

# Deep Convolutional Networks

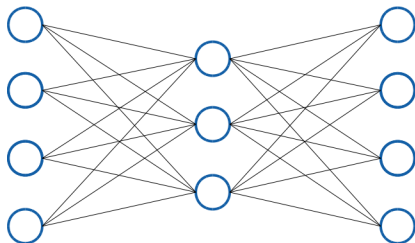
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Study Project

24th of February 2016

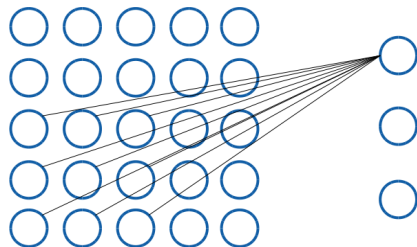
# Convolutional Neural Networks

- Contains convolutional layers
- Learns the weights of convolutional filters
- Exploits spatial structure in the input
- Convolution of entire input with filter implies shared weights
- Reduced amount of weights allows lots of filters



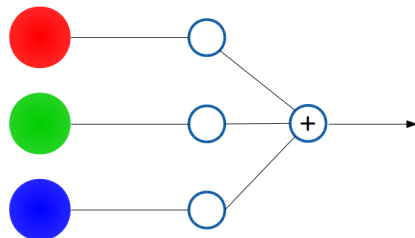
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# Network Structure

Layer	Type	Configuration	Activation function
0	Convolutional	100 filters of size $7 \times 7$ per channel	tanh
1	Max Pooling	Pool size $2 \times 2$	-
2	Convolutional	150 filters of size $4 \times 4$ per channel	tanh
3	Max Pooling	Pool size $2 \times 2$	-
4	Convolutional	250 filters of size $4 \times 4$ per channel	tanh
5	Max Pooling	Pool size $2 \times 2$	-
6	Dense	300 neurons	tanh
7	Dense	43 neurons	softmax

# German Traffic Sign Recognition Benchmark

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- What is the task?

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- German Traffic Sign Recognition Benchmark
- What is the task?
- Show some images



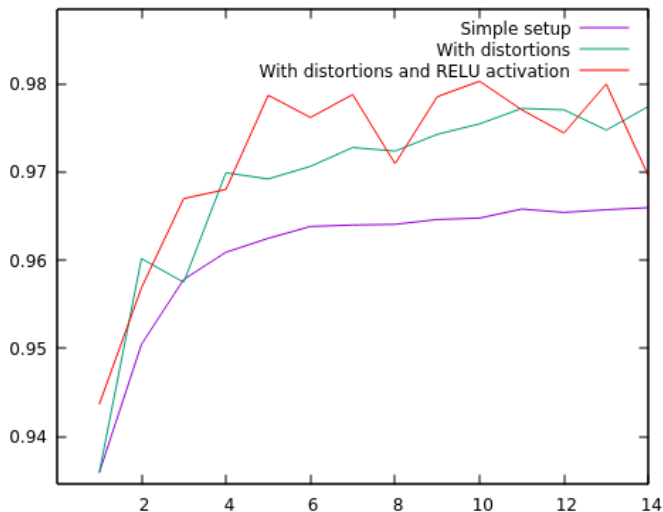
# Simple Setup

- Describe Simple Setup

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- Present Results

# Results on GTSRB



# Input Distortions

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- Explain them
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- Maybe add one or two images before and after the transformations

# Results with RELU

- Add RELU image



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- Add RELU image
- Present results with RELU activation function

# Missclassified images



Input



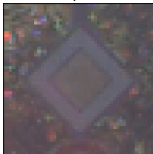
0.5814



0.2840



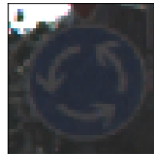
0.0401



Input



0.8513



0.0923



0.0493



Input



0.4296



0.2681



0.2390

# Filter Reuse

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- Copy GTSRB filters to the new network
- Train only the fully connected layers!

## COIL100

RUB



- Columbia Object Image Library 100  $\Rightarrow$  COIL100

# COIL100



- Columbia Object Image Library 100  $\Rightarrow$  COIL100
- 100 different objects

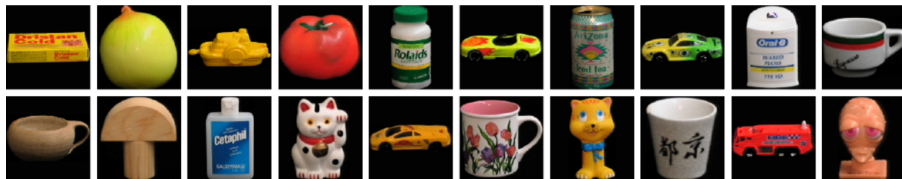


# COIL100



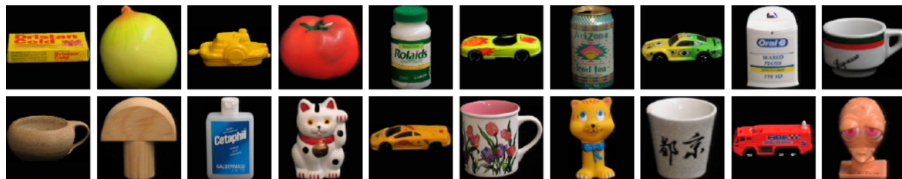
- Columbia Object Image Library 100  $\Rightarrow$  COIL100
- 100 different objects
- Objects turning on a black turntable

# COIL100

**RUB**

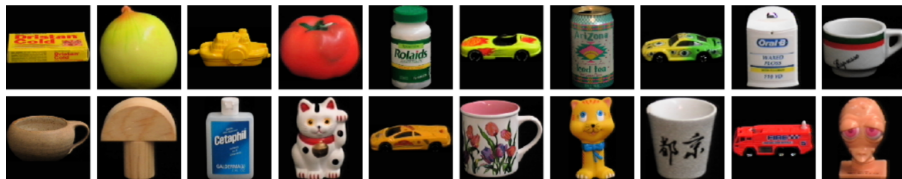
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- One foto each time the object has turned by  $5^\circ$
- 72 images per object, 7200 images in total

# COIL100



- Columbia Object Image Library 100  $\Rightarrow$  COIL100
- 100 different objects
- Objects turning on a black turntable
- One foto each time the object has turned by  $5^\circ$
- 72 images per object, 7200 images in total
- Random separation into 58 training and 14 test images per object

- Describe INRIA dataset

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- Show results with reused filters

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- Show image
- Show results with reused filters
- Show results with original filters



# Conclusion

- Summarize results

# Questions?

**RUB**

Questions?

