



UNIVERSITÄT ZU LÜBECK  
INSTITUT FÜR  
NEURO- UND BIOINFORMATIK

# Künstliche neuronale Netze

Die Top-Down-Perspektive

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MetaNook 2019  
08.11.2019







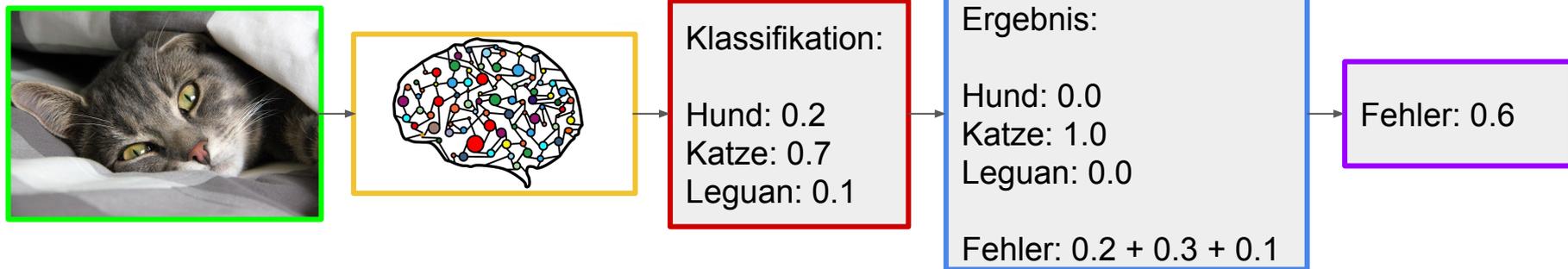
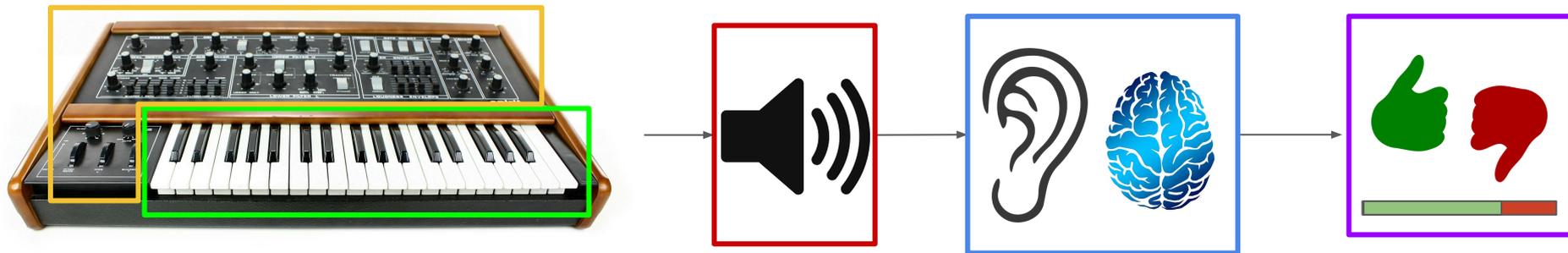
Eingabe

Verarbeitung (Blackbox)

Ausgabe

Bewertungsfunktion

Bewertung



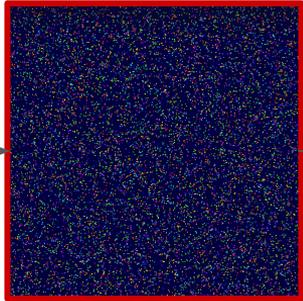
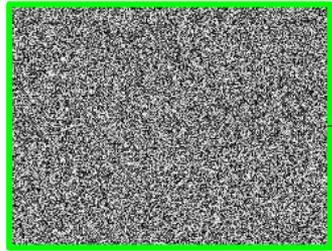
Eingabe

Verarbeitung (Blackbox)

Ausgabe

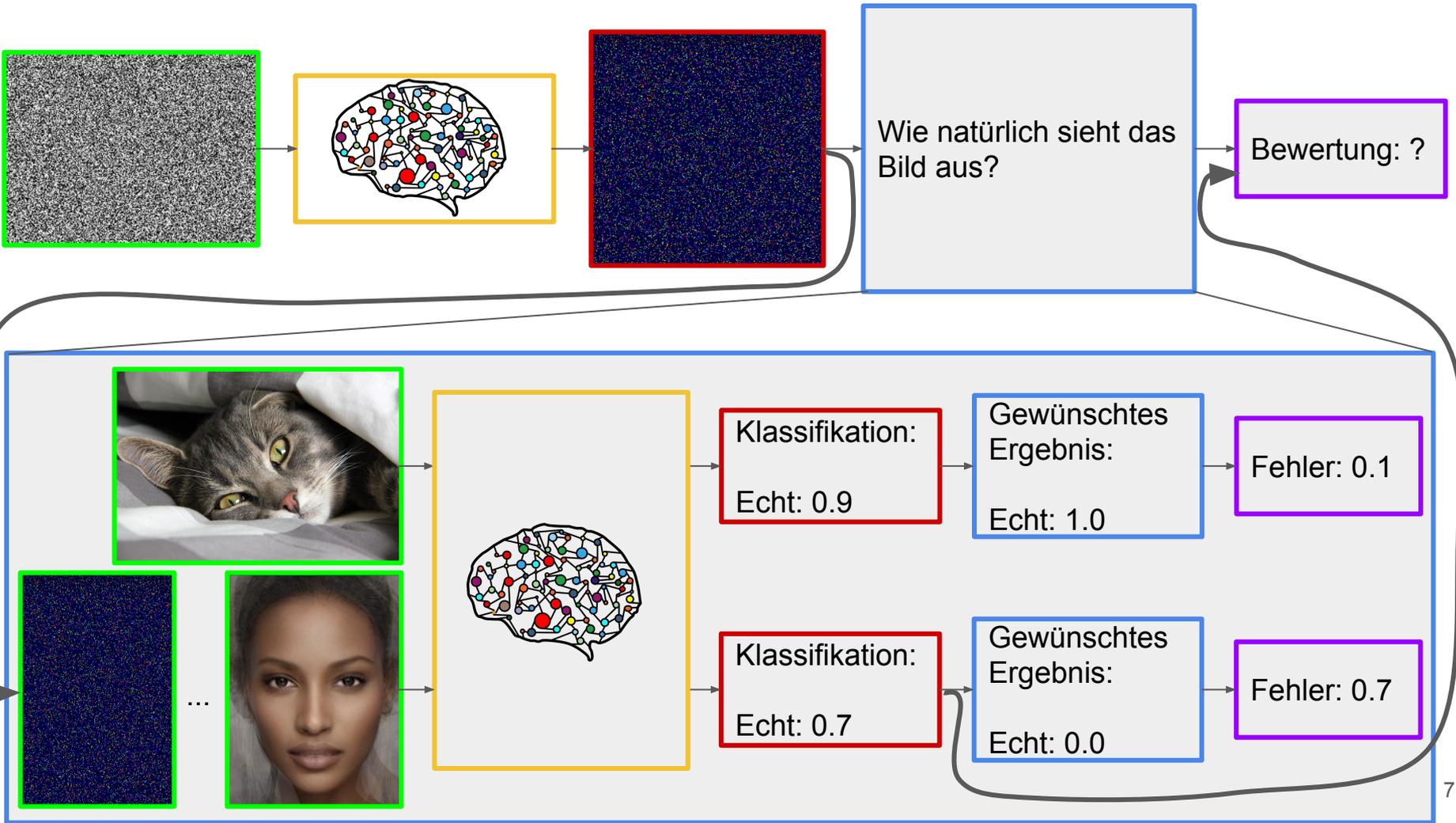
Bewertungsfunktion

Bewertung

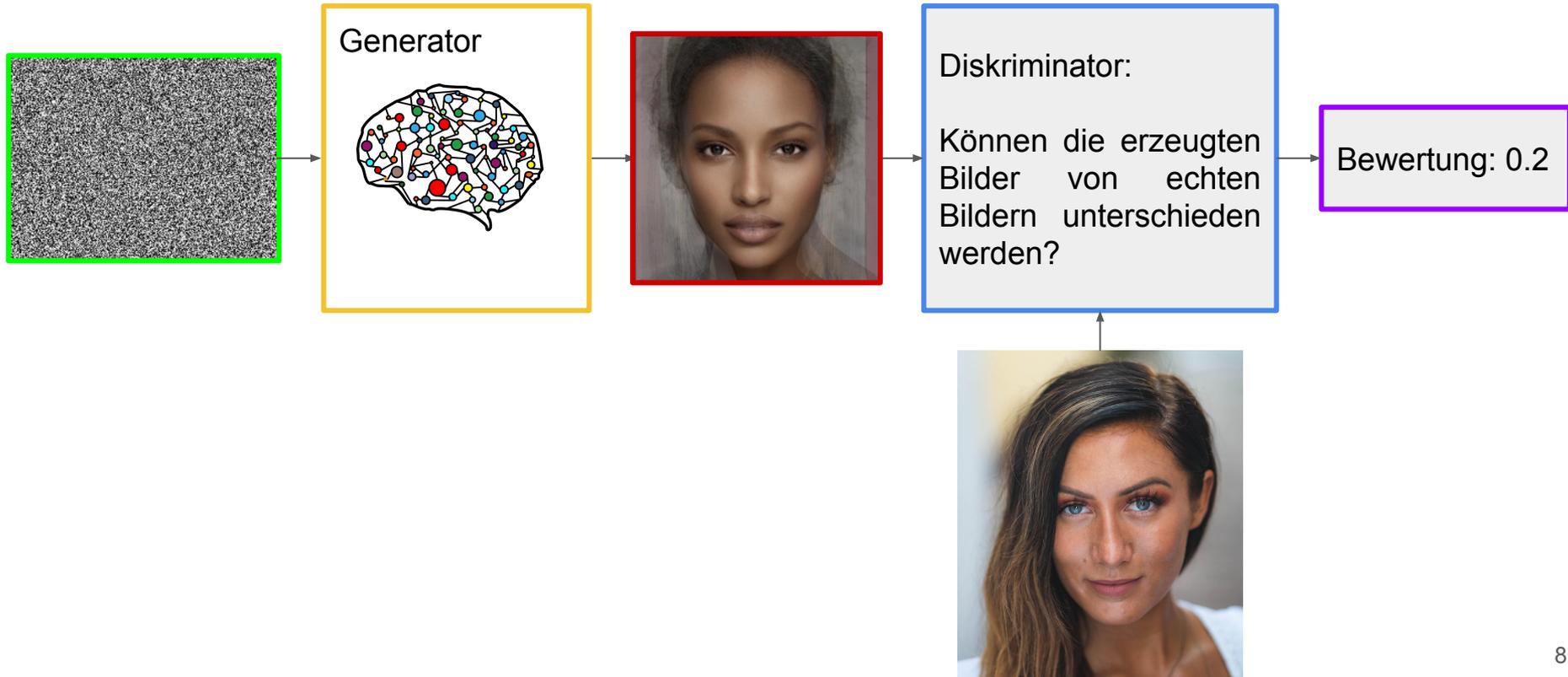


Wie natürlich sieht das Bild aus?

Bewertung: ?



# Generative Adversarial Network (GAN)



# Generative Adversarial Network (GAN)



this**cat**does**not**exist.com



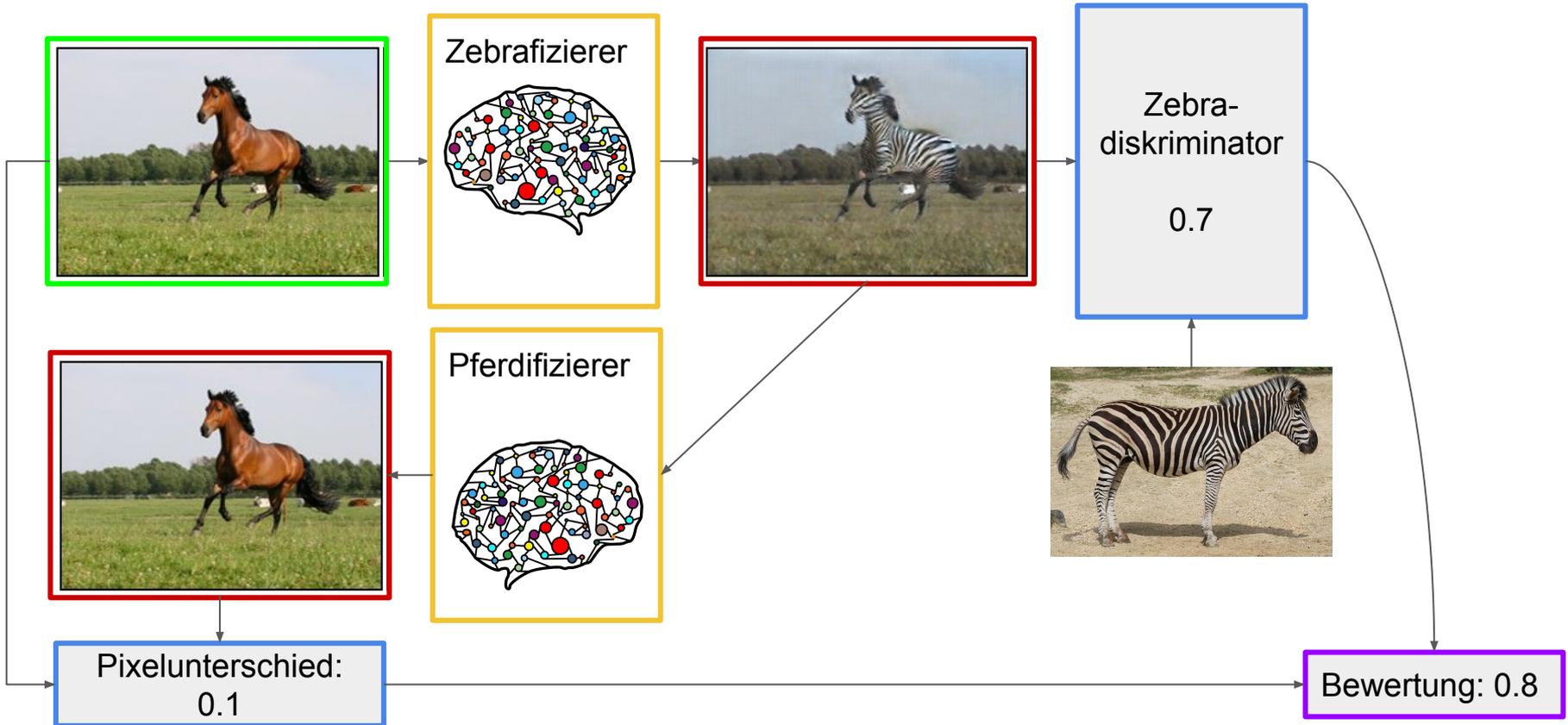
this**person**does**not**exist.com



Wie natürlich sieht das Zebra aus und zeigt das Bild das gleiche Motiv?

Bewertung: ?

# CycleGAN



# CycleGAN

Monet ↔ Photos



Monet → photo

Zebras ↔ Horses



zebra → horse

Summer ↔ Winter



summer → winter

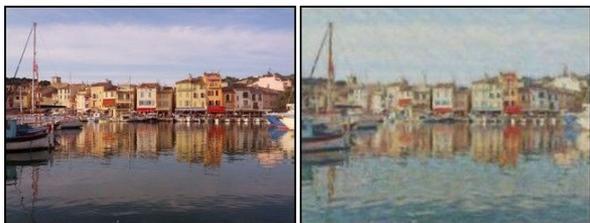


photo → Monet



horse → zebra



winter → summer



Photograph



Monet



Van Gogh

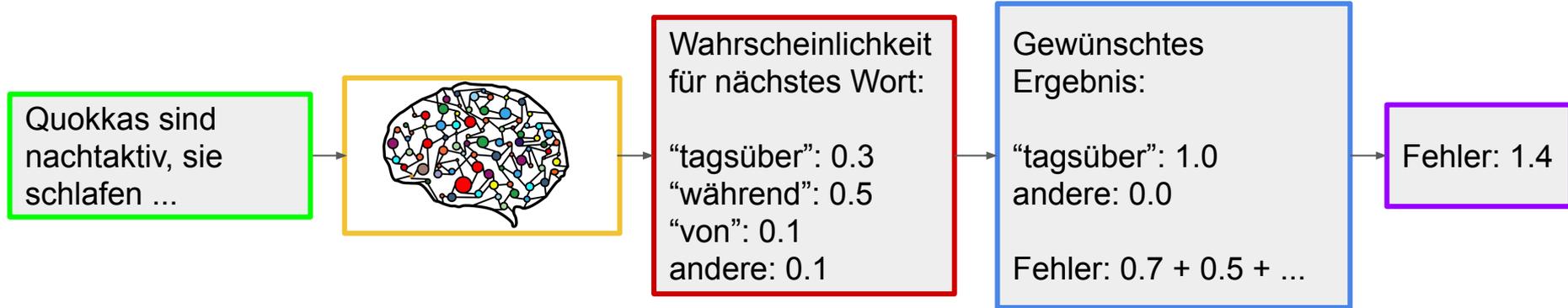


Cezanne



Ukiyo-e

# Language Model



# Language Model

Quokkas sind  
nachtaktiv, sie  
schlafen ...



Wahrscheinlichkeit  
für nächstes Wort:

“tagsüber”: 0.3  
“während”: 0.5  
“von”: 0.1  
andere: 0.1

Gewünschtes  
Ergebnis:

“tagsüber”: 1.0  
andere: 0.0

Fehler:  $0.7 + 0.5 + \dots$

Fehler: 1.4



# Language Model

*Vorgabe:*

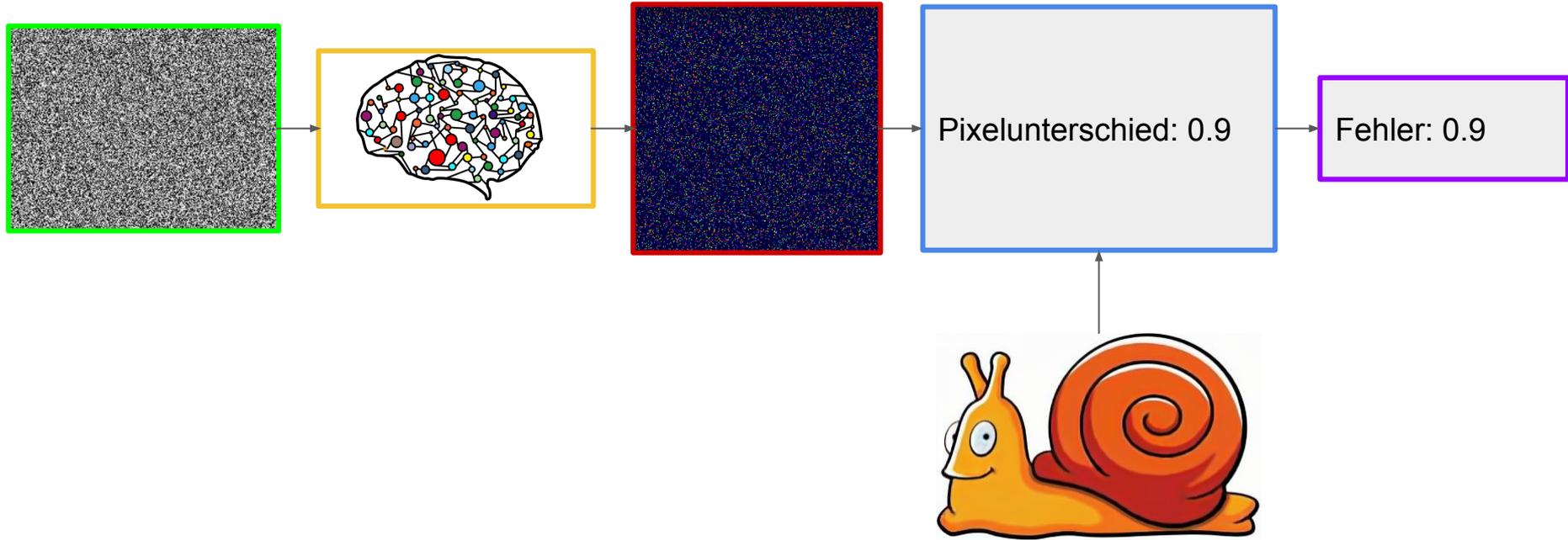
*In a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English.*

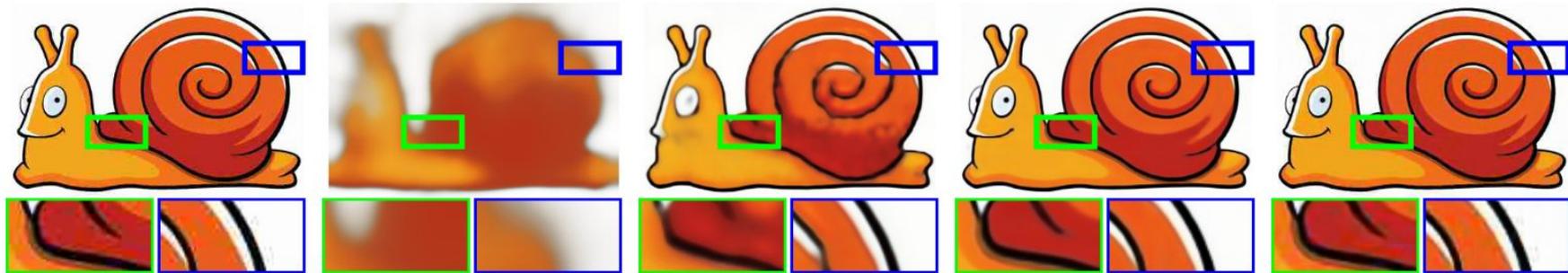
Language-Model-Ausgabe:

The scientist named the population, after their distinctive horn, Ovid's Unicorn. These four-horned, silver-white unicorns were previously unknown to science.

...

# Deep Image Prior (DIP)





Corrupted

100 iterations

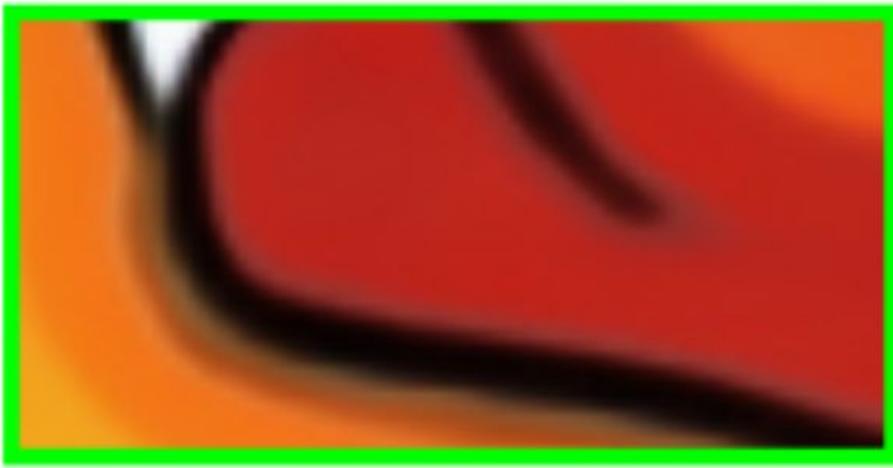
600 iterations

2400 iterations

50K iterations



Corrupted



2400 Lernschritte



50.000 Lernschritte

### JPEG Artifacts removal



Corrupted



Deep image prior

### Inpainting



Corrupted



Deep image prior

### Inpainting



Corrupted



Deep image prior

### Super-resolution



Corrupted



Deep image prior

### Denosing



Corrupted



Deep image prior

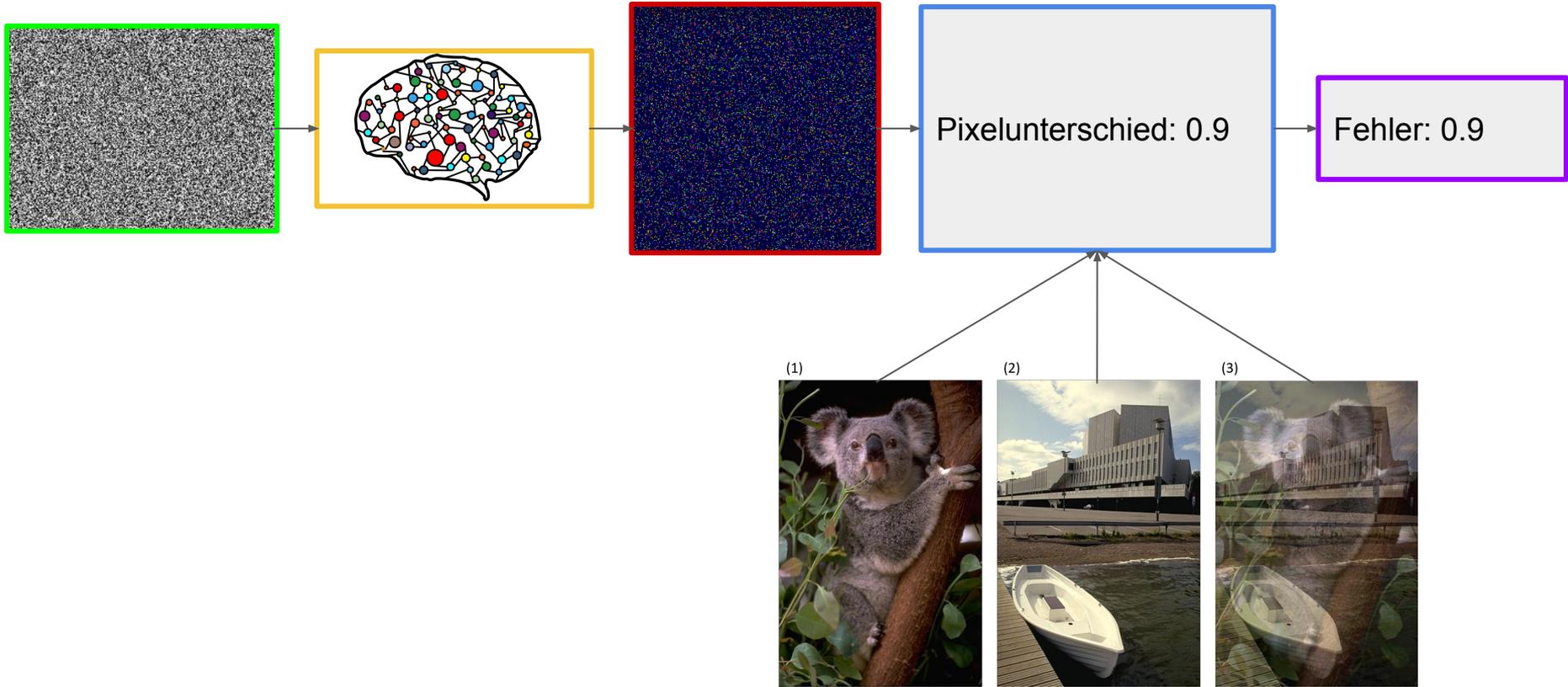
### Inpainting

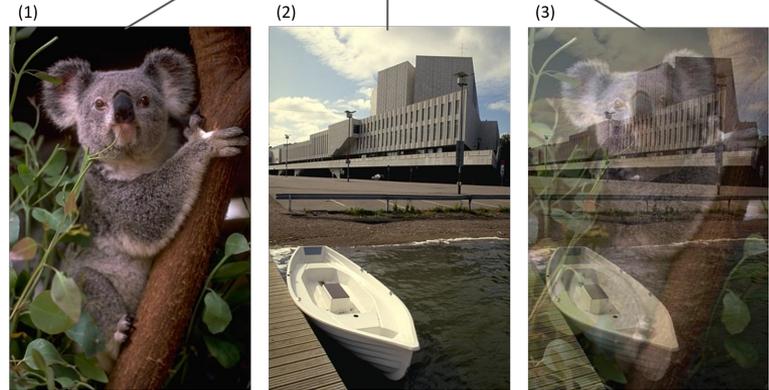
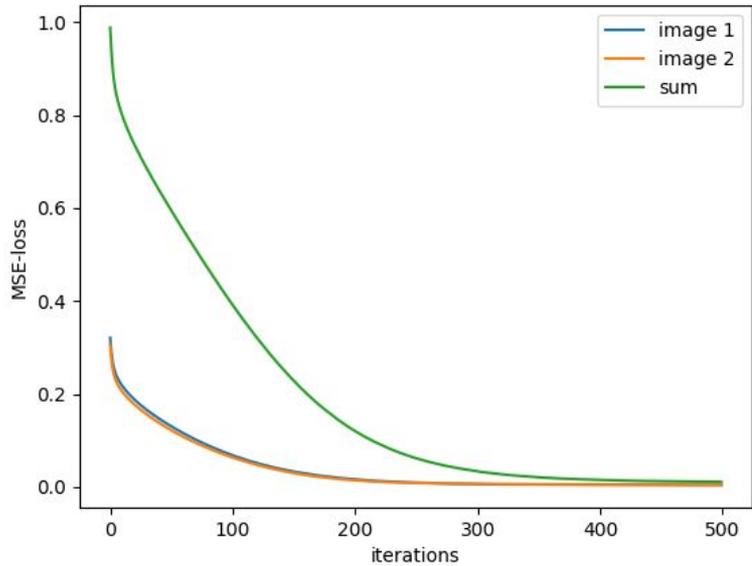
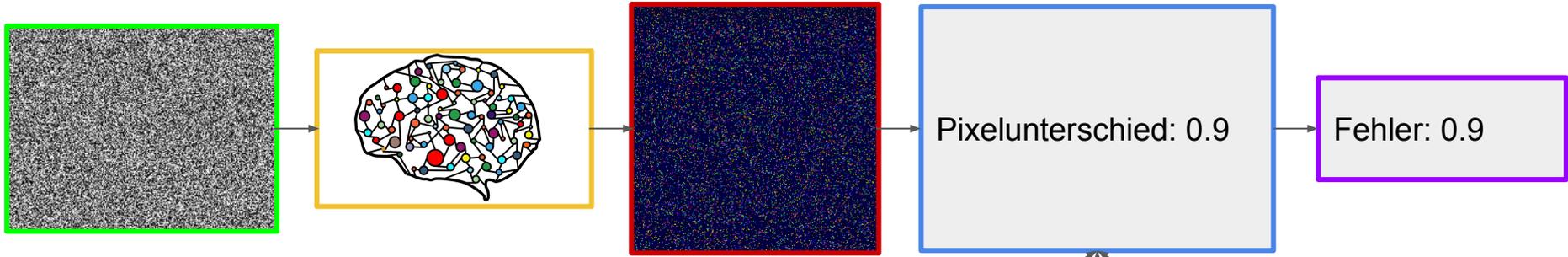


Corrupted

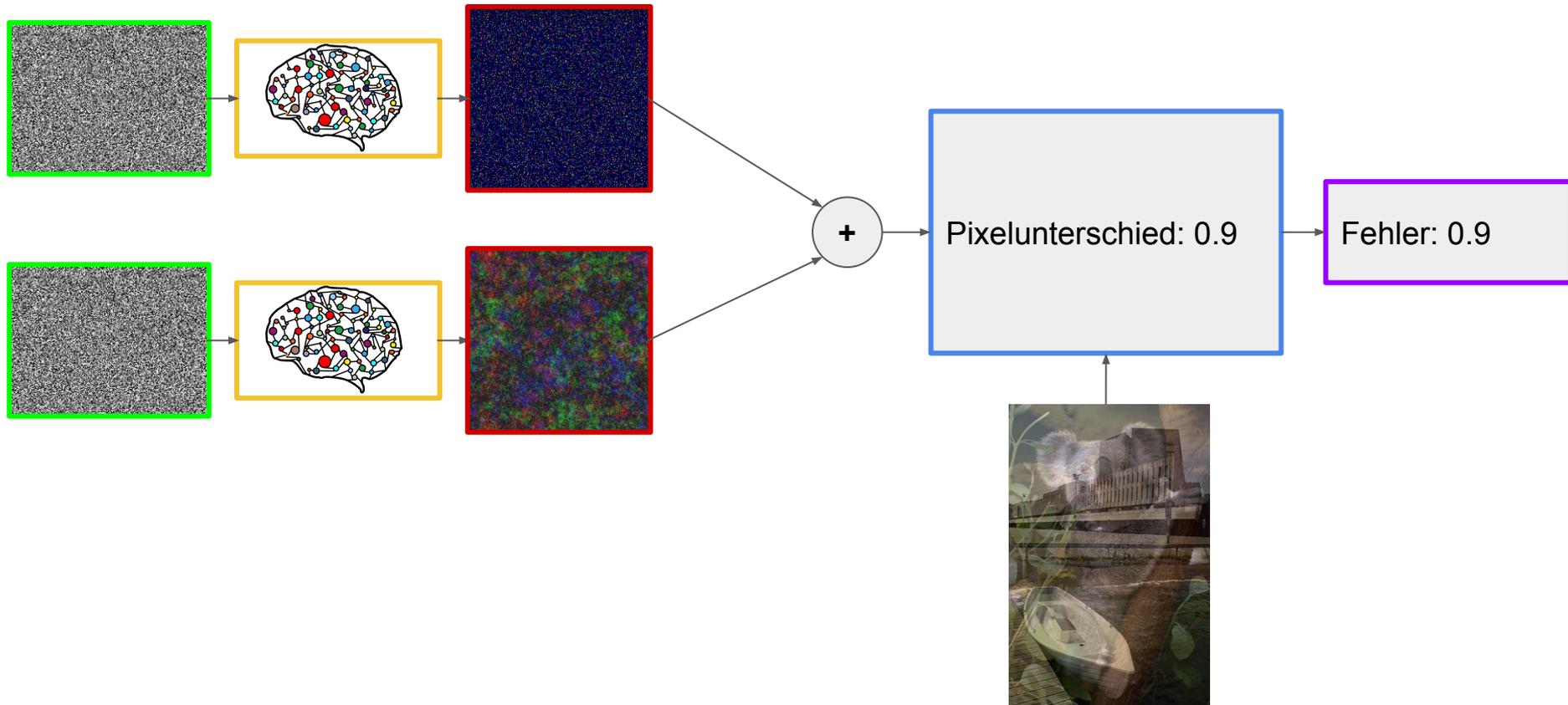


Deep image prior

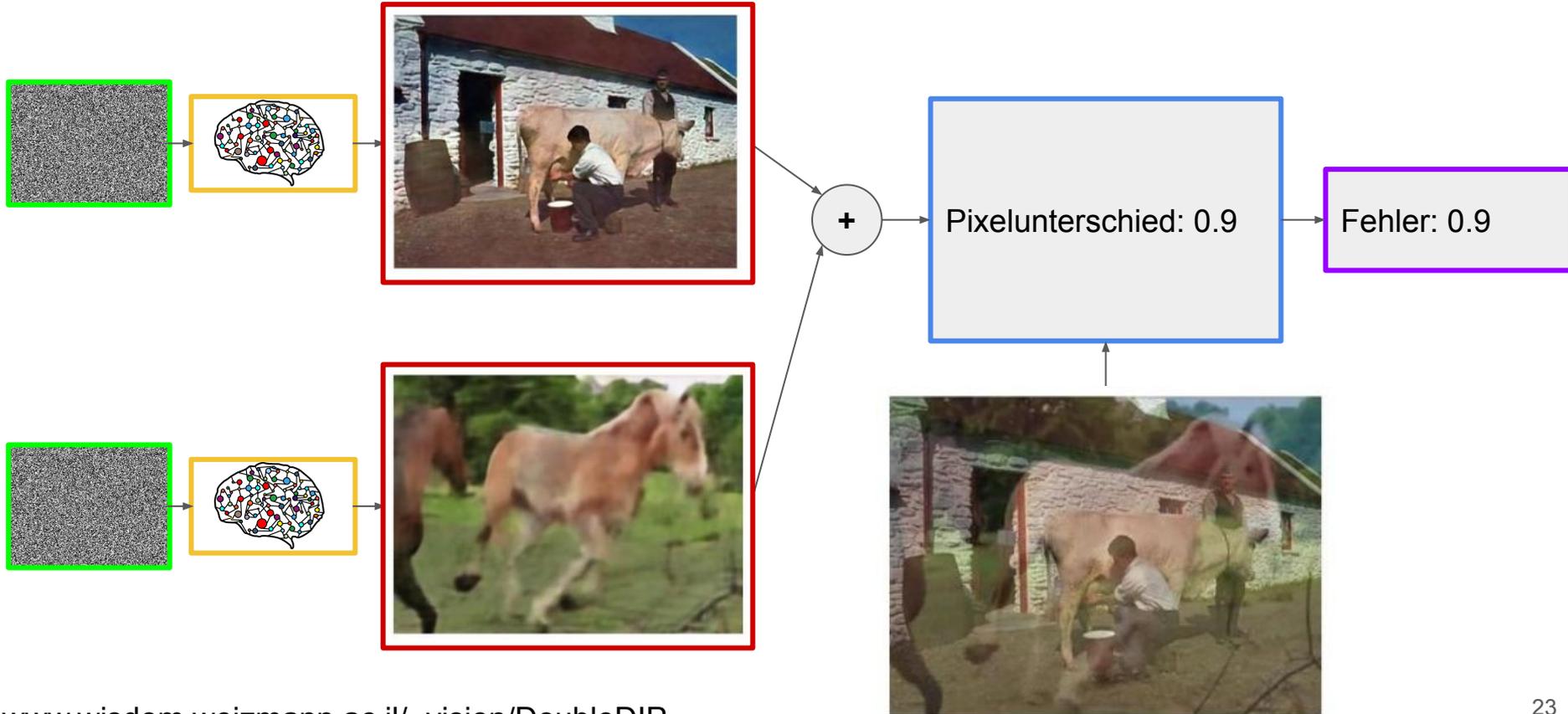




# Double DIP



# Double DIP



# Segmentierung (mit Double DIP)



# Segmentierung (mit Double DIP)



# Segmentierung (mit Double DIP)

**Input Watermarked Images**



**Recovered Images**



**Recovered Watermark**



# Double DIP

## Image Segmentation



=

*Mask*



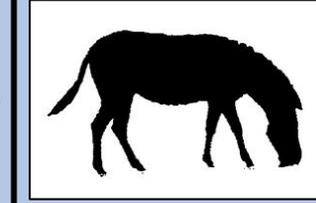
×

*First Layer*



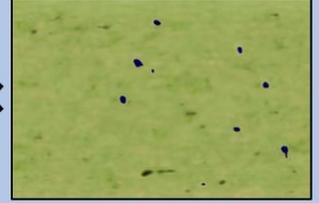
+

*(1 - Mask)*



×

*Second Layer*



## Image Dehazing



=

*Tmap*



×

*Haze-free Image*



+

*(1 - Tmap)*

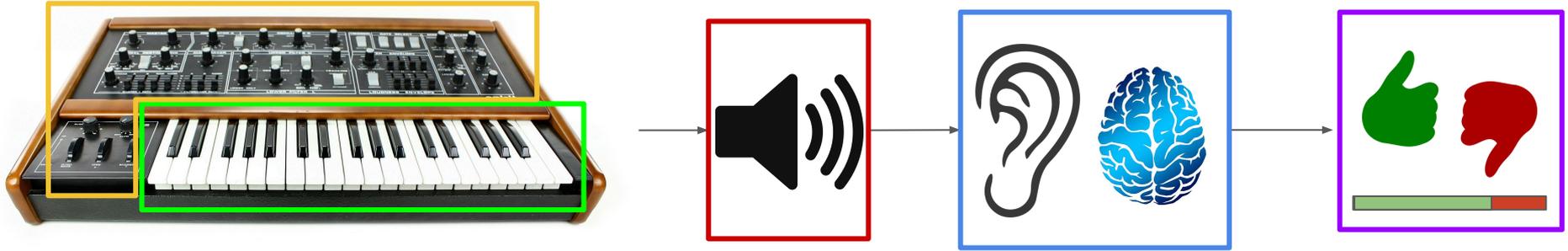


×

*Airlight*



# Zusammenfassung



Eingabe

Verarbeitung (Blackbox)

Ausgabe

Bewertungsfunktion

Bewertung

- Praxis eigentlich immer irgendeine Abwandlung dieser Pipeline
- Kreativität bei Bewertungsfunktion ermöglicht interessante Anwendungen
- Konkrete Gestaltung der neuronalen Netzwerkarchitektur (Blackbox) schwierig, innere Abläufe schwer zu interpretieren