



Neural Networks, Part 2

Data Visualization and Data Mining
Talk 2 by Jana Cavojska

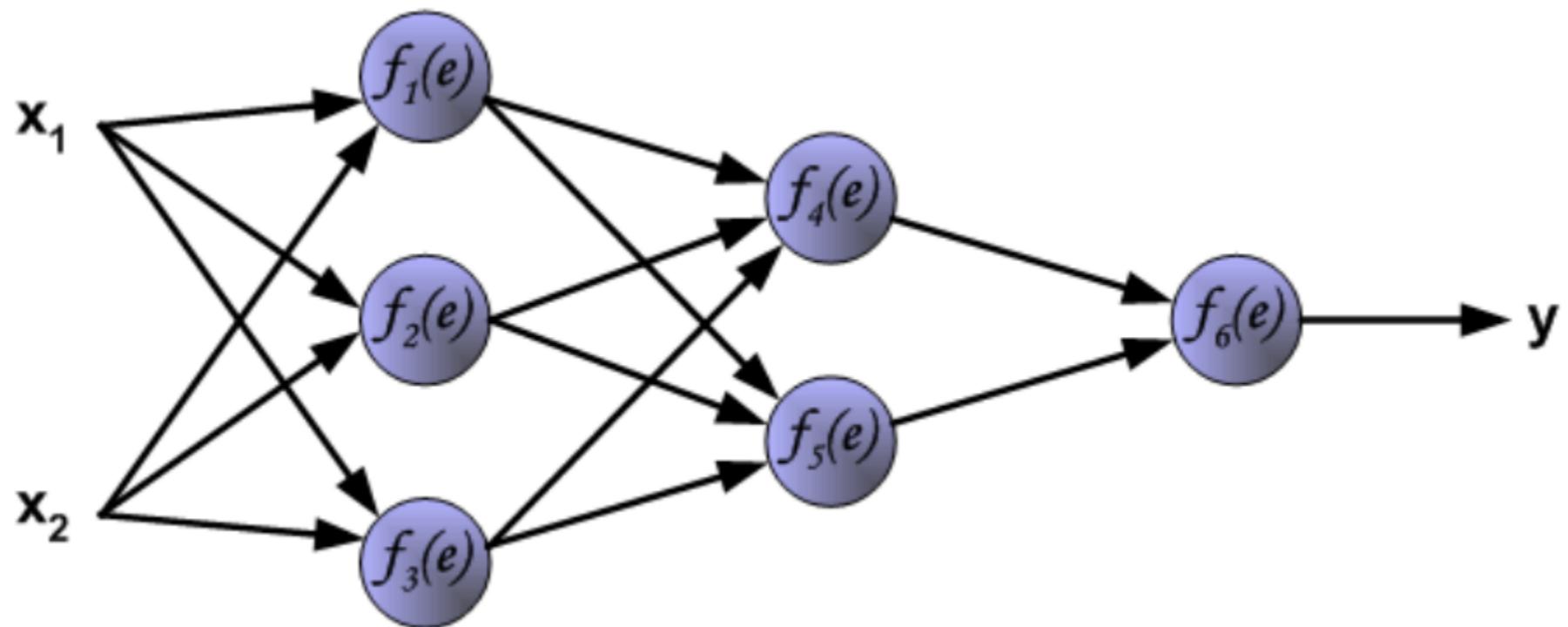
Instructors:

Prof. Dr. Agnès Voisard
Daniel Kressner

Overview

- 1. Neural Networks**
2. Convolutional Neural Networks
3. Visualization Approaches
4. Visualizing via Deconvolutional Networks
5. Visualizing via Gradient Ascent
6. Detecting Neuron Invariances

1. Neural Networks (NN)

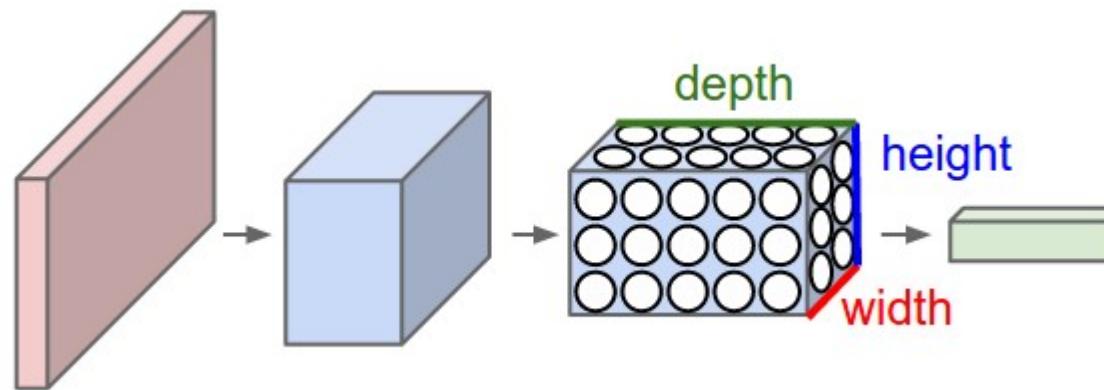
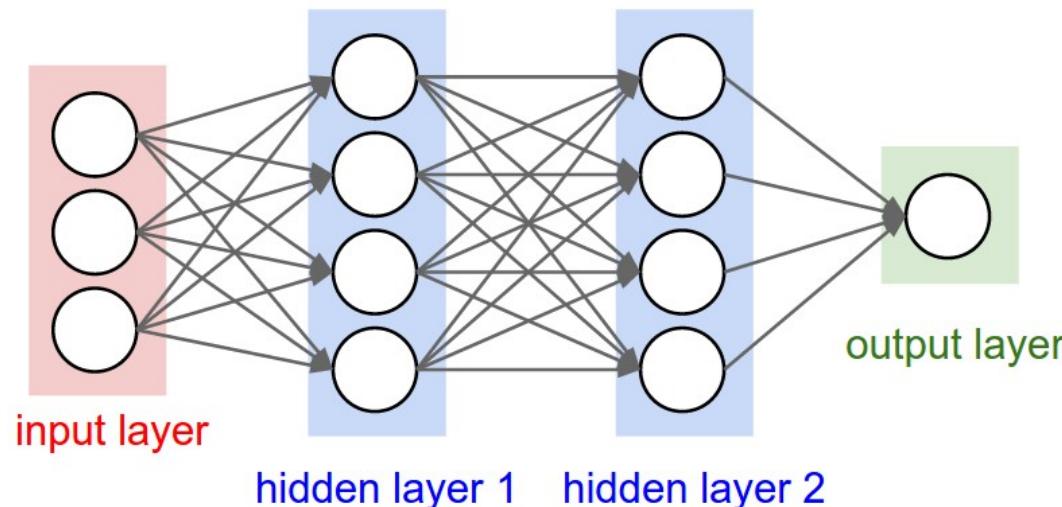


Source: [1]

Overview

1. Neural Networks
2. **Convolutional Neural Networks**
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2. Convolutional Neural Networks (CNN)

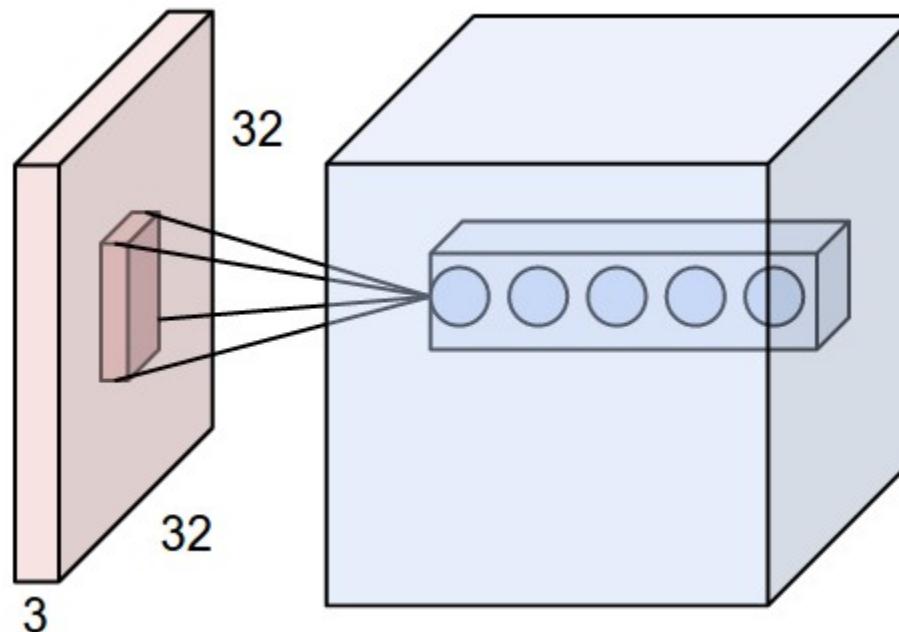


Source: [2]



2. Convolutional Neural Networks (CNN)

Complexity Reduction

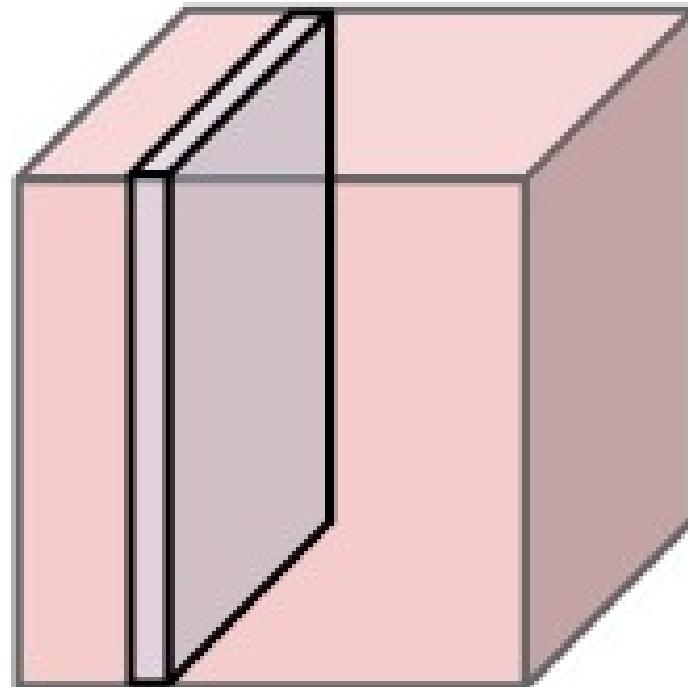


Source: [2]



2. Convolutional Neural Networks (CNN)

Complexity Reduction



Source: [2]

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3. Visualization Approaches

1. Deconvolutional Approach
2. Gradient Ascent in Image Space
(deepdream)
3. Studying Invariants via Regularized Regression

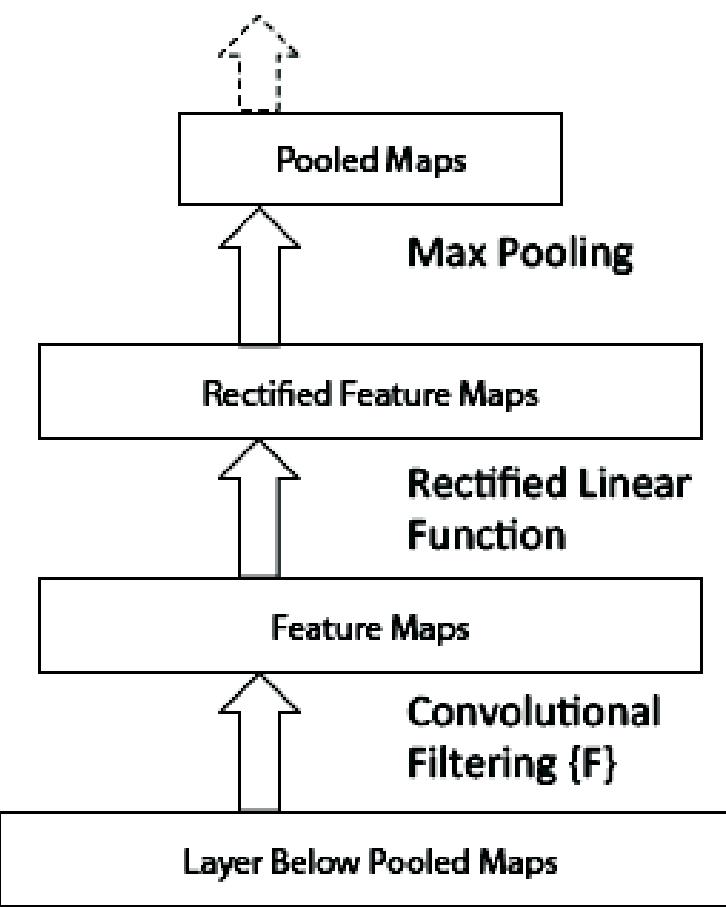
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4. Visualizing via Deconvolutional Networks

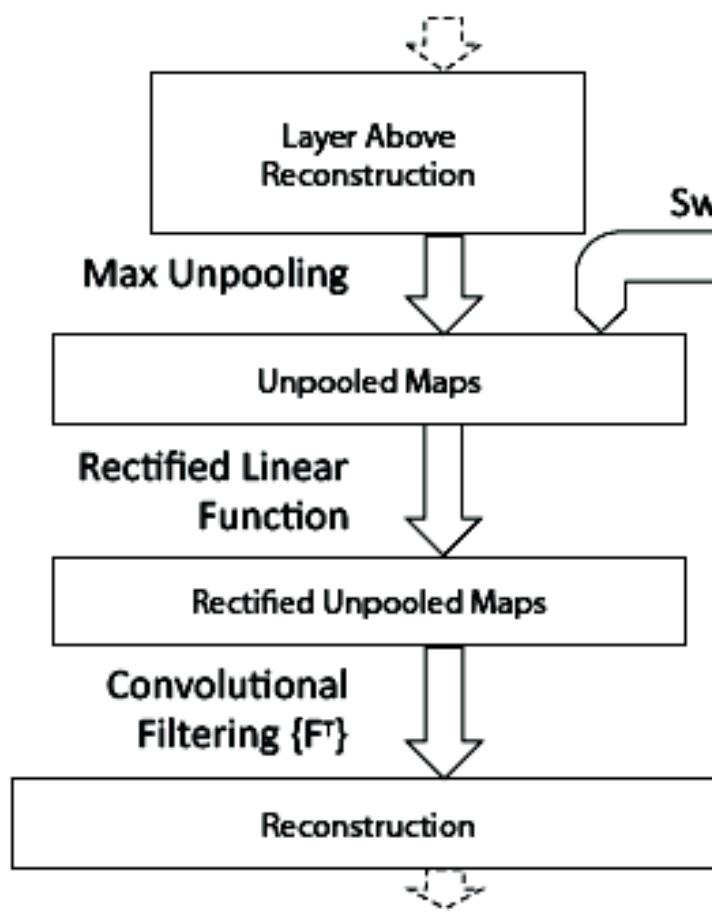
convnet



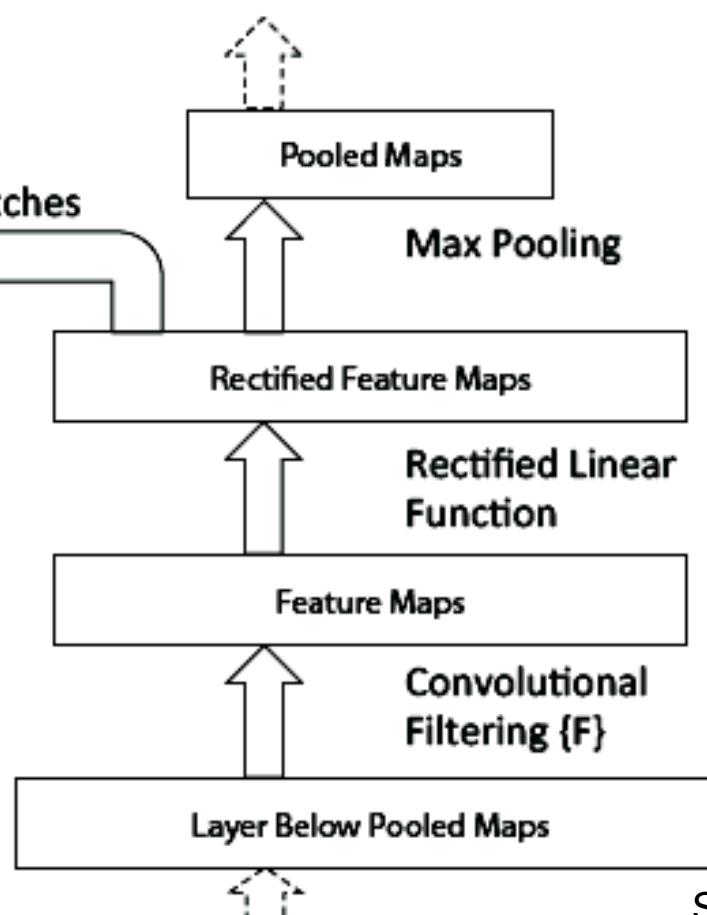
Source: [3]

4. Visualizing via Deconvolutional Networks

deconvnet



convnet

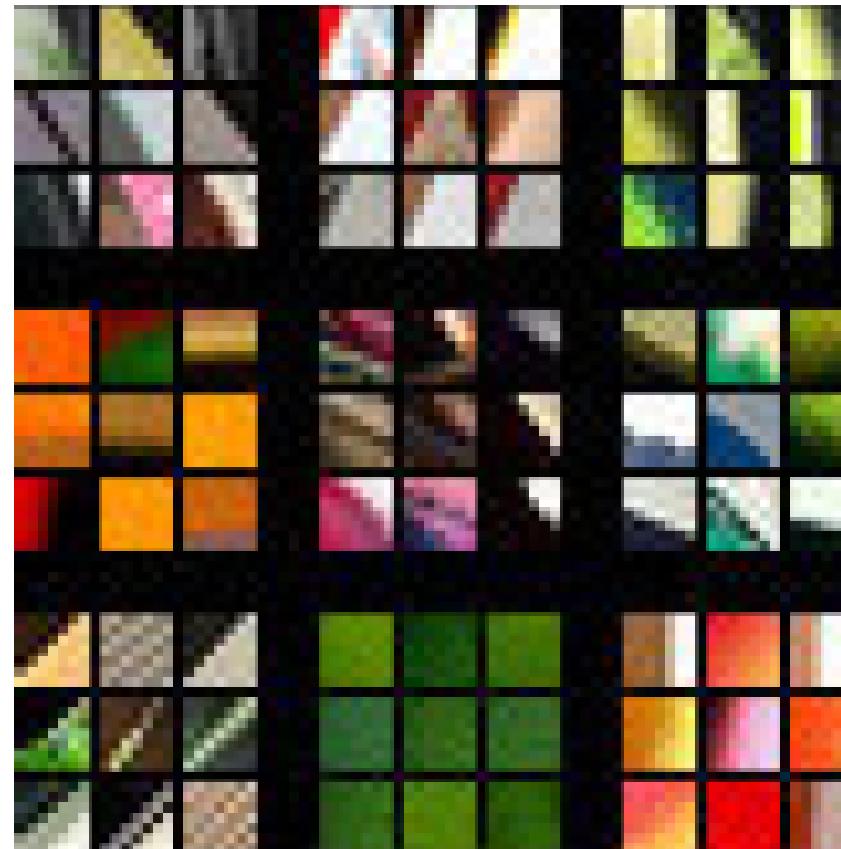
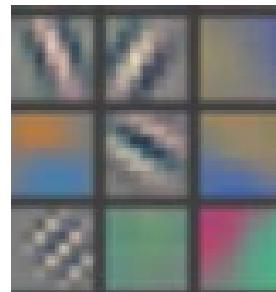


Source: [3]



4. Visualizing via Deconvolutional Networks

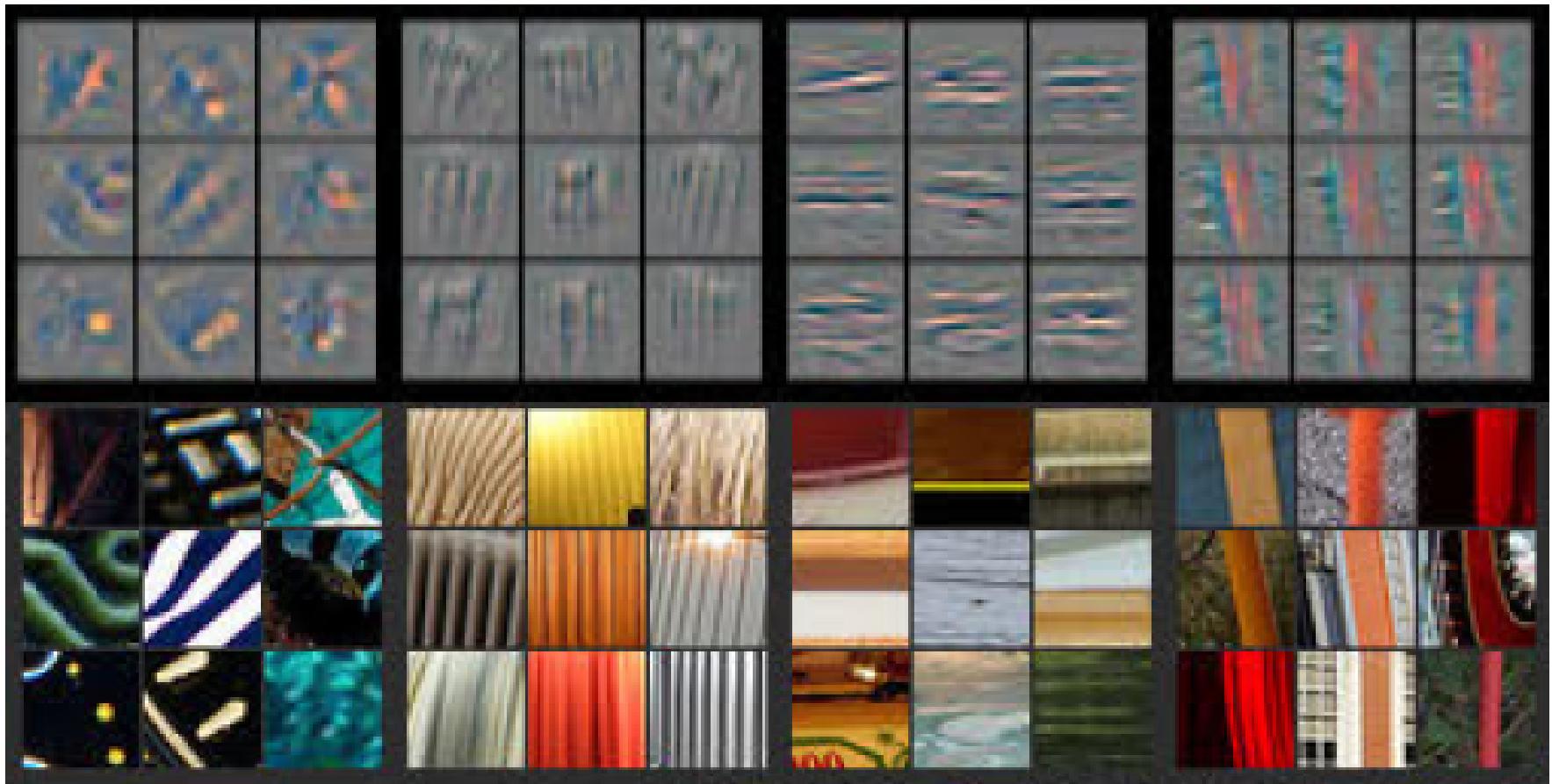
Layer 1



Source: [3]

4. Visualizing via Deconvolutional Networks

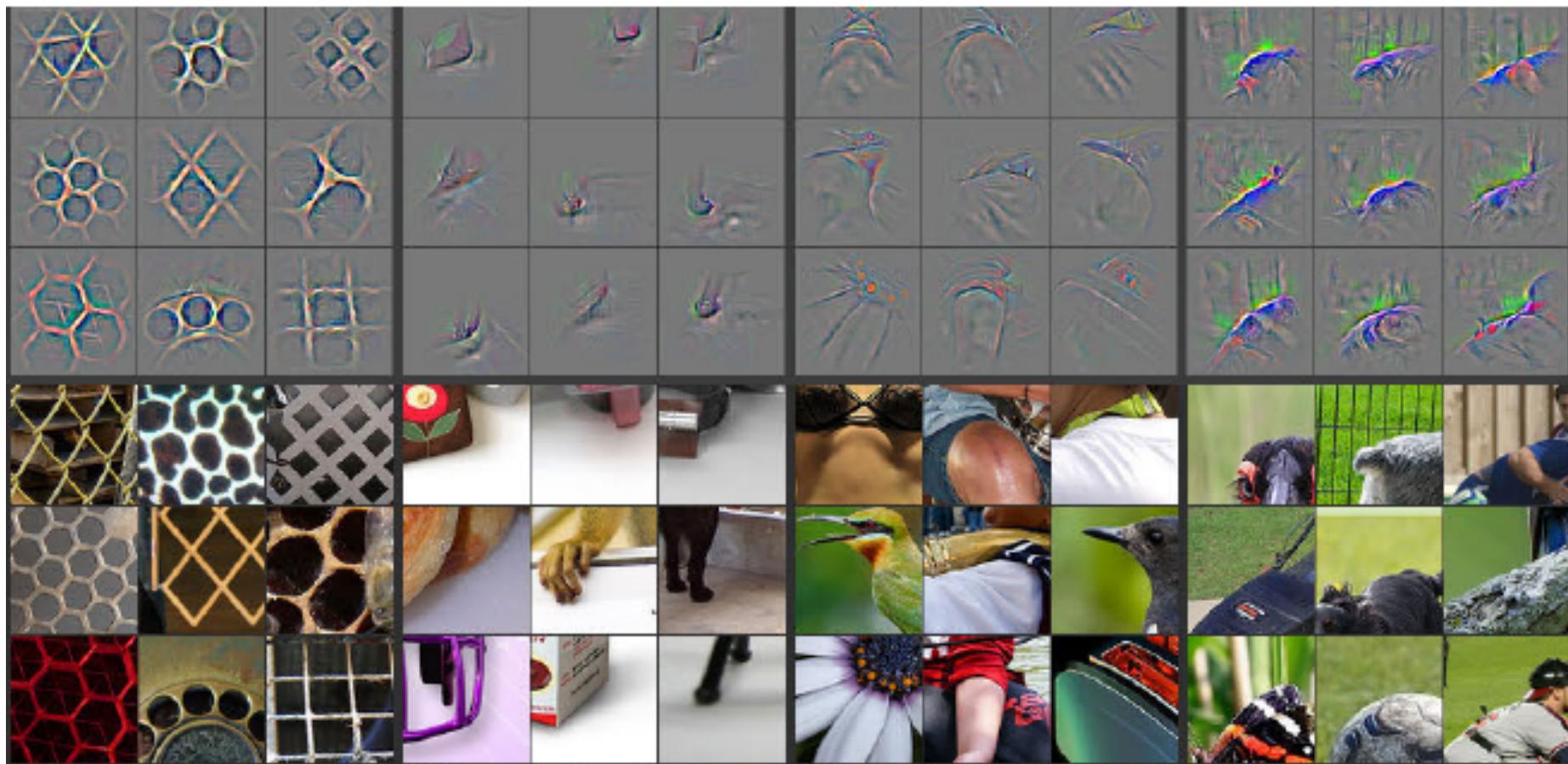
Layer 2



Source: [3]

4. Visualizing via Deconvolutional Networks

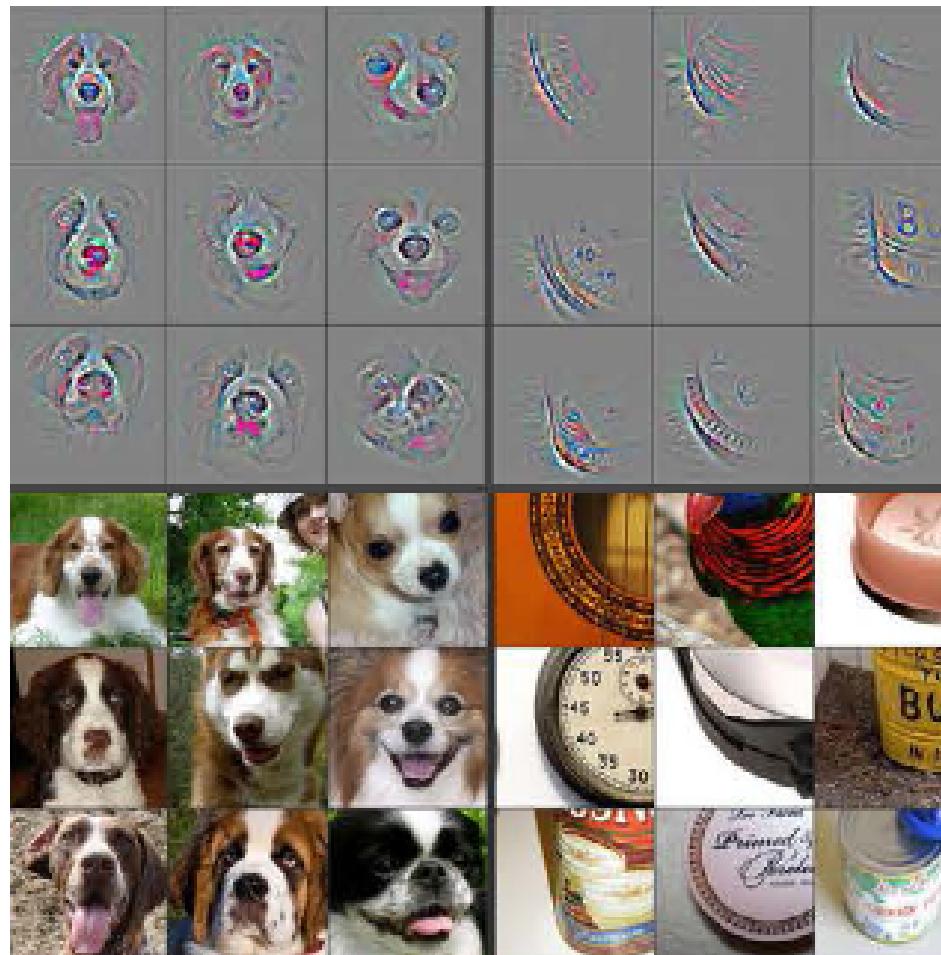
Layer 3



Source: [3]

4. Visualizing via Deconvolutional Networks

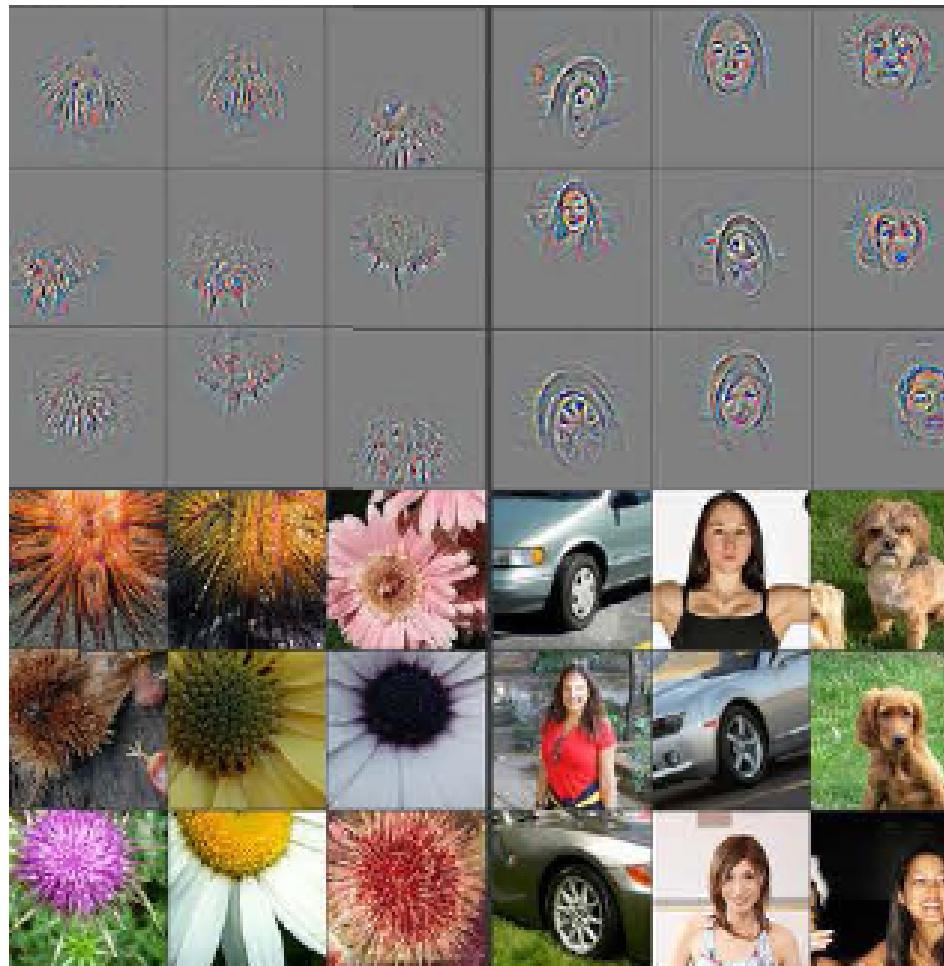
Layer 4



Source: [3]

4. Visualizing via Deconvolutional Networks

Layer 5



Source: [3]

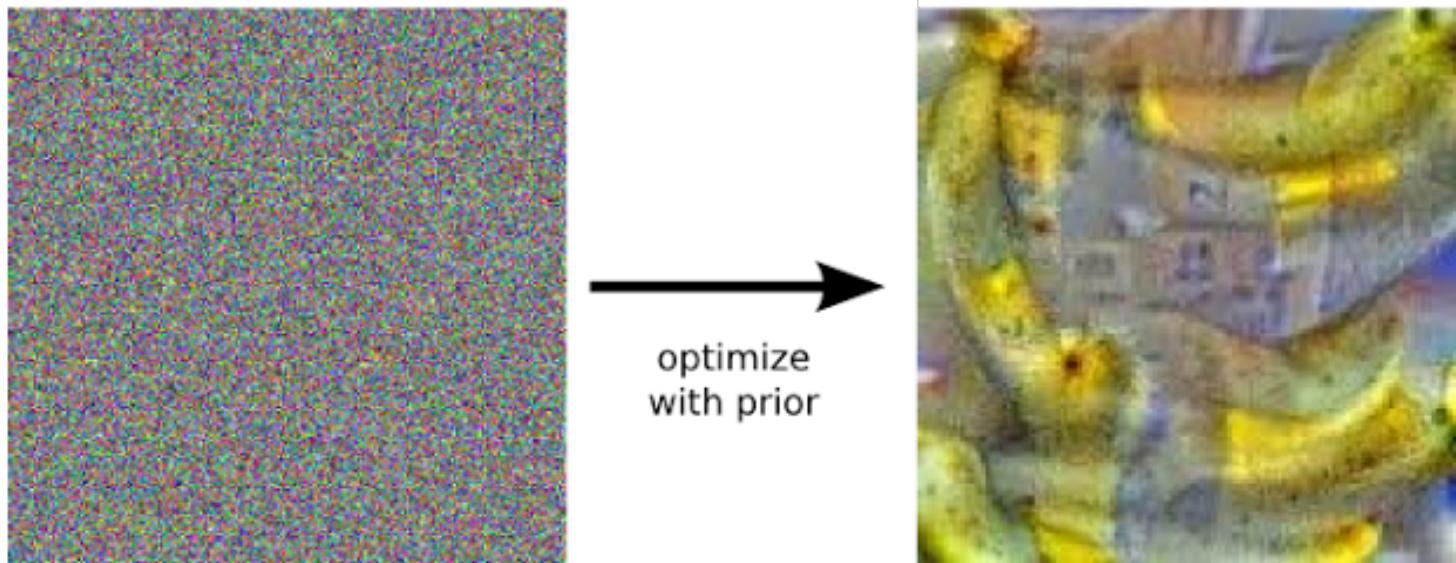
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5. Visualizing via Gradient Ascent (DeepDream)

A typical banana



Source: [4]



5. Visualizing via Gradient Ascent (DeepDream)

Other typical objects



Hartebeest



Measuring Cup



Ant



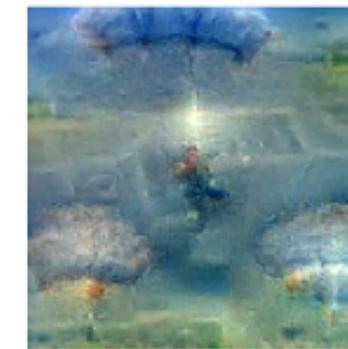
Starfish



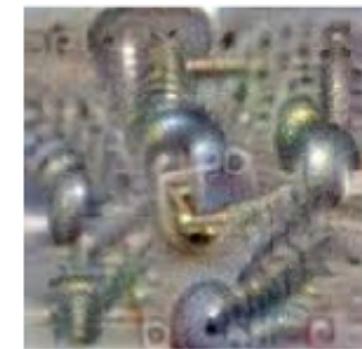
Anemone Fish



Banana



Parachute



Screw

Source: [4]



5. Visualizing via Gradient Ascent (DeepDream)

Upps... or How it can go wrong

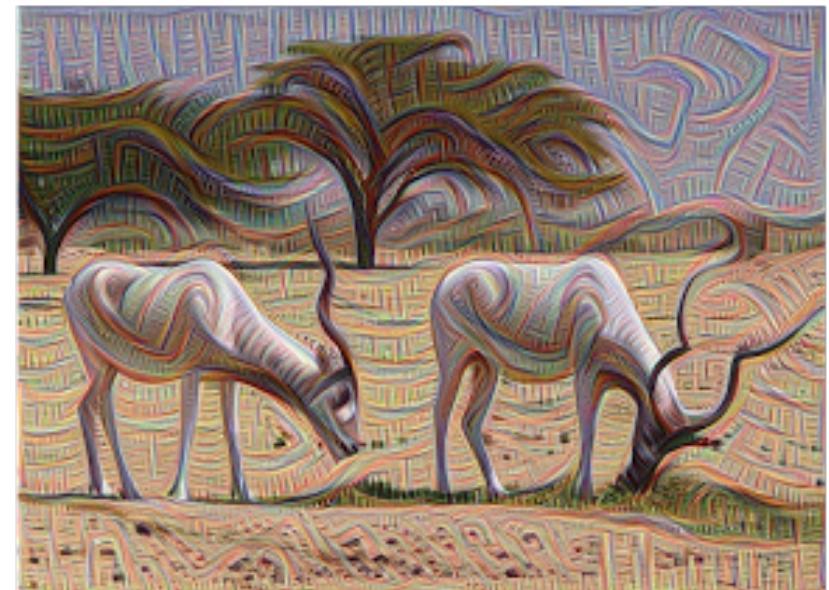


Source: [4]



5. Visualizing via Gradient Ascent (DeepDream)

Enhancing low level features

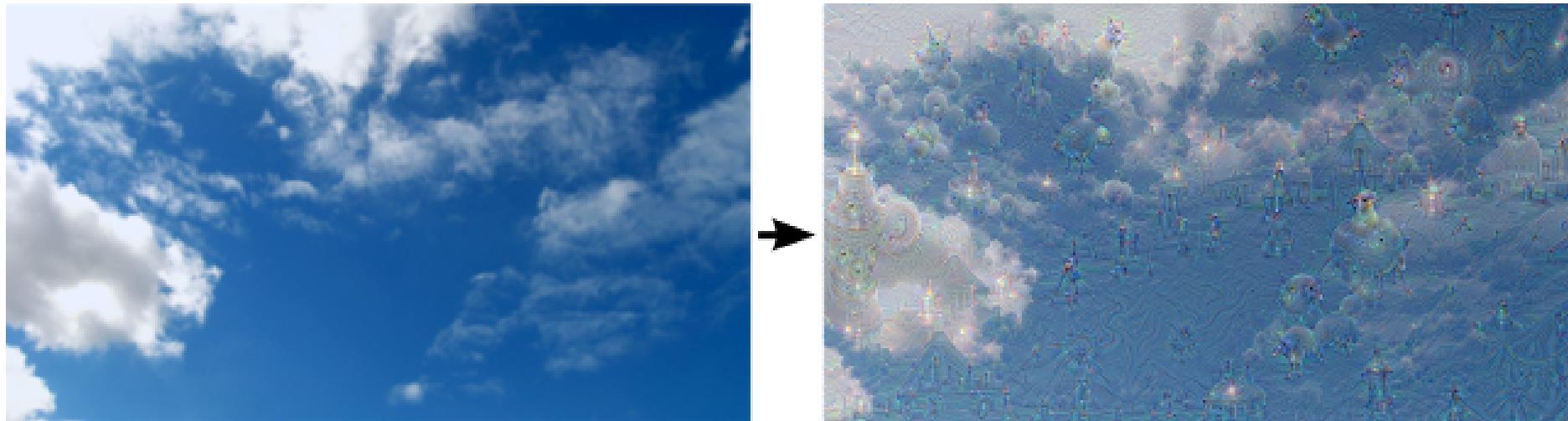


Source: [4]



5. Visualizing via Gradient Ascent (DeepDream)

Enhancing high level features



Source: [4]

5. Visualizing via Gradient Ascent (DeepDream)

Enhancing high level features



"Admiral Dog!"



"The Pig-Snail"



"The Camel-Bird"



"The Dog-Fish"

Source: [4]

5. Visualizing via Gradient Ascent (DeepDream)

Iterative feature enhancing and zooming

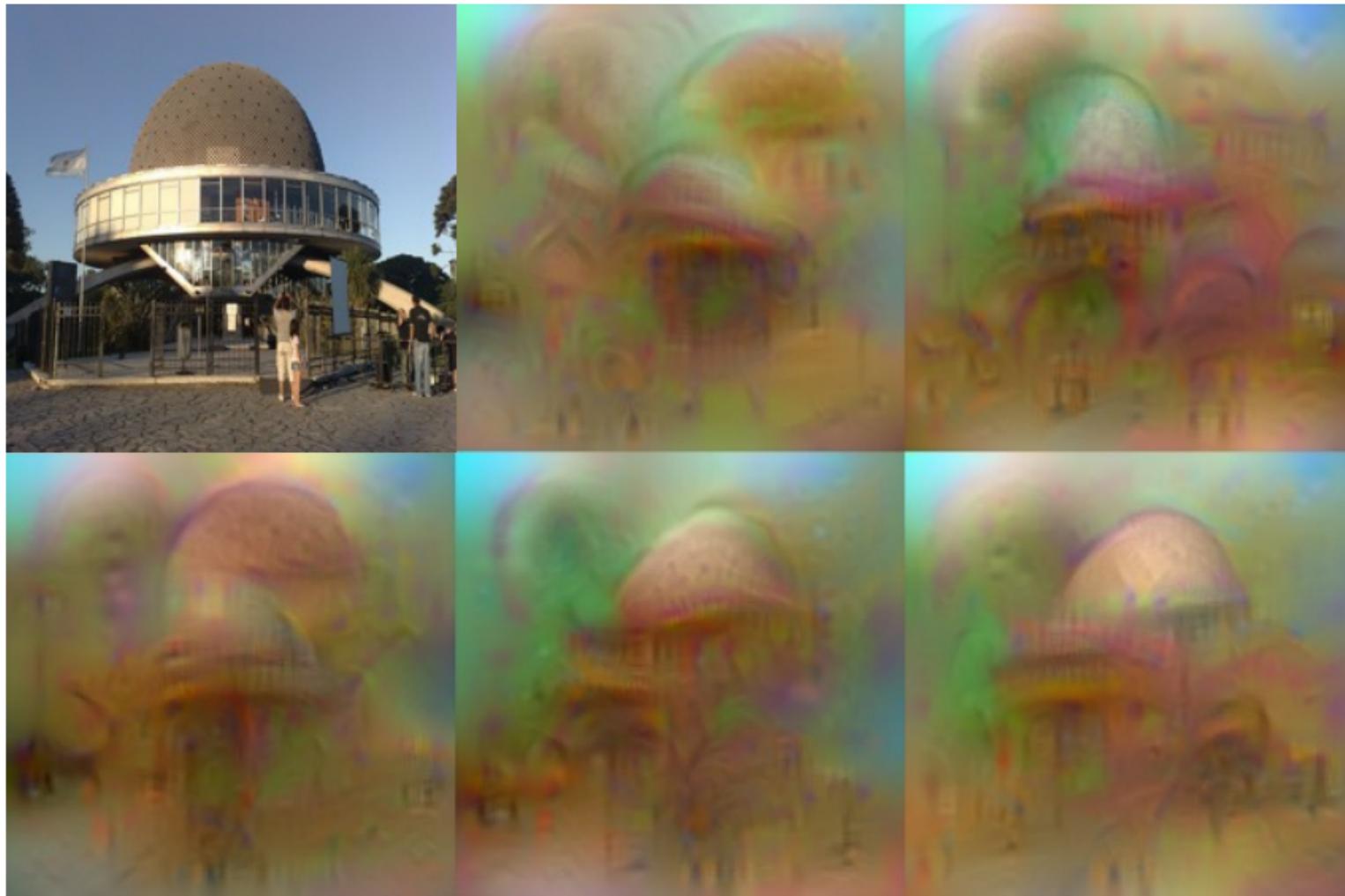


Source: [4]

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6. Detecting Neuron Invariances



Source: [5]



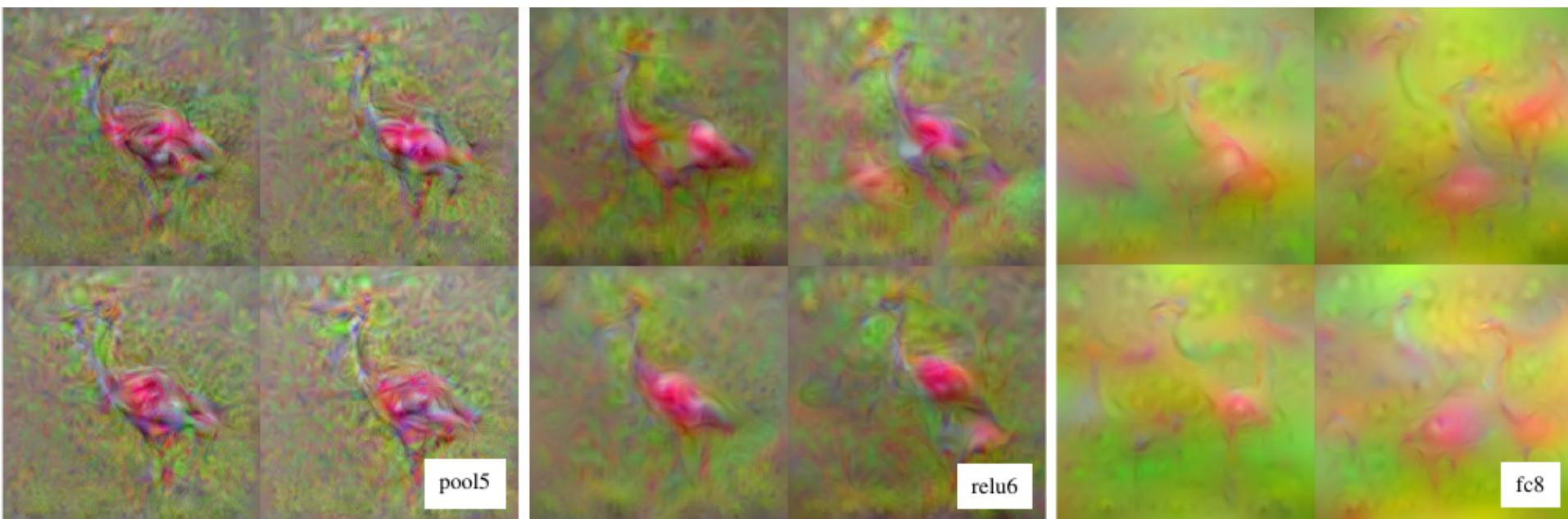
6. Detecting Neuron Invariances



Source: [5]



6. Detecting Neuron Invariances



Source: [5]



Thanks!

Sources

- [1] „Vertiefung: Neural Networks for Secondary Structure Prediction“. URL: http://medicalbioinformatics.de/downloads/lectures/Algorithmische_BioInformatik/WS
- [2] „Convolutional Neural Networks (CNNs / ConvNets)“. URL: <http://cs231n.github.io/convolutional-networks/>
- [3] Matthew D. Zeiler and Rob Fergus. „Visualizing and Understanding Convolutional Networks“. Dept. of Computer Science, Courant Institute, New York University. 2013.
- [4] Alexander Mordvintsev, Christopher Olah, and Mike Tyka. Inceptionism: Going Deeper into Neural Networks. URL: <http://googleresearch.blogspot.de/2015/06/inceptionism-going-deeper-into-neural.html>.
- [5] Aravindh Mahendran and Andrea Vedaldi. “Understanding Deep Image Representations by Inverting Them”. In: CoRR abs/1412.0035 (2014). URL: <http://arxiv.org/abs/1412.0035>.

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