

# **Do we have an image enhancer that can bit map?**

super-resolution through deep learning

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wose

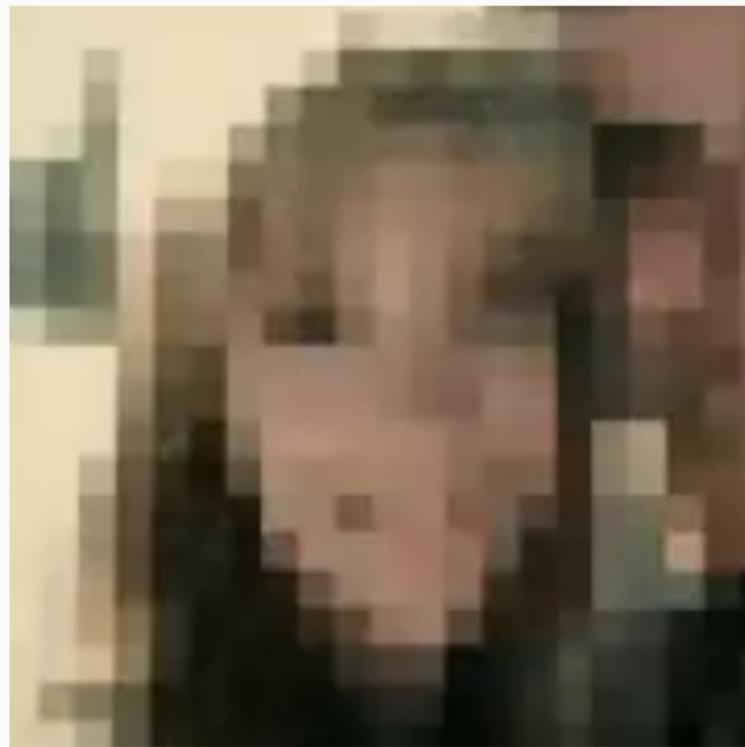
22. Oktober 2016

Kino!

## Science Fiction(?)

- Call Northside 777 (1948)
- Blade Runner (1982)
- Star Trek TNG (1987)
- MacGyver (1988)
- CSI: Miami (2002)
- Battlestar Galactica (2004)
- ...

## Science Fiction(?)



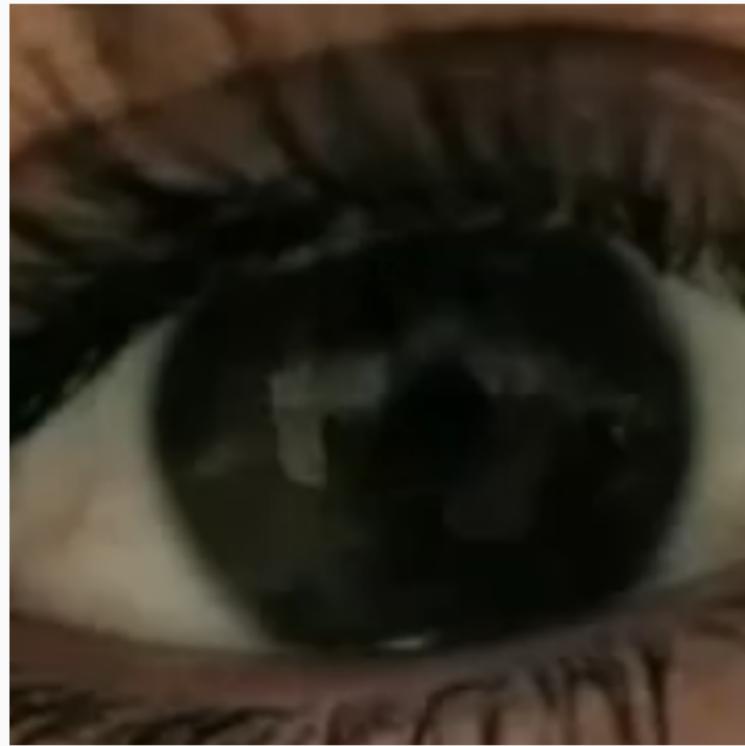
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- ... eine 40 Megapixel Kamera genutzt wurde.

# Science Fiction(?)

Möglich?

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**Wenn...**

- ... eine 40 Megapixel Kamera genutzt wurde.
- ... neben dem Fotomotiv eine Atombombe explodiert ist.

# Bildauflösung

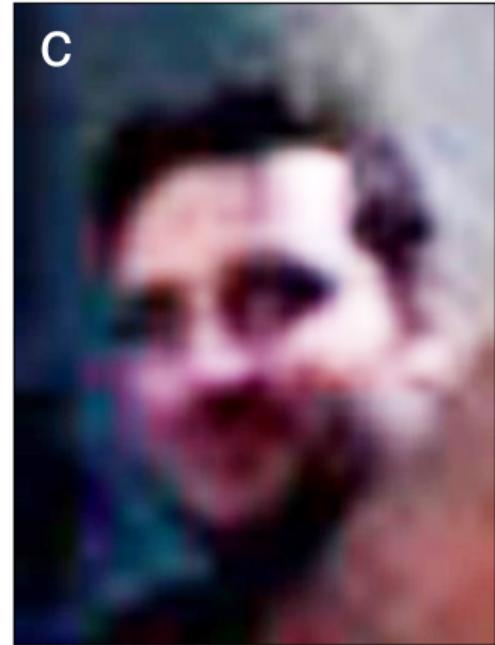
a



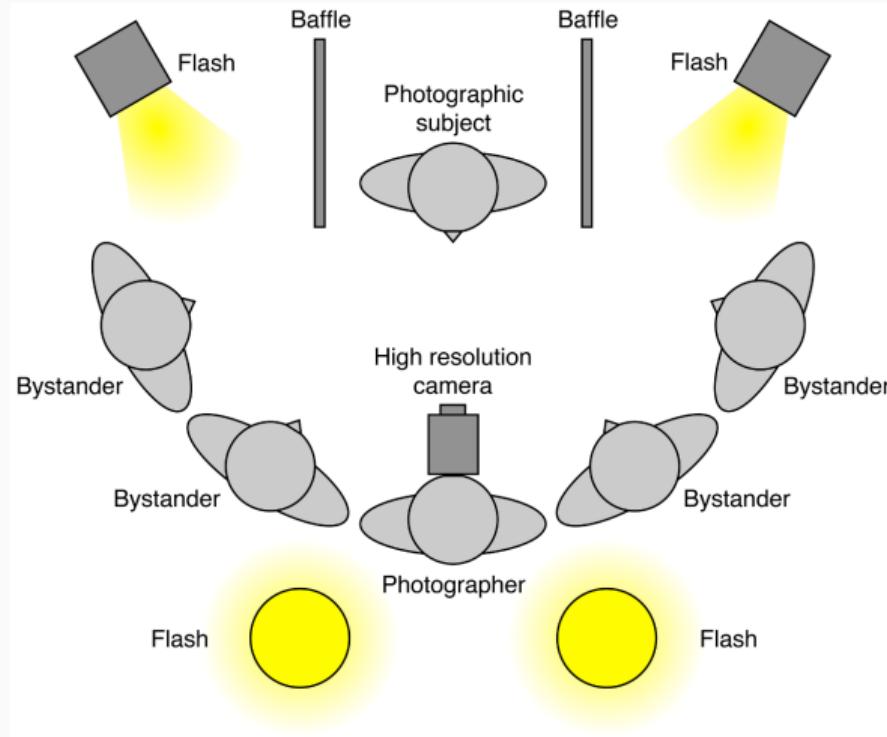
b



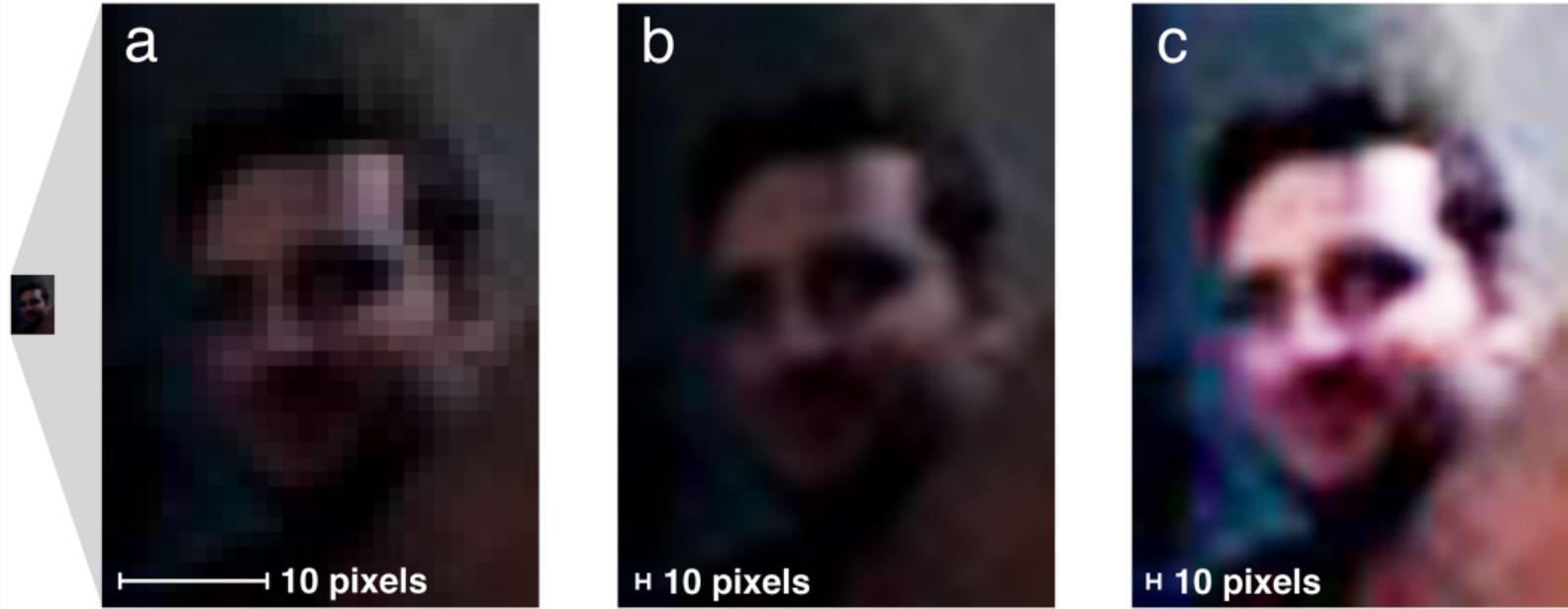
c



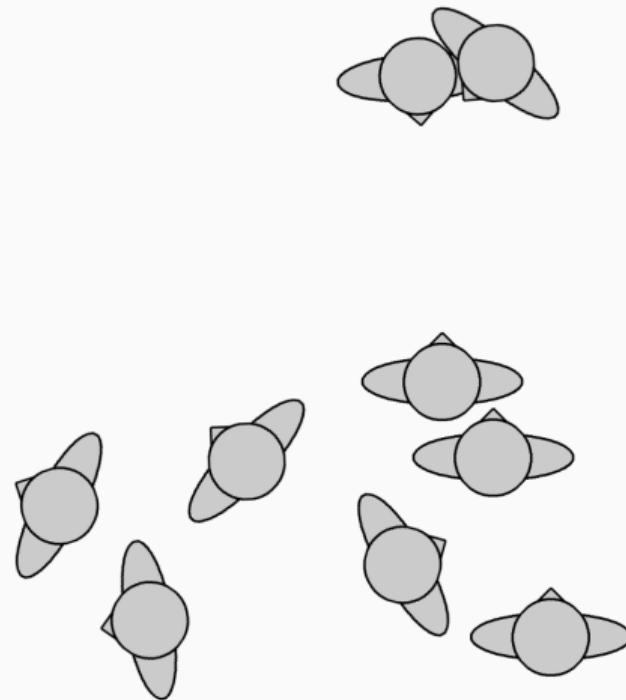
# Bildauflösung



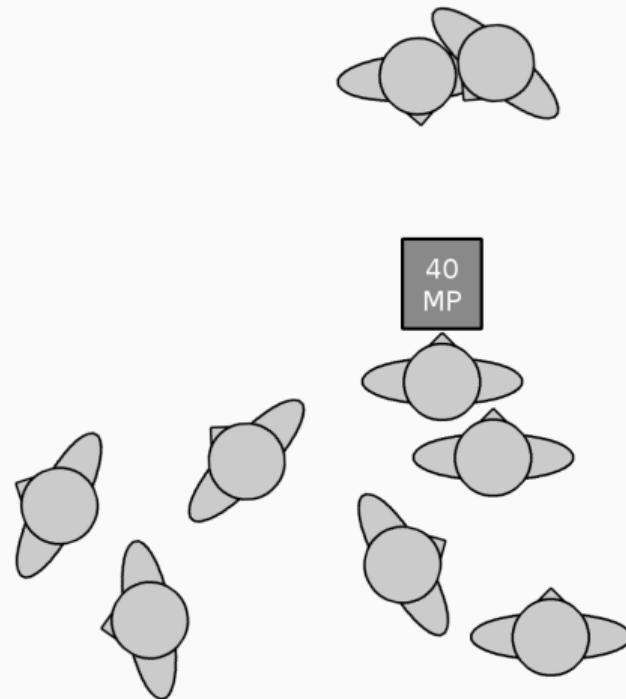
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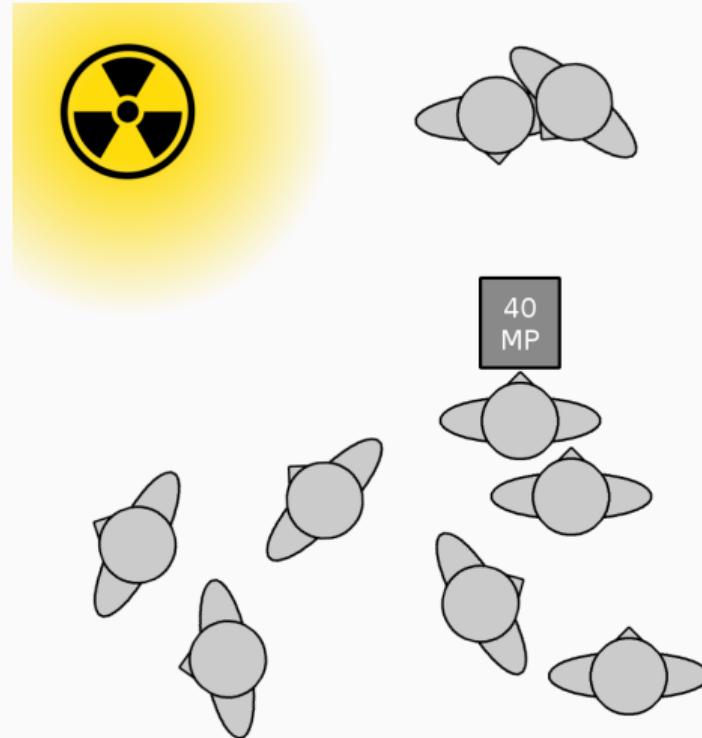
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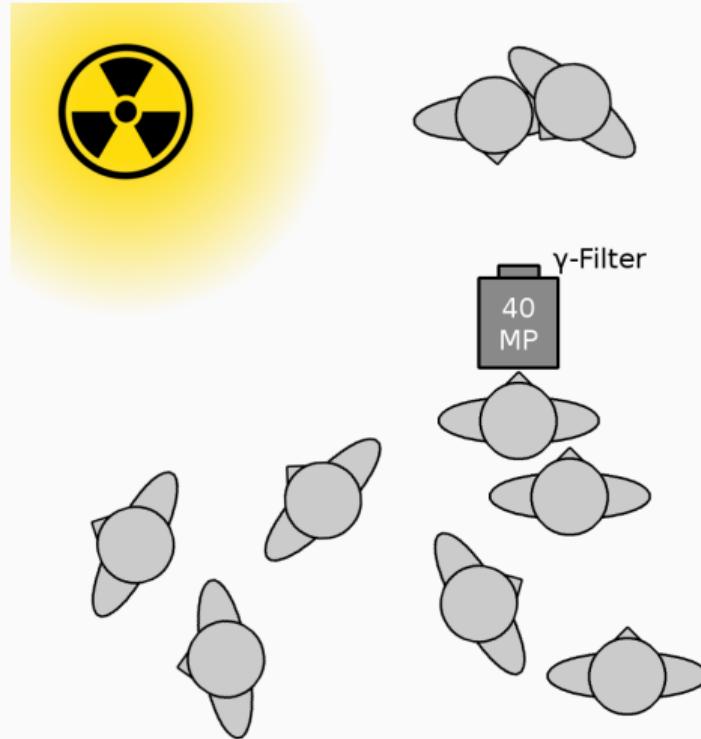
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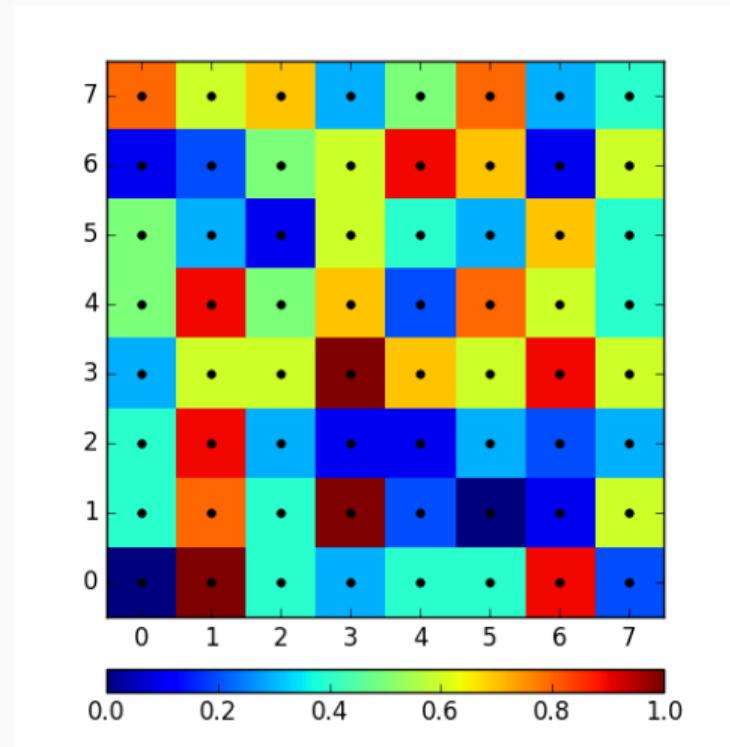
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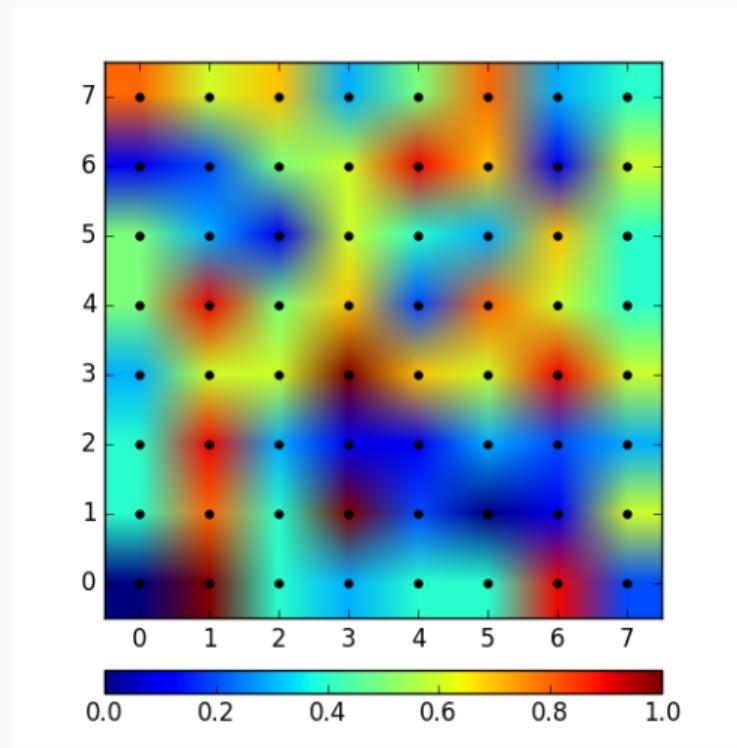
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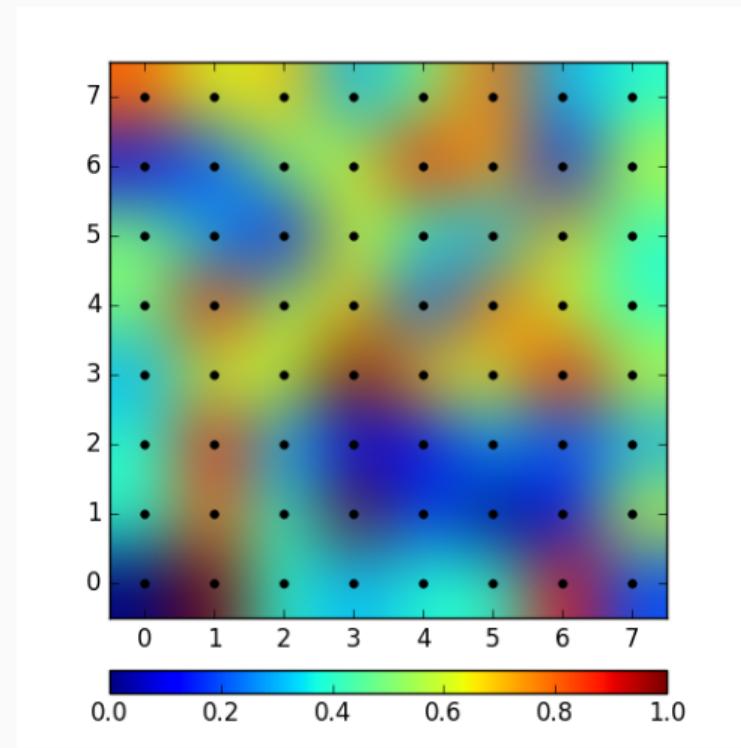
# Interpolation - Nearest Neighbor



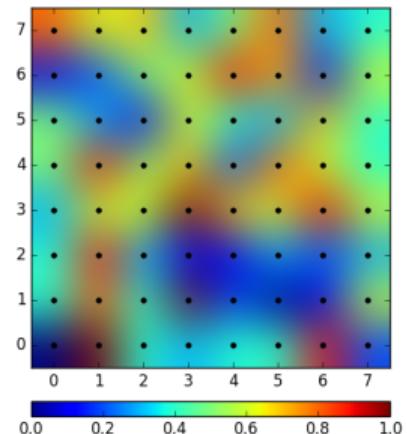
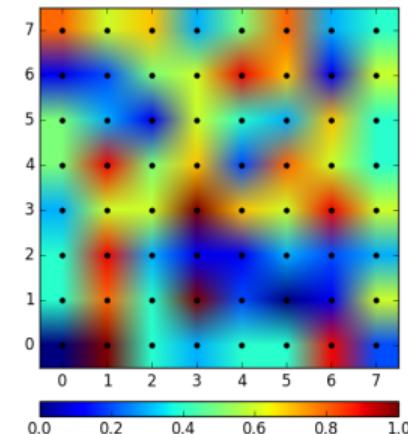
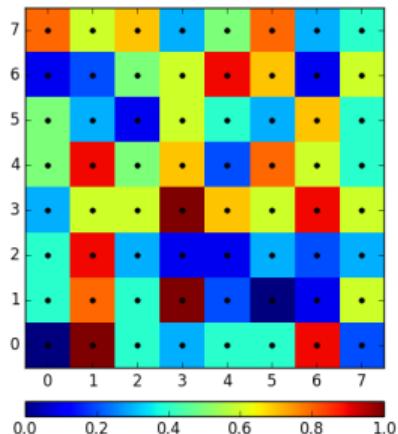
## Interpolation - Bilinear



## Interpolation - Bicubic

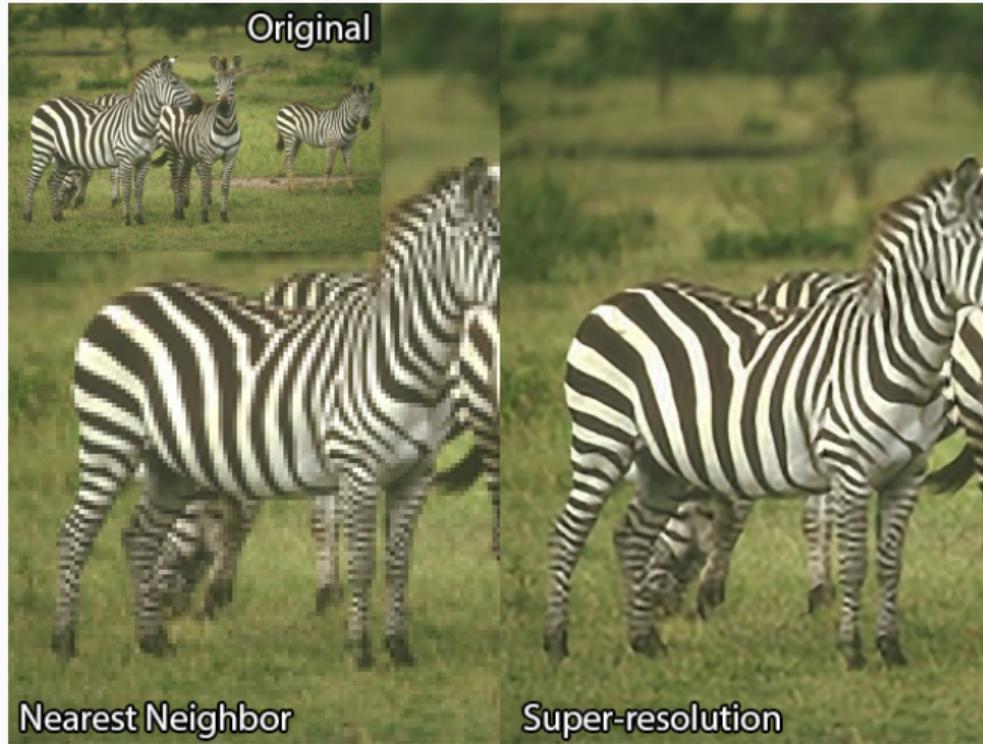


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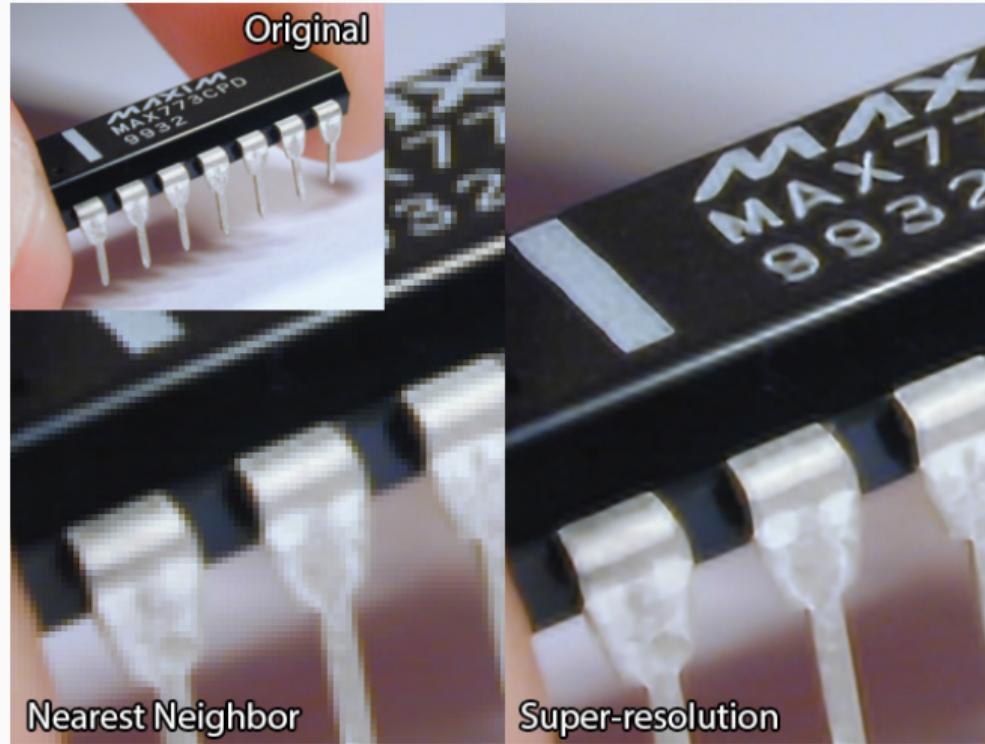


**super-resolution**

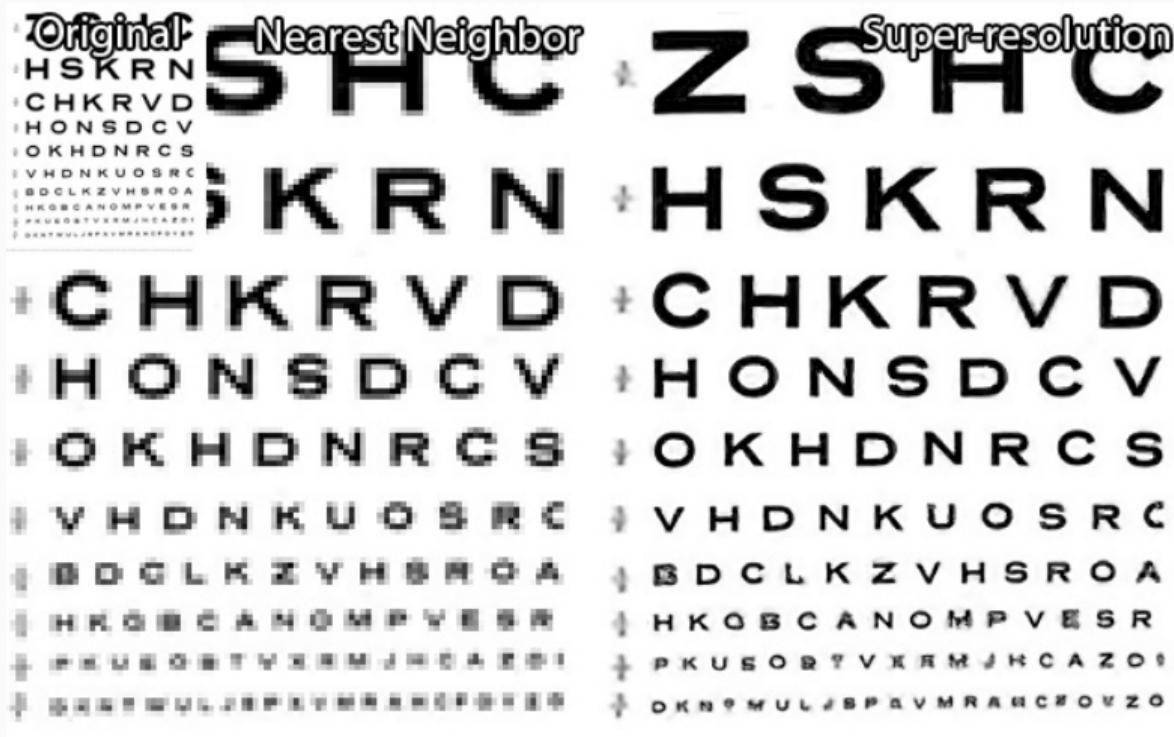
## super-resolution



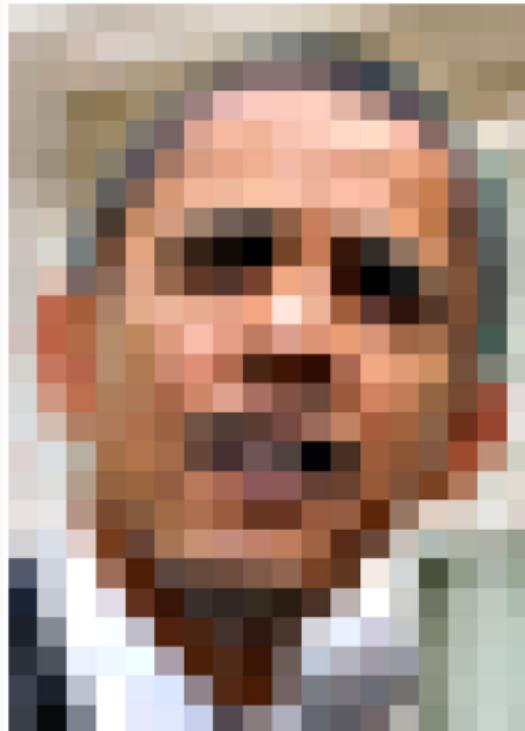
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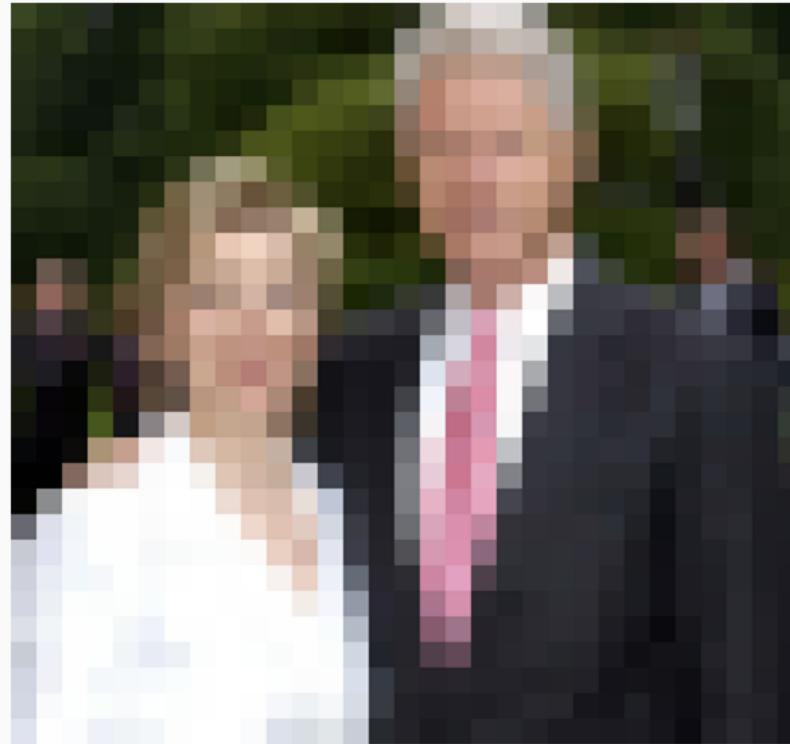
# Was macht unser Gehirn anders?



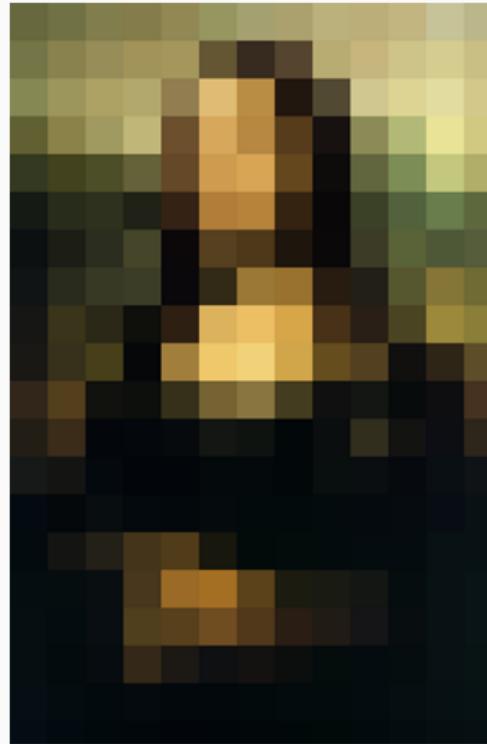
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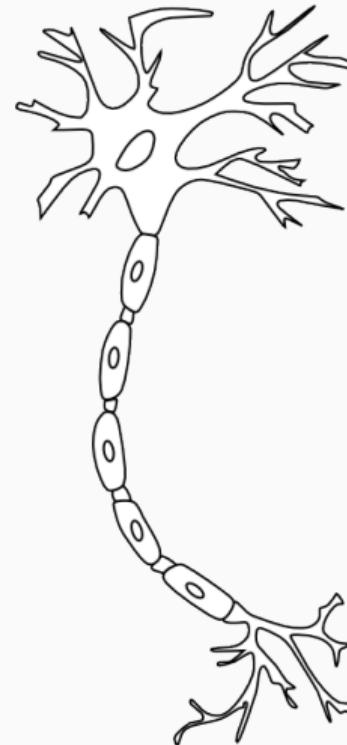
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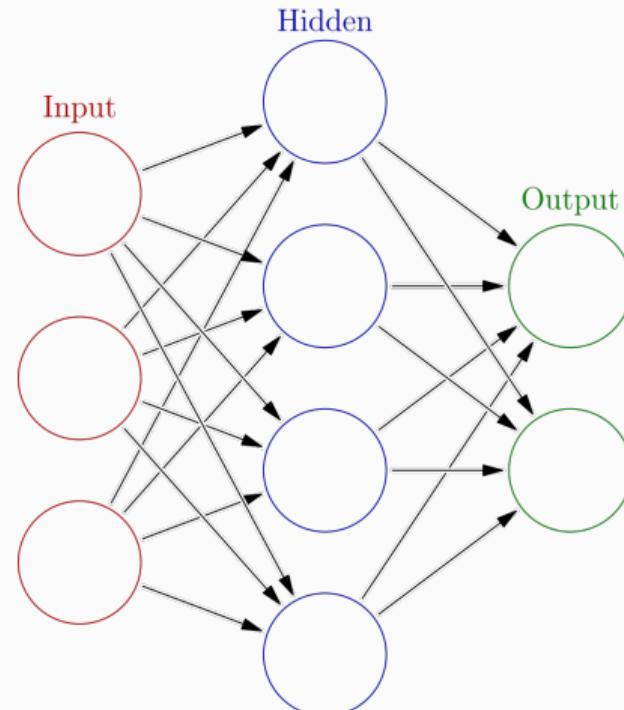
# **Neurale Netze**

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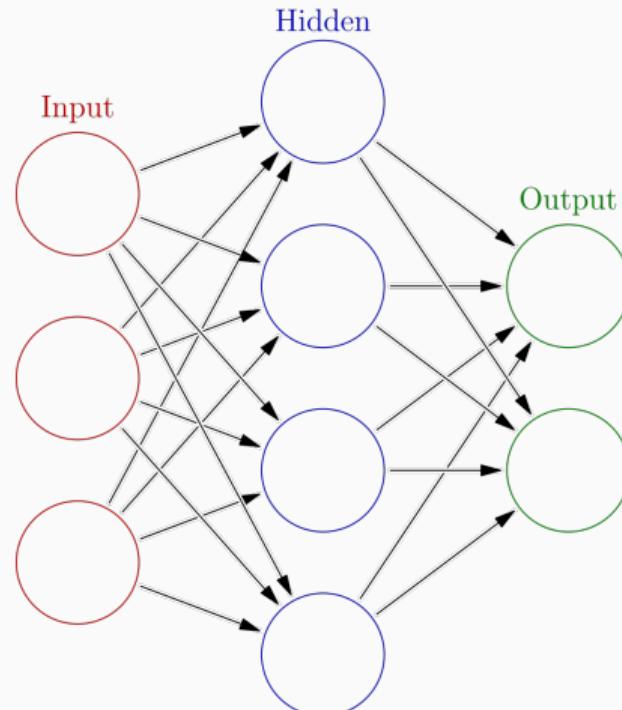
- Modell der Arbeitsweise unseres Gehirns
- Anfänge in den 40er Jahren
- Blackbox
- Trainieren ist erforderlich



# Neurale Netze

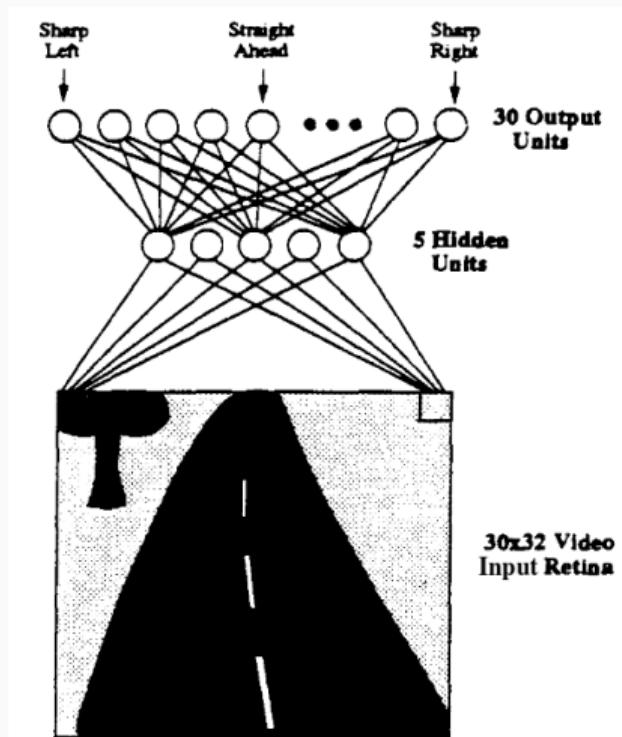


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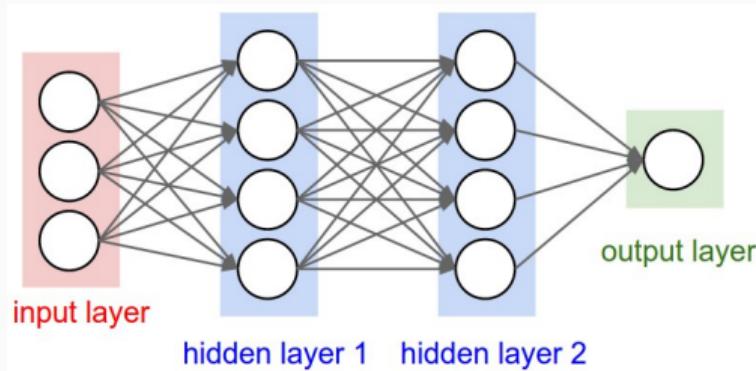
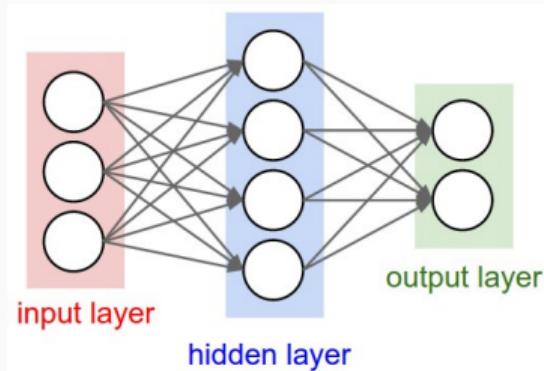


[playground.tensorflow.org](http://playground.tensorflow.org)

# Neurale Netze



# Deep Neural Net

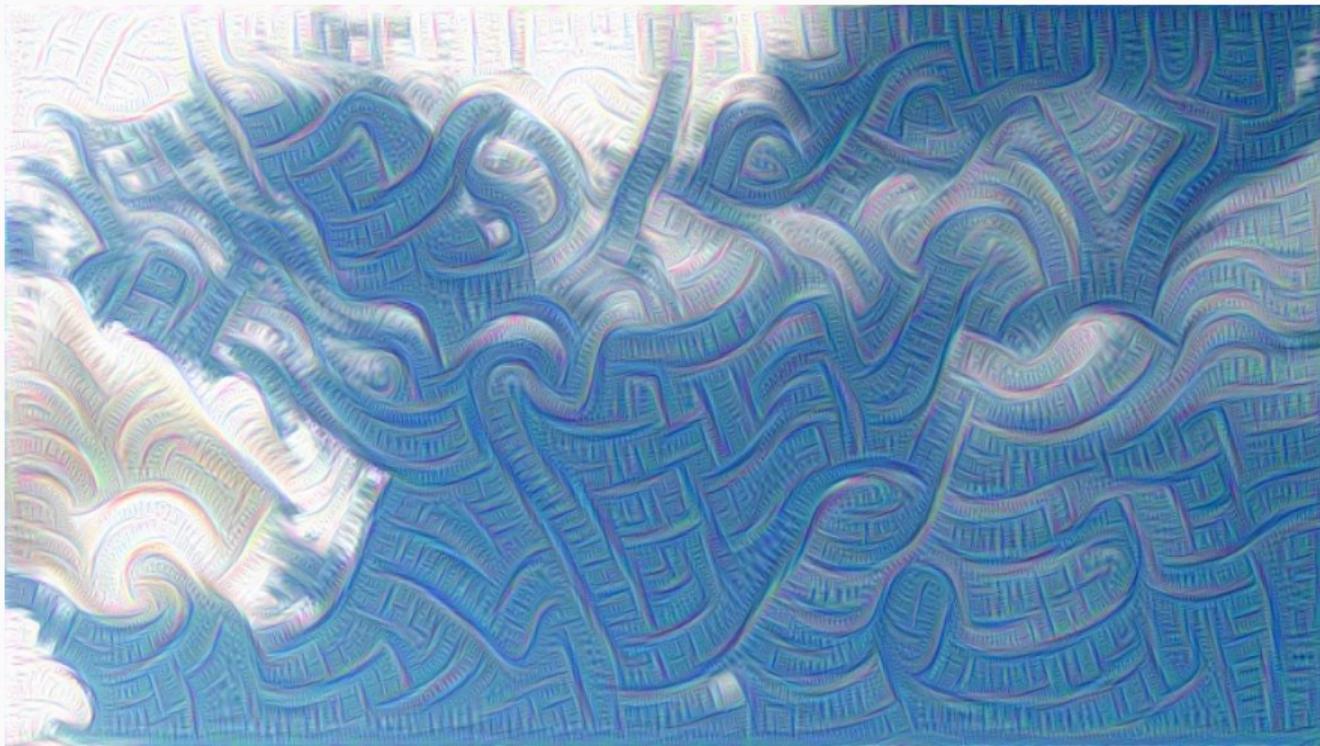


# **Generornetze**

# DeepDream



# DeepDream



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# DeepDream



# DeepStyle



# DeepStyle



# DeepStyle



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# DeepStyle



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**super-resolution through deep learning**

- David Garcia

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- GPU Held (Architektur, Gerätetreiber)

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- ein paar Milliarden Geräte mit seiner Arbeit

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- 27. August 2016 erster commit [github.com/david-gpu/srez](https://github.com/david-gpu/srez)
- 16x16 Pixel → 64x64 Pixel

Let's enhance!

# Training

- Python3 (numpy, scipy, moviepy)

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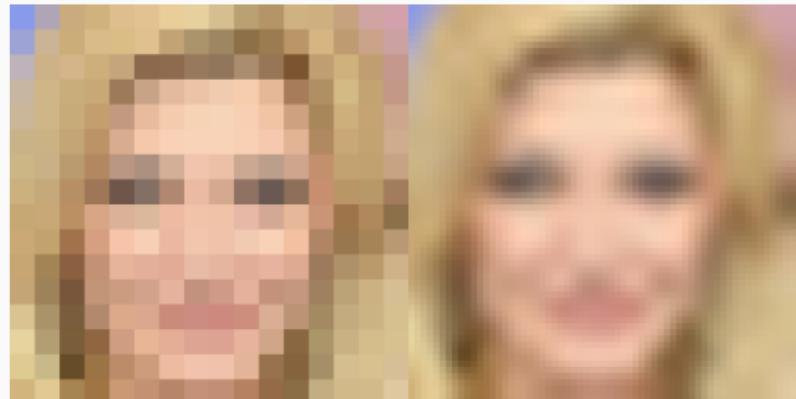
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- Training Set / Test Set
- 9h 970 GTX ca. 160.000 Batches (12 Epochen)

## Beispiel 1 (CelebA)



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## Beispiel 2 (CelebA)



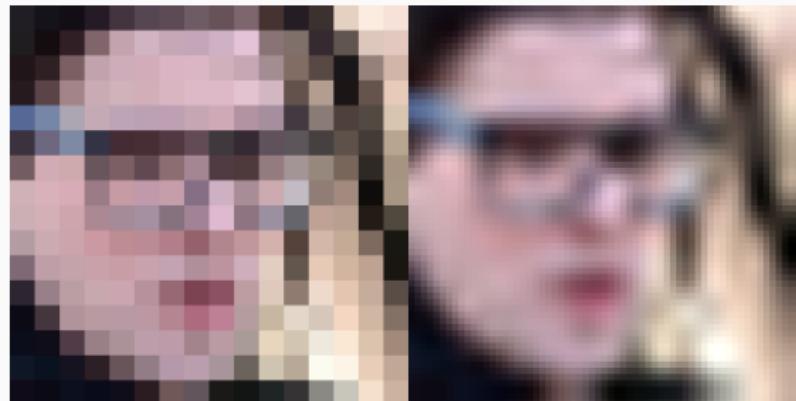
## Beispiel 2 (CelebA)



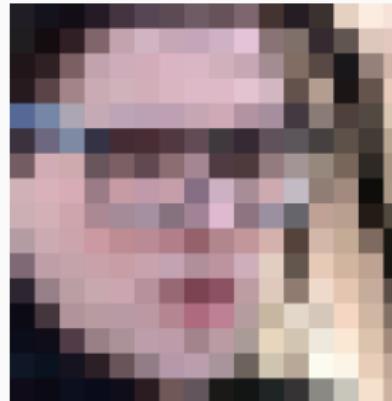
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## Beispiel 3 (CelebA)



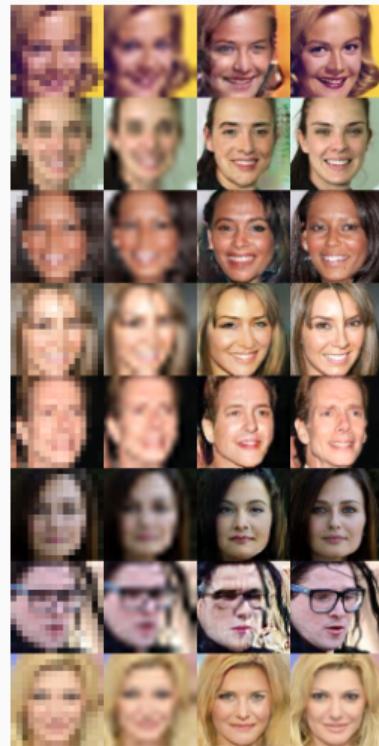
## Beispiel 3 (CelebA)



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## noch mehr Beispiele



# Training Video

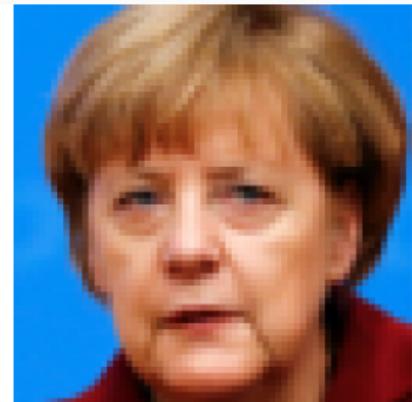
## andere Fotos



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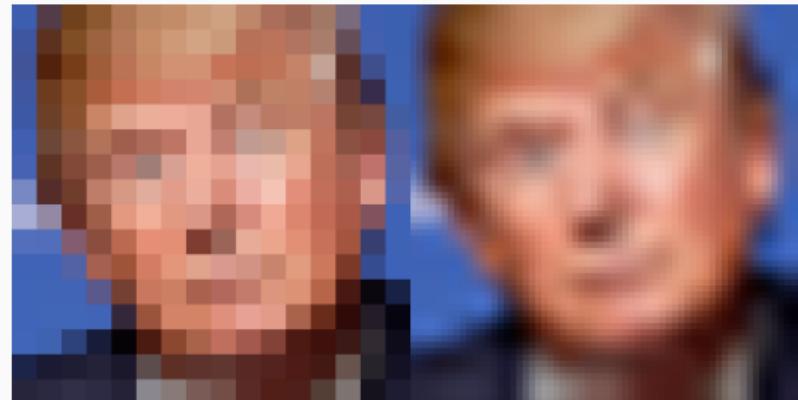
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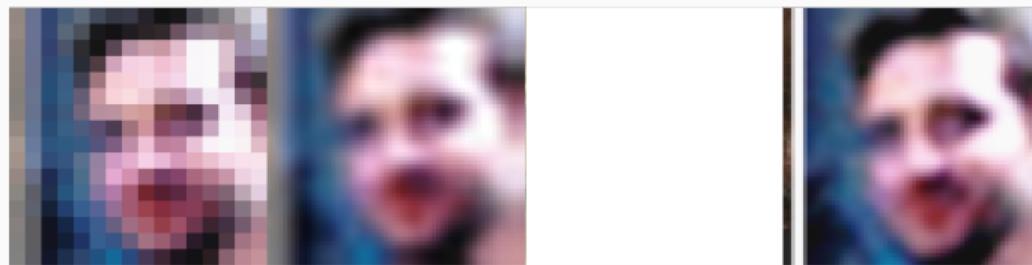
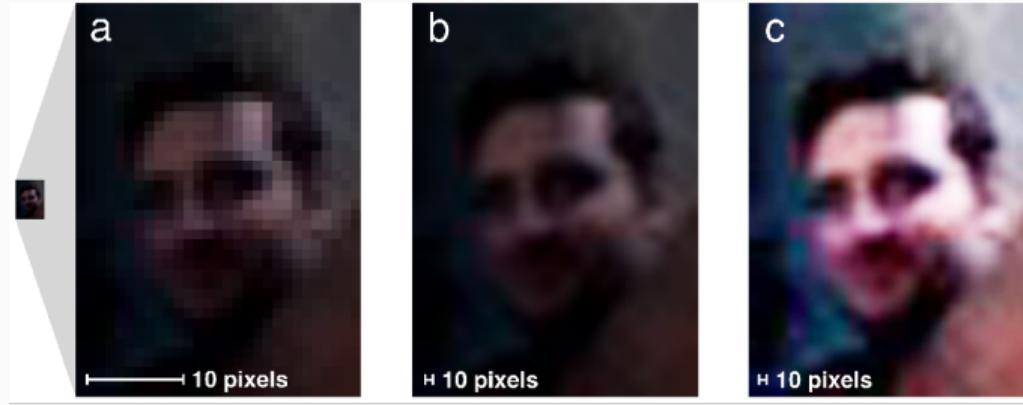
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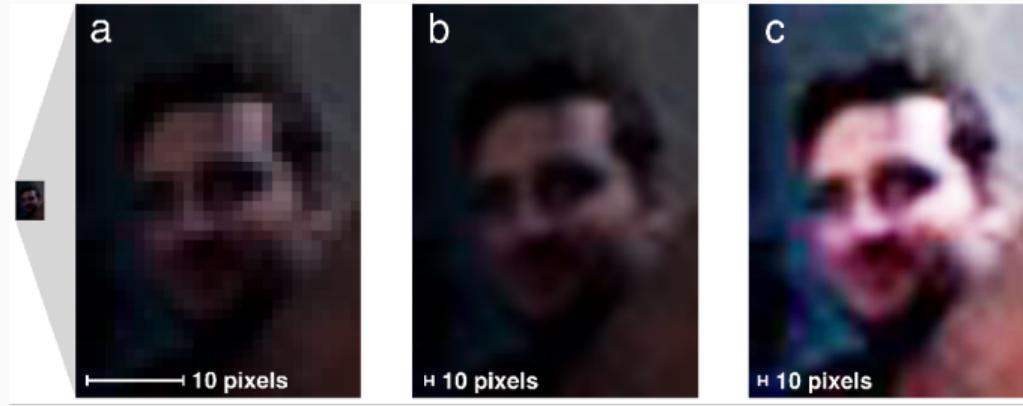
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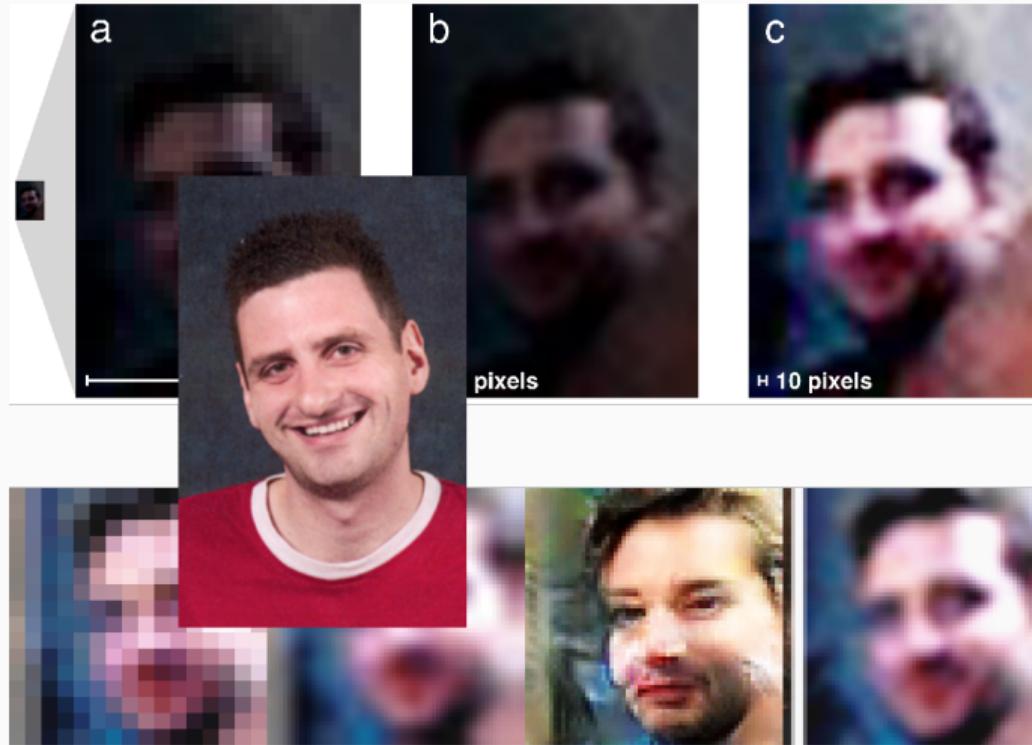
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- Lösung des Problems ist in einer Blackbox

# Danger, Will Robinson!



david-gpu commented on Aug 31

Owner + 😊

| What about city-wide CCTV monitoring?

A number of people have reached out with thoughts like that.

It's a *terrible* idea.

These reconstructions are necessarily inaccurate. If you use them to comb a large facial database you will get lots of false positives. Think about what that means: innocent people who were not there, who had nothing to do with the crime, will be flagged as suspects and, because the justice system is not perfect, some of them will be convicted. When an innocent person is convicted, you are not only punishing an innocent but also you are letting free the actual person who committed the crime.

This isn't science-fiction. DNA fingerprints have been misused in exactly the same manner; while they are accurate to identify a person out of a small number of suspects, they lead to lots of false positives when misused by searching through a large database. Let's not make the same mistakes again.

Now, going back to the original question.

| Would this be possible to use with a IP camera system such as ZoneMinder?

I don't see why not. But keep in mind that security camera footage will be quite different from the dataset that was used to train this system. Different lighting conditions, different angles, different artifacts like noise or glare, etc. It would not work very well unless you can train it with a large database (e.g. a million faces) produced from actual security cameras.

<http://github.com/wose/ds2016>

Danke.

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# Fragen?

<http://github.com/wose/ds2016>