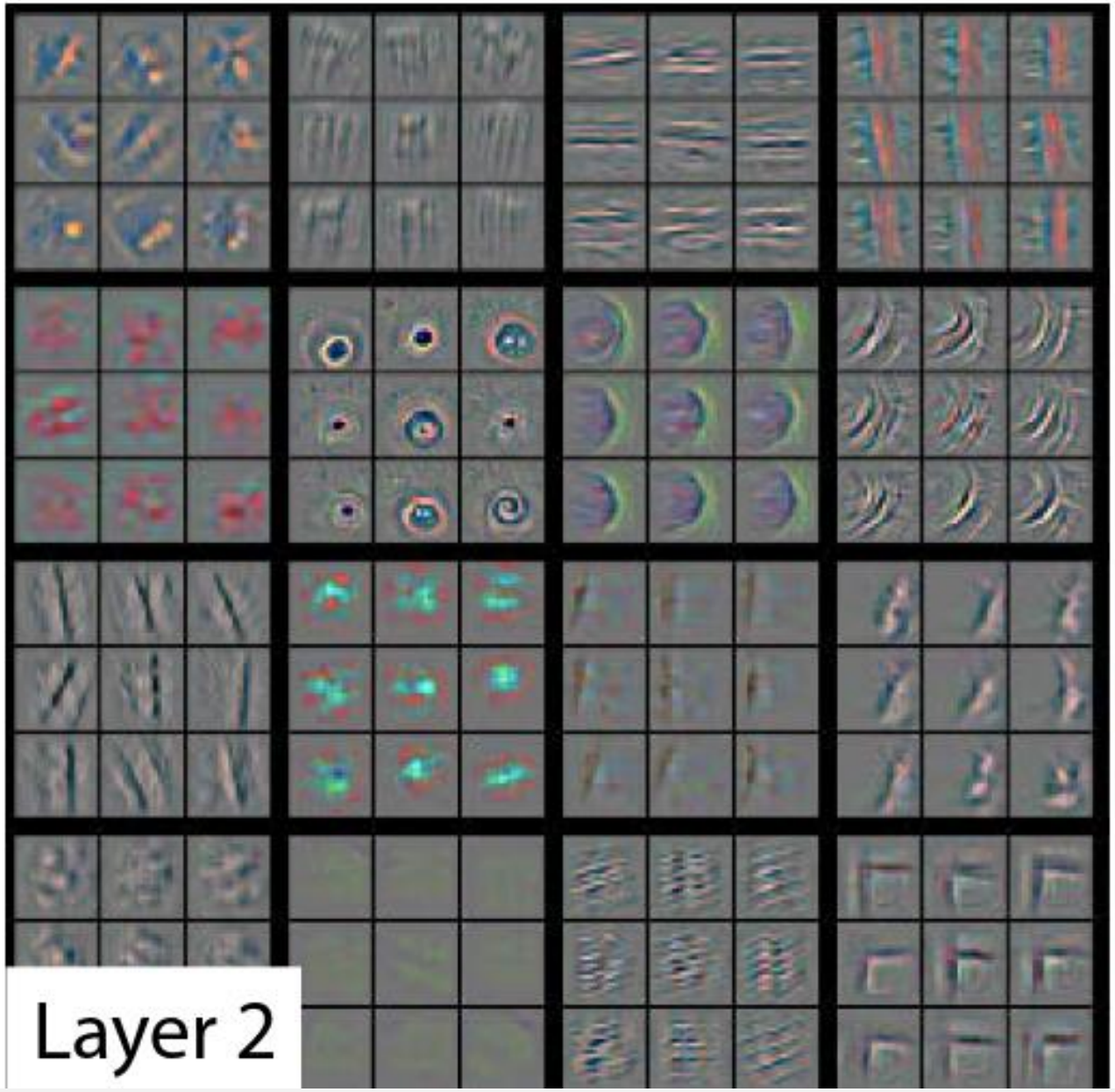
Rob Fergus

2013, Dept. of Computer Science, Courant Institute, New York University





Layer 1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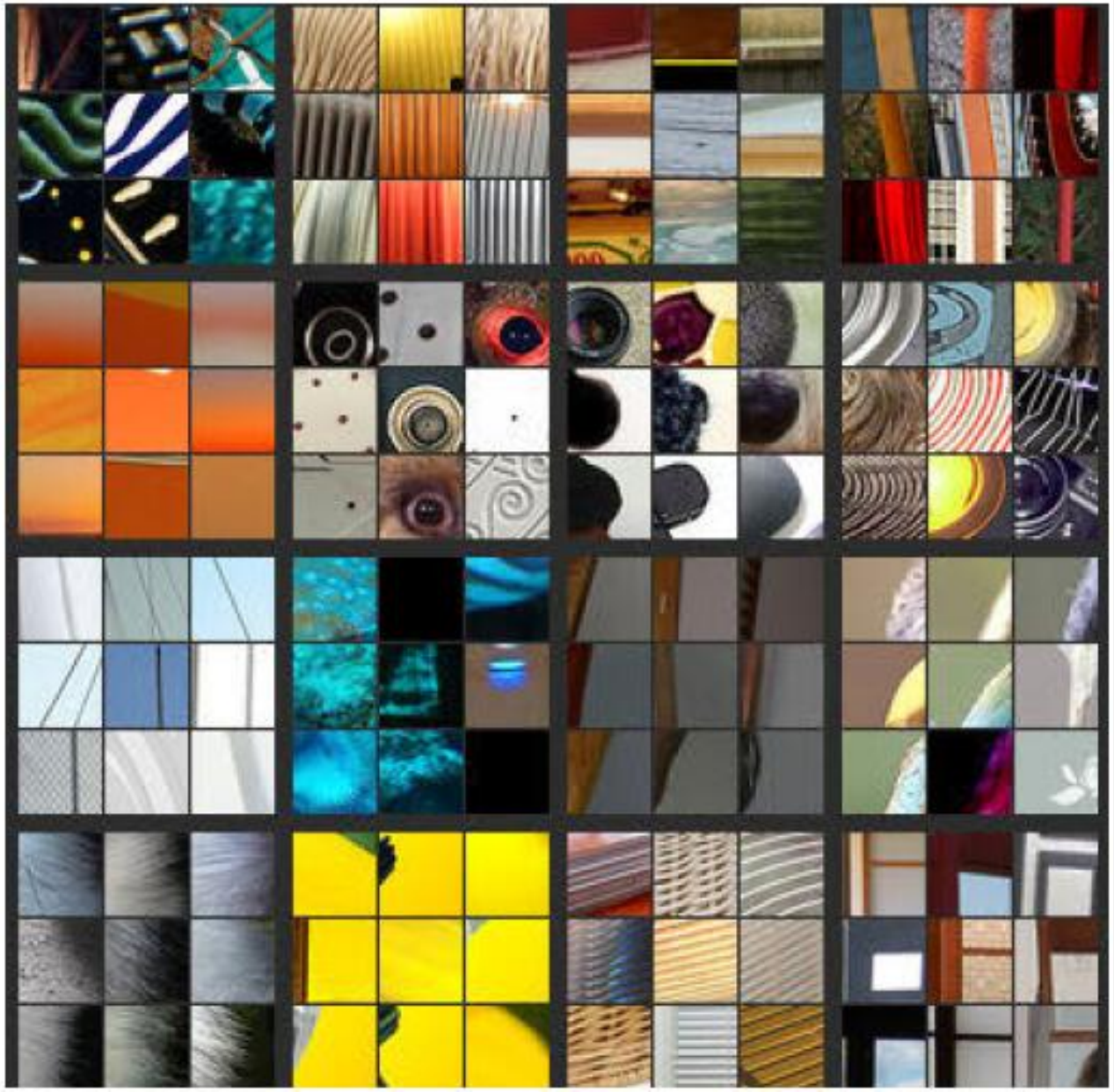

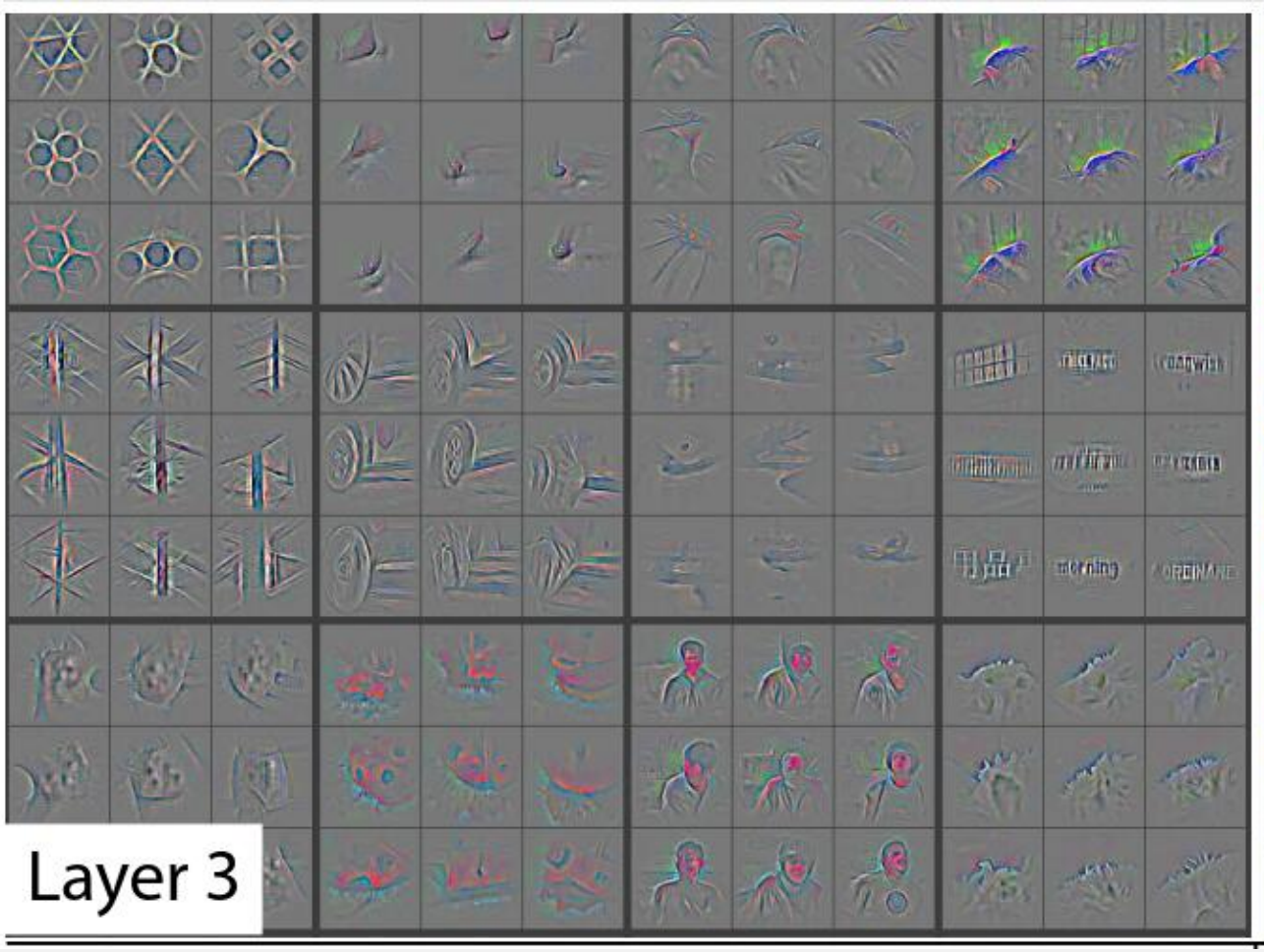
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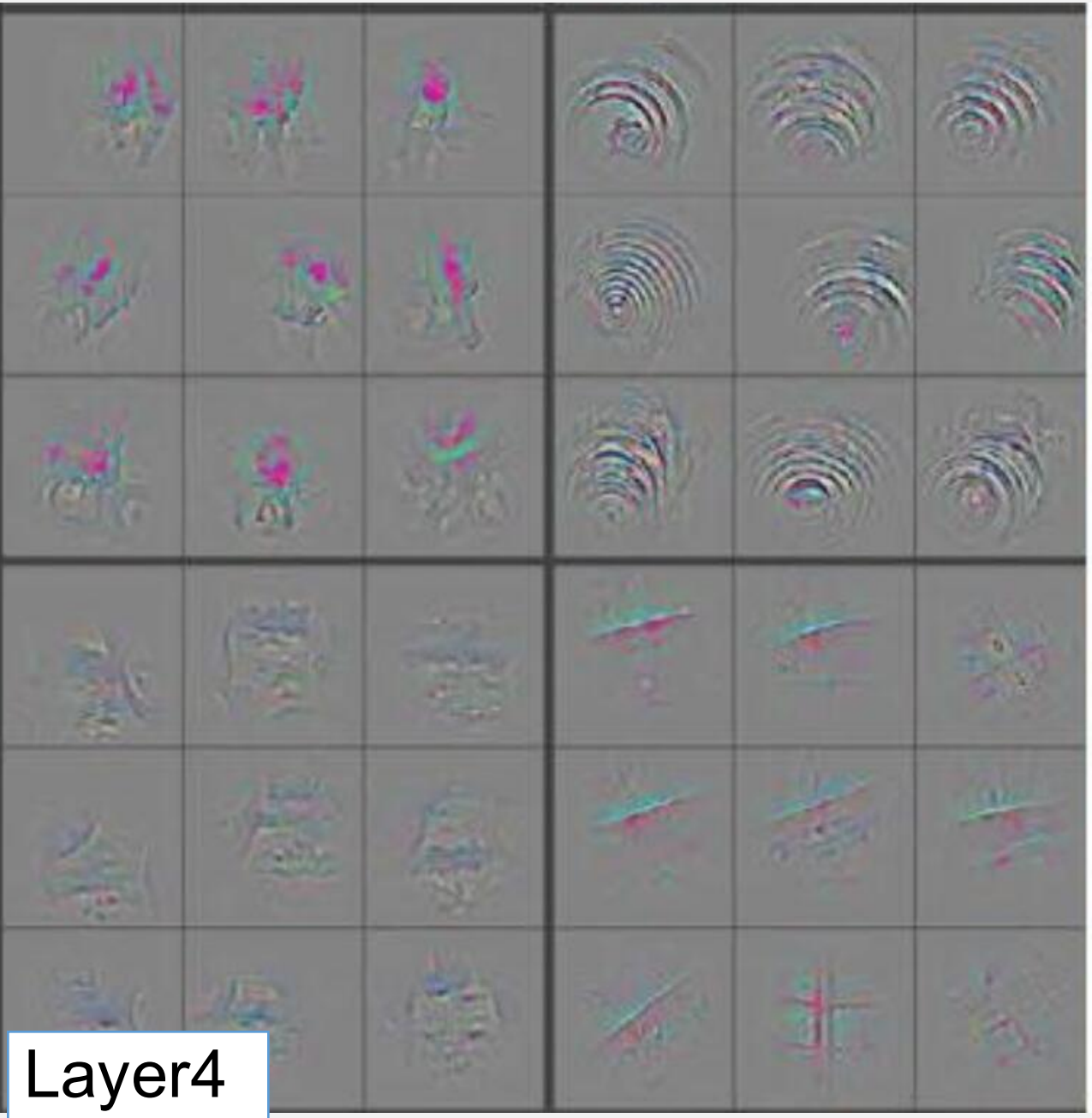

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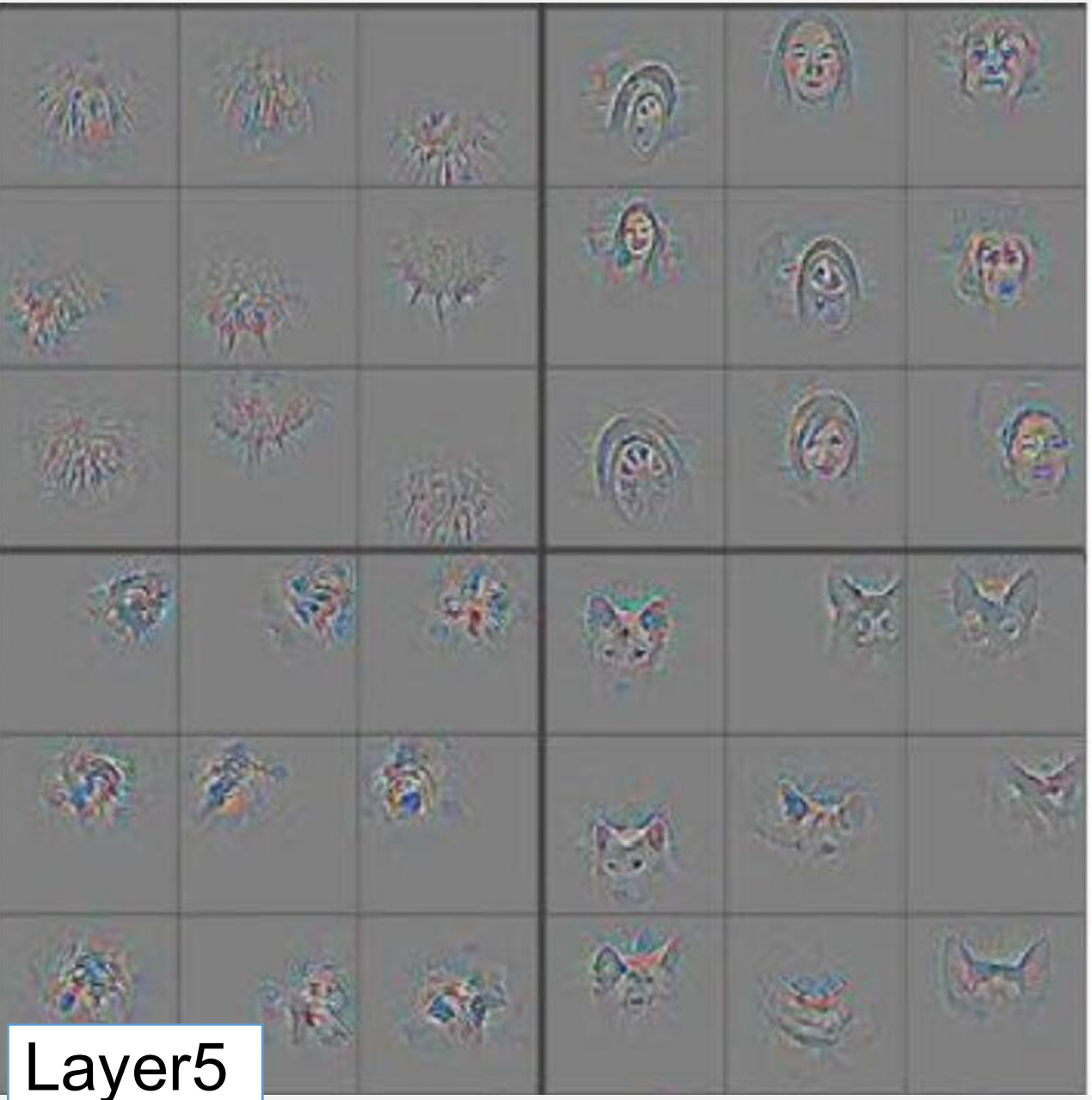

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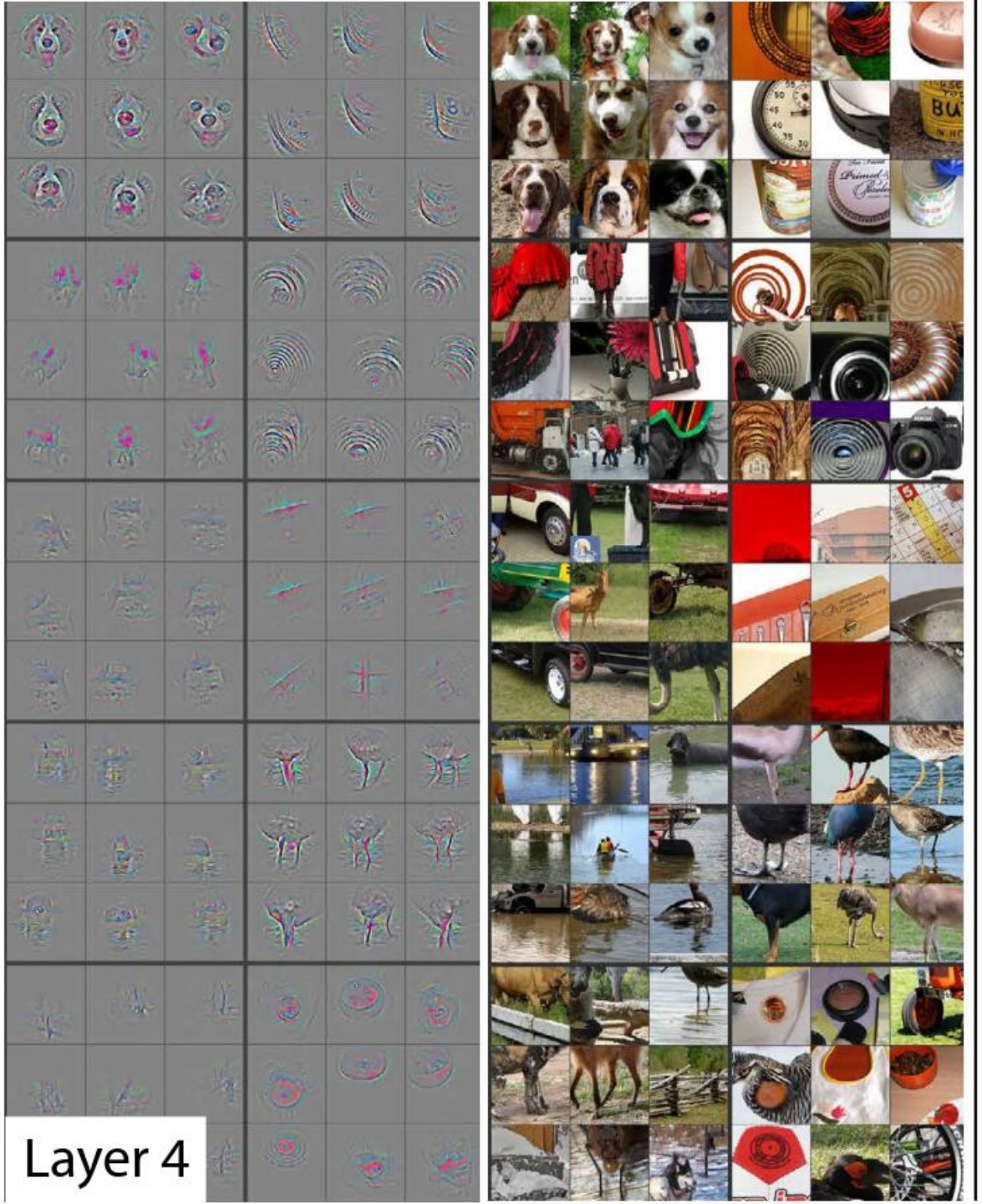
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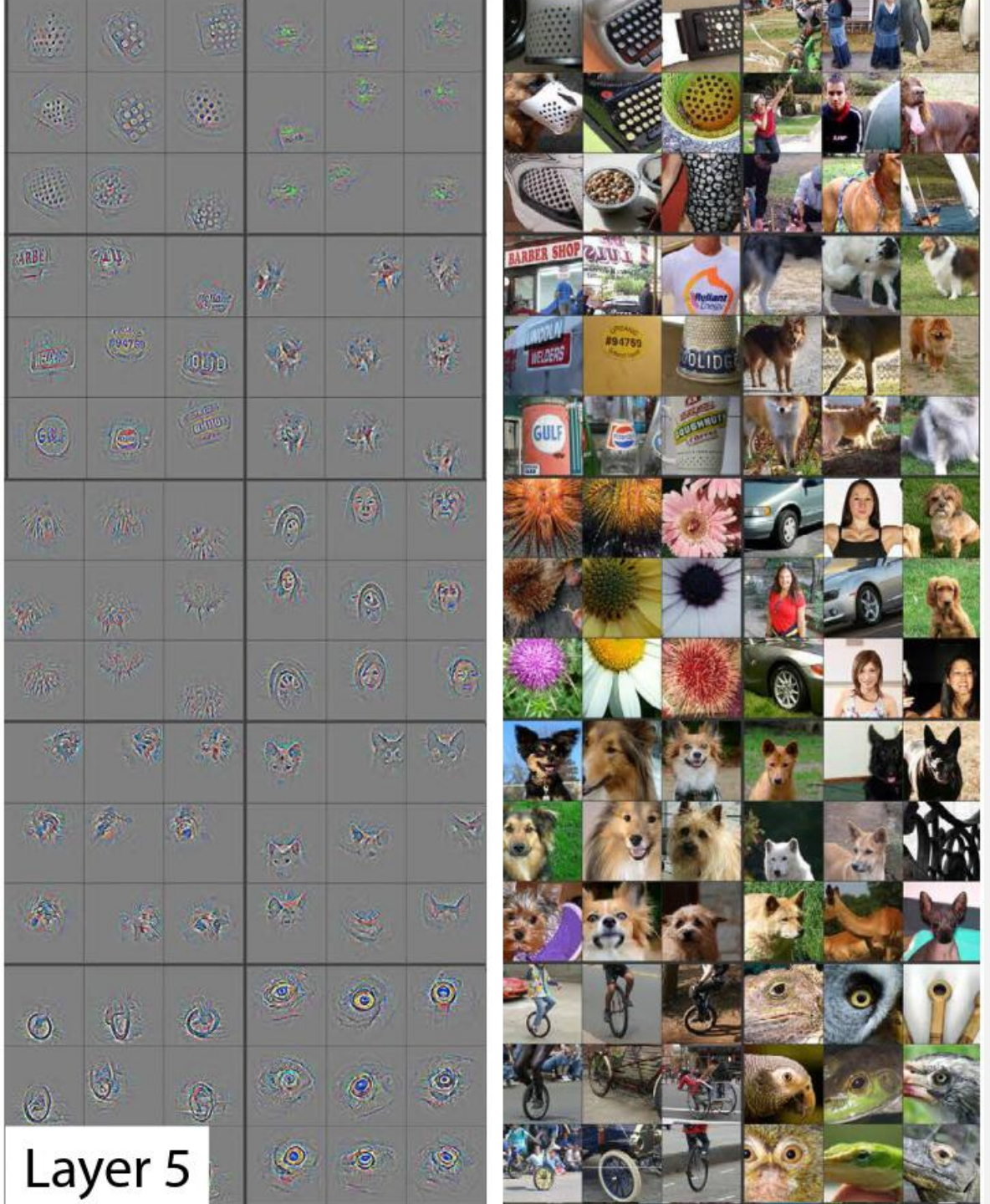
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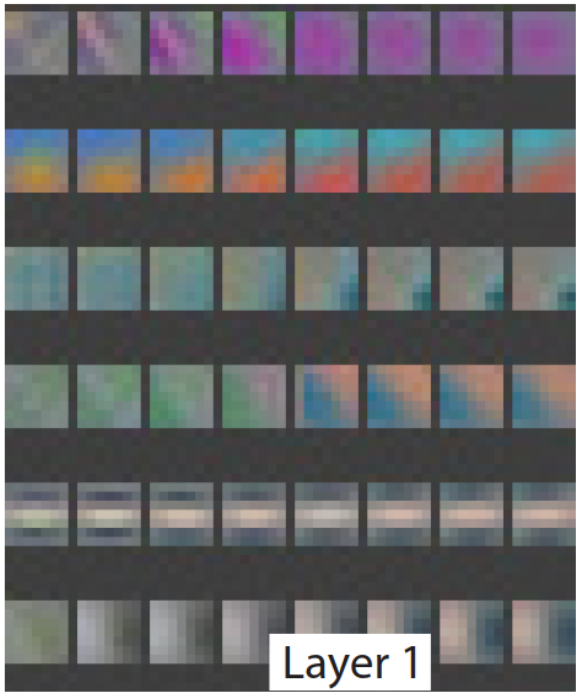
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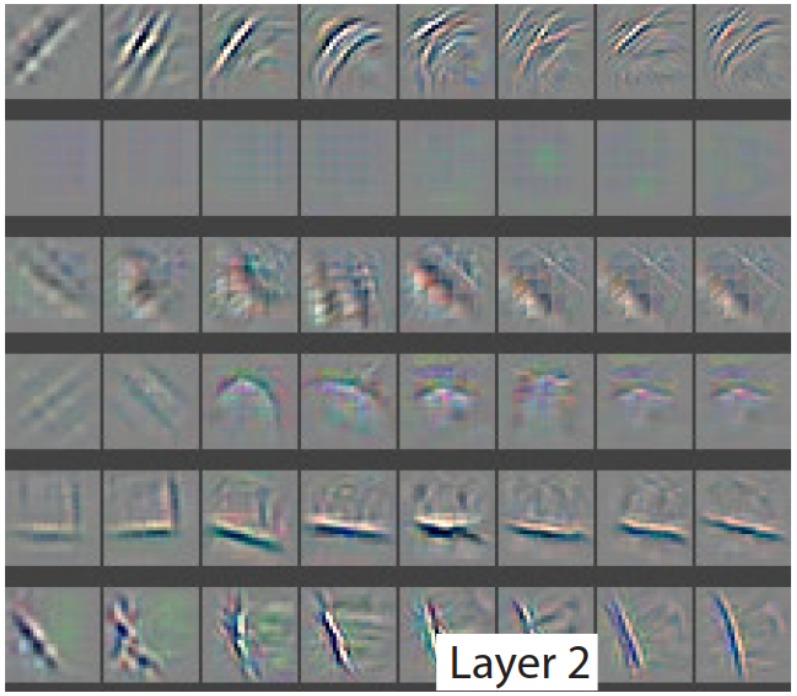
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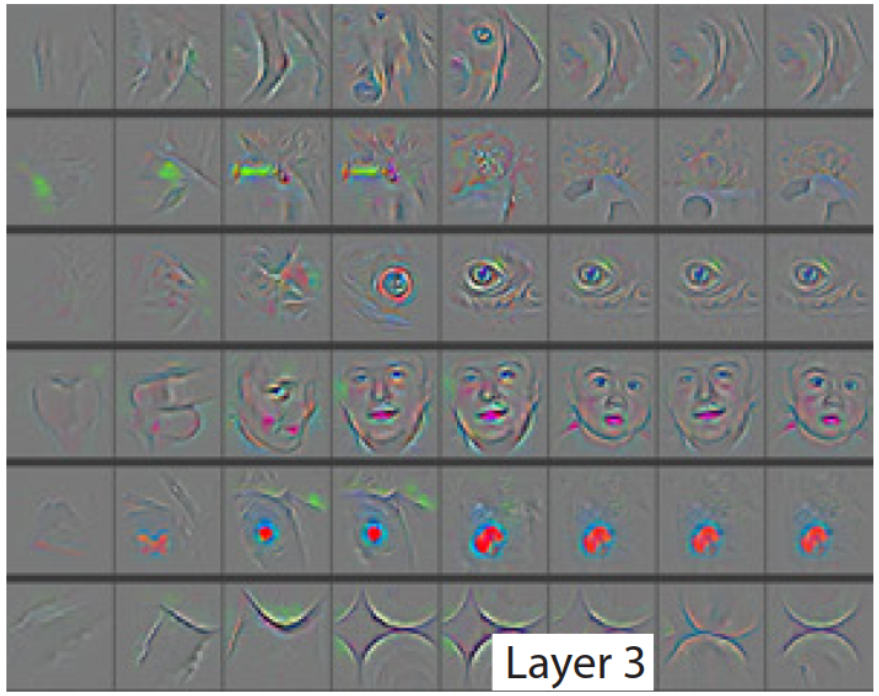
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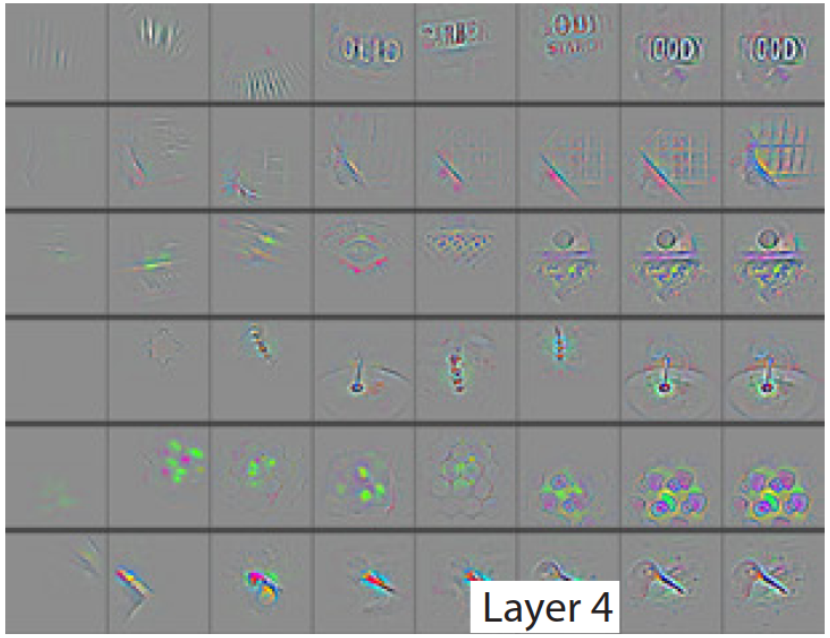
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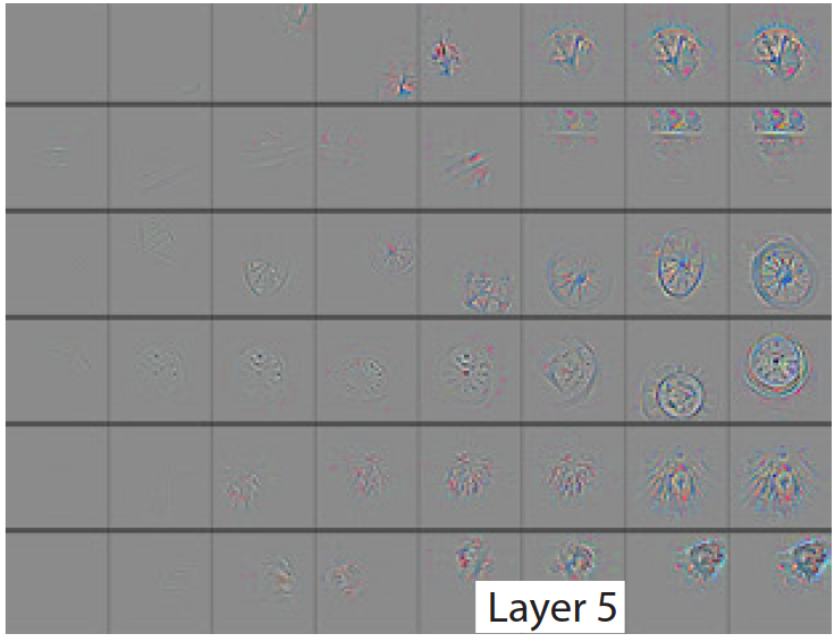
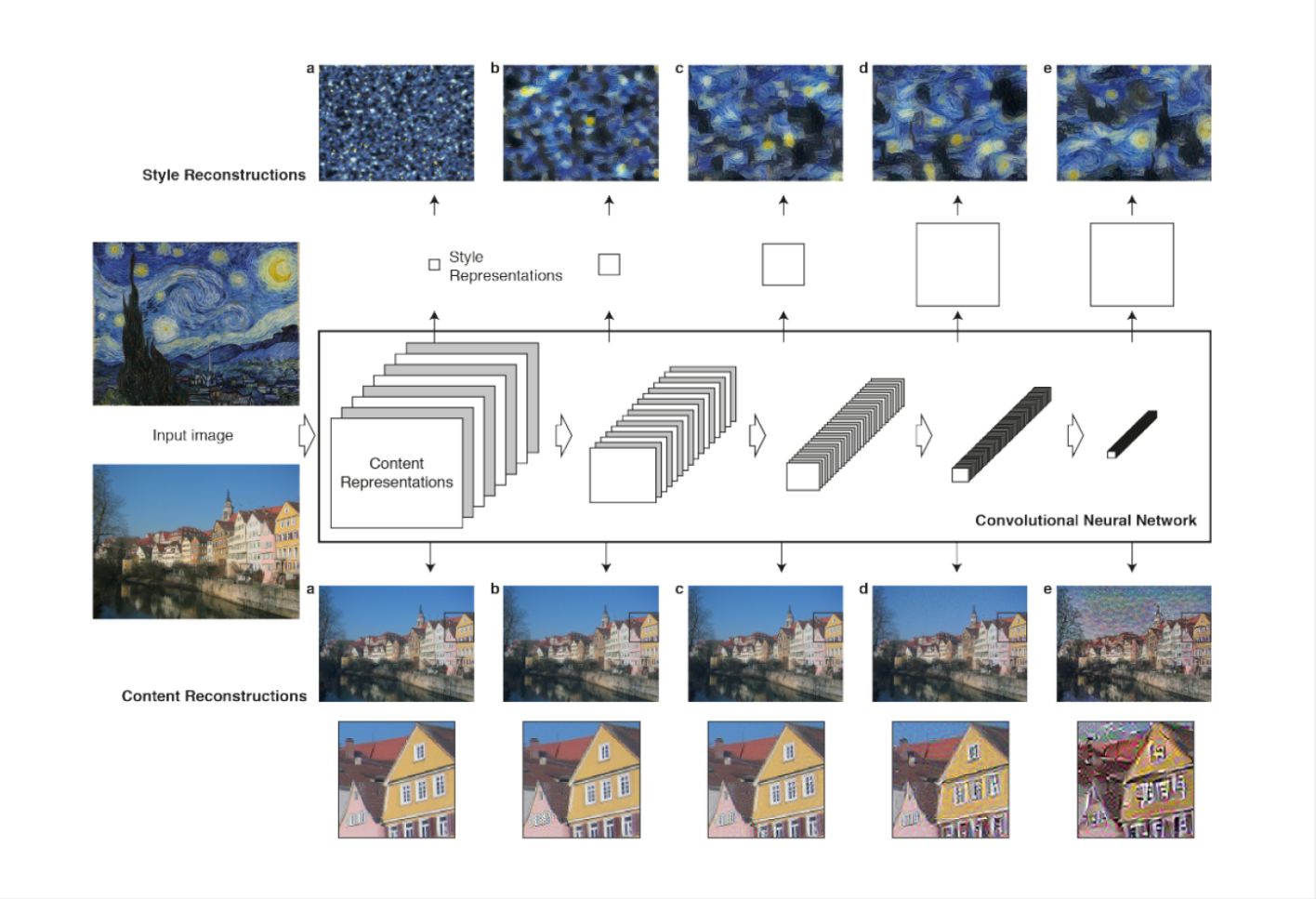
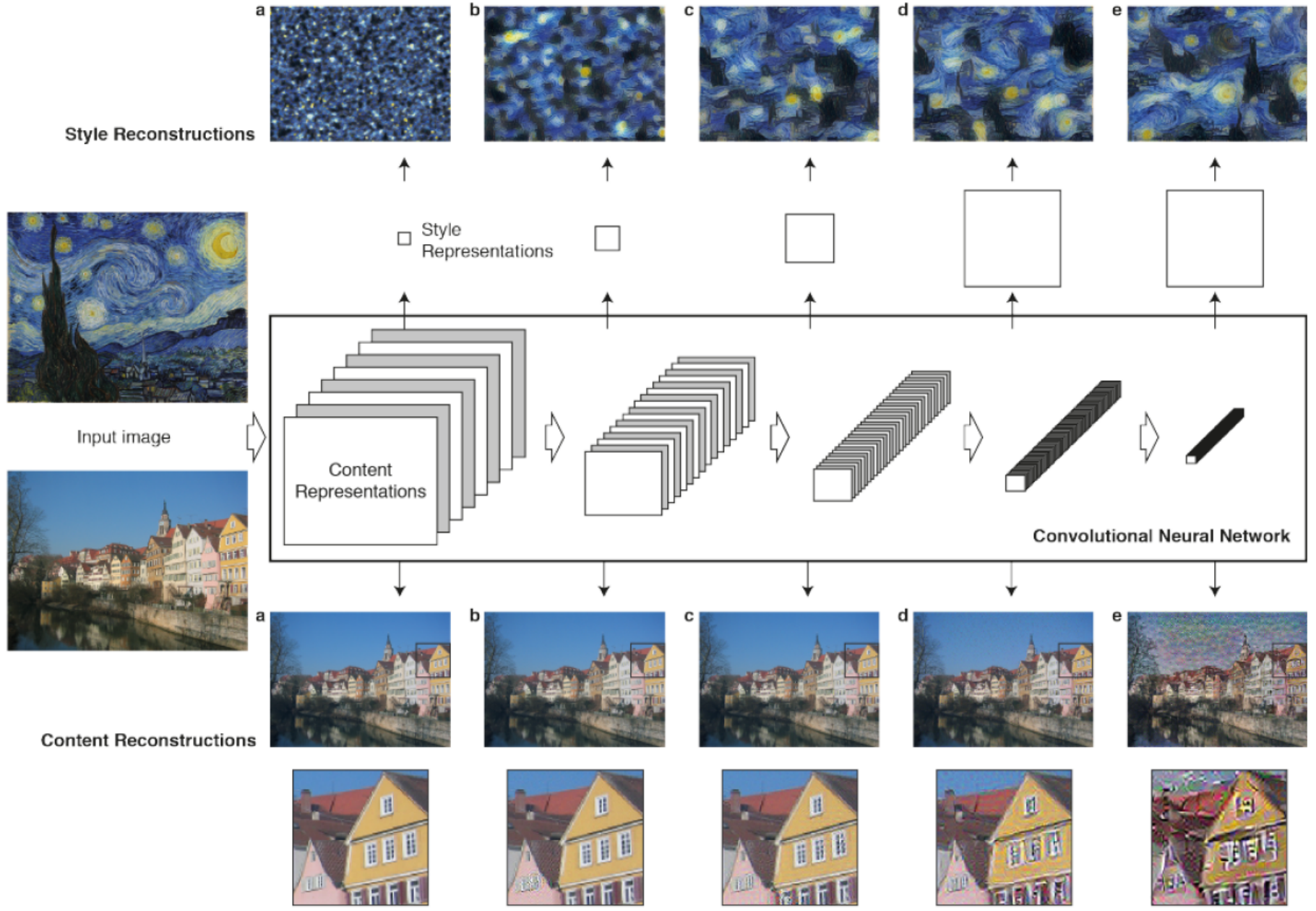

Layer 5

A Neural Algorithm of Artistic Style



Leon A. Gatys, Alexander S. Ecker, Matthias Bethge, 2015


a
b
c
d
e
Style Reconstructions
Style
Representations
Input image
Content
Representations
Convolutional Neural Network
a
b
c
d
e
Content Reconstructions

$$\mathcal{L}_{content}(\vec{p}, \vec{x}, l) = \frac{1}{2} \sum_{i,j} \left(F_{ij}^{l} - P_{ij}^{l} \right)^2 .$$

内容损失函数

$$E_l = \frac{1}{4N_l^2 M_l^2} \sum_{i,j} \left(G_{ij}^{l} - A_{ij}^{l} \right)^2$$

$$\mathcal{L}_{style}(\vec{a}, \vec{x}) = \sum_{l=0}^{L} w_l E_l$$

风格损失函数

$$\mathcal{L}_{total}(\vec{p}, \vec{a}, \vec{x}) = \alpha \mathcal{L}_{content}(\vec{p}, \vec{x}) + \beta \mathcal{L}_{style}(\vec{a}, \vec{x})$$

合并损失函数

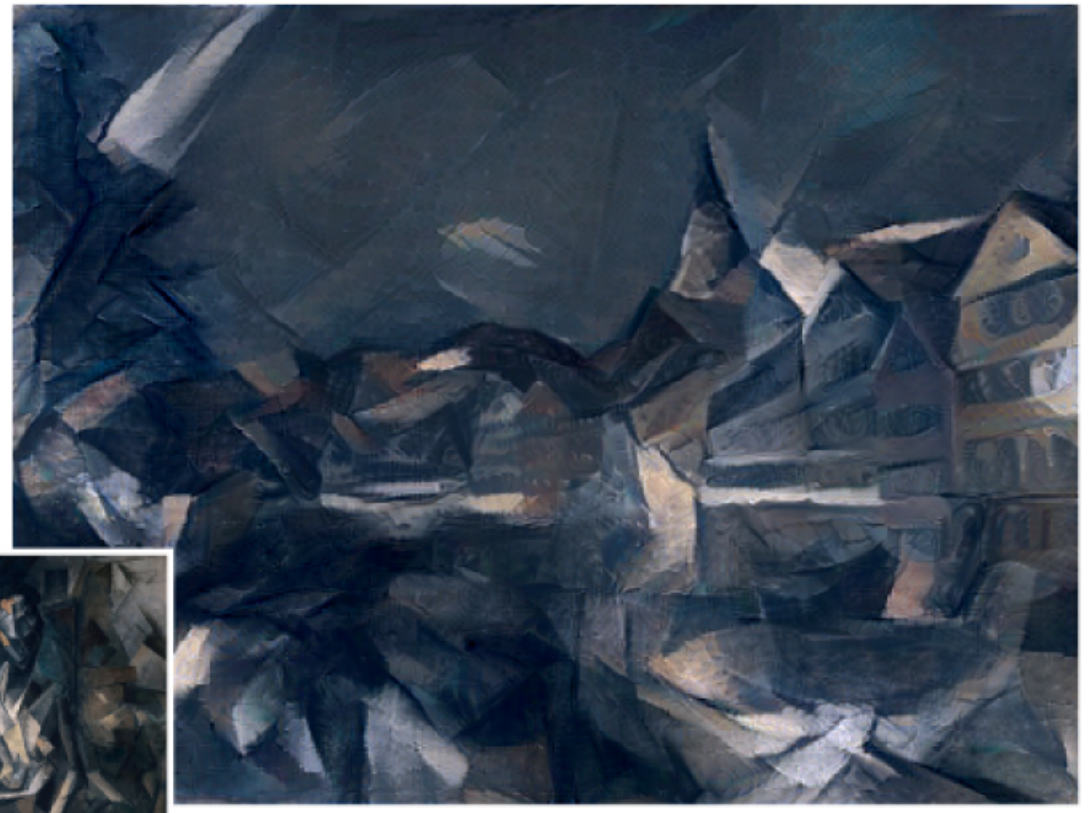
A
B
C
D
E
10^{-5}
10^{-4}
10^{-3}
10^{-2}
Conv1_1
Conv2_1
Conv3_1
Conv4_1
Conv5_1

B

C

D

E



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参考资料及文献

- Stanford University CS231n: Convolutional Neural Networks for Visual Recognition
- A Neural Algorithm of Artistic Style, LA Gatys, AS Ecker, M Bethge, Computer Science, 2015
- Visualizing and Understanding Convolutional Networks, MD Zeiler , R Fergus, Lecture Notes in Computer Science, 2013, 8689 : 818-833

感谢指正