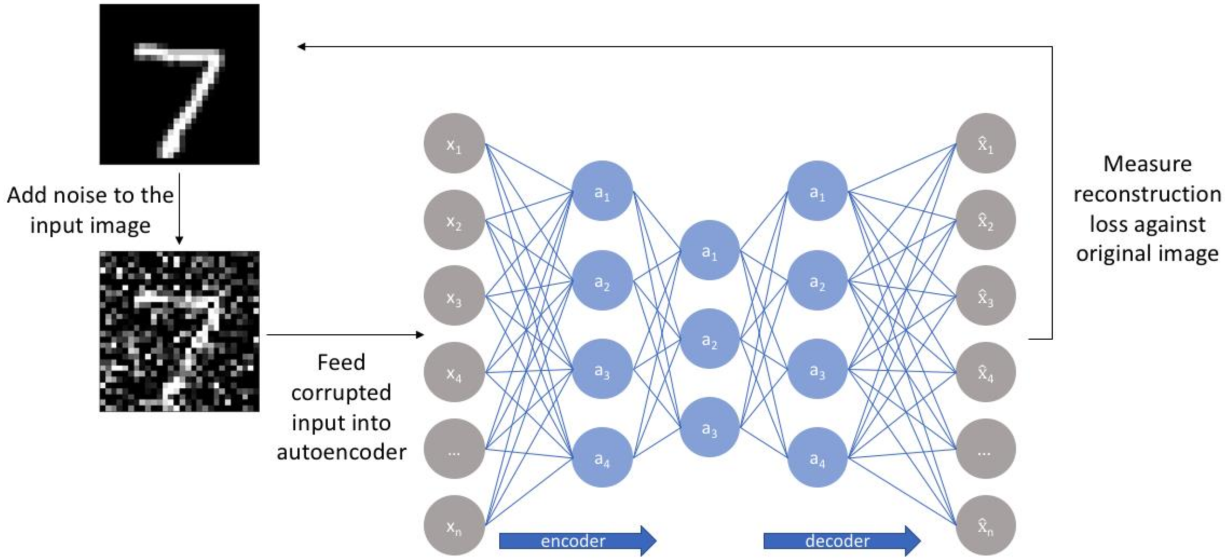
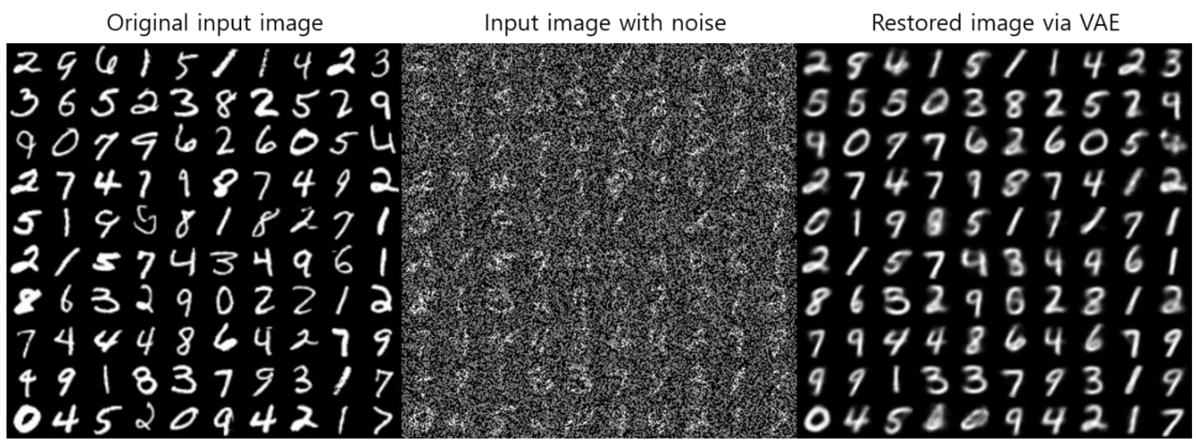
8 Machine Learning III
- Specialized Areas in Machine Learning
(3) Autoencoder

Denoise Autoencoder (DAE)



Ein **Denoise Autoencoder (DAE)** lernt **Rauschen zu entfernen**.



Autoencoders : A Brief Study, 2020
medium.com/@goyal.shubhangi/a-brief-study-autoencoders-517845d51ebd

Which statement is TRUE about Autoencoder?

Art des Wissens / Schwierig-keitsgrad	Abfragewissen (Vorlesung)	Anwendungswissen (Literatur)
Einfach		
Mittel		
Schwierig		

a) Autoencoder apply a **supervised learning technique** to learn efficient **representations of data**.

b) The **Encoder** represents the **reconstruction side**, the **Decoder** represents the **reduction side**.

c) Encoder and **Decoder** only **function together, but not alone**.

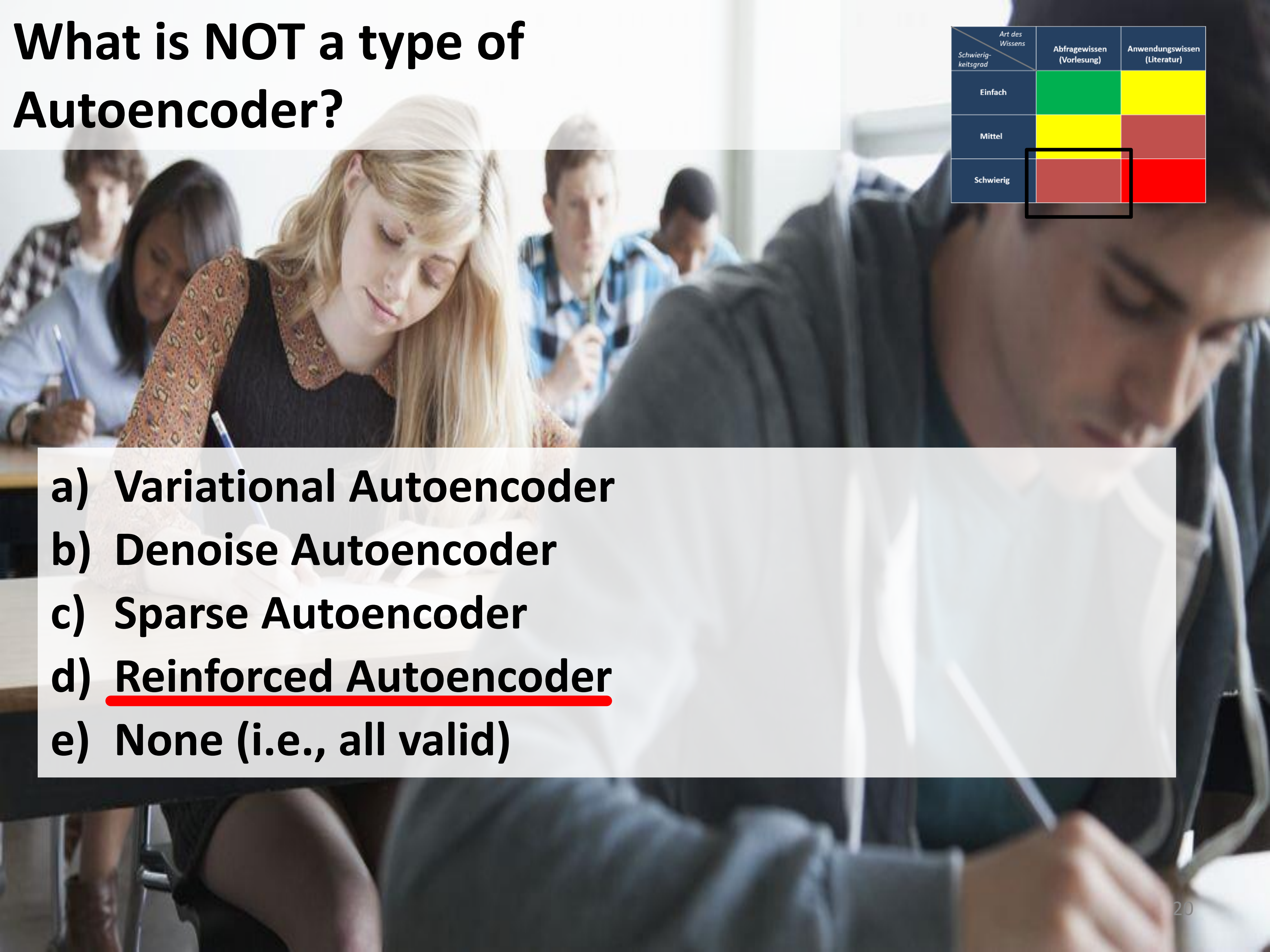
d) Video upscaling is a potential **application** of **Autoencoders**.

e) Encodes and **Decoder work in parallel**.

What is NOT a type of Autoencoder?

Art des Wissens / Schwierig-keitsgrad	Abfragewissen (Vorlesung)	Anwendungswissen (Literatur)
Einfach		
Mittel		
Schwierig		

a) Variational Autoencoder
b) Denoise Autoencoder
c) Sparse Autoencoder
d) Reinforced Autoencoder
e) None (i.e., all valid)



8 Machine Learning III
- Specialized Areas in Machine Learning

Content:

1. **Transfer Learning** & Teachable Machine
2. **YOLO** & Real-Time Object Detection
3. **Autoencoder** & Super Sampling
4. **Generative Adversarial Networks (GAN)**
5. **Reinforcement Learning**
6. **The Human Role** in **Machine Learning Live**
7. **Summary**

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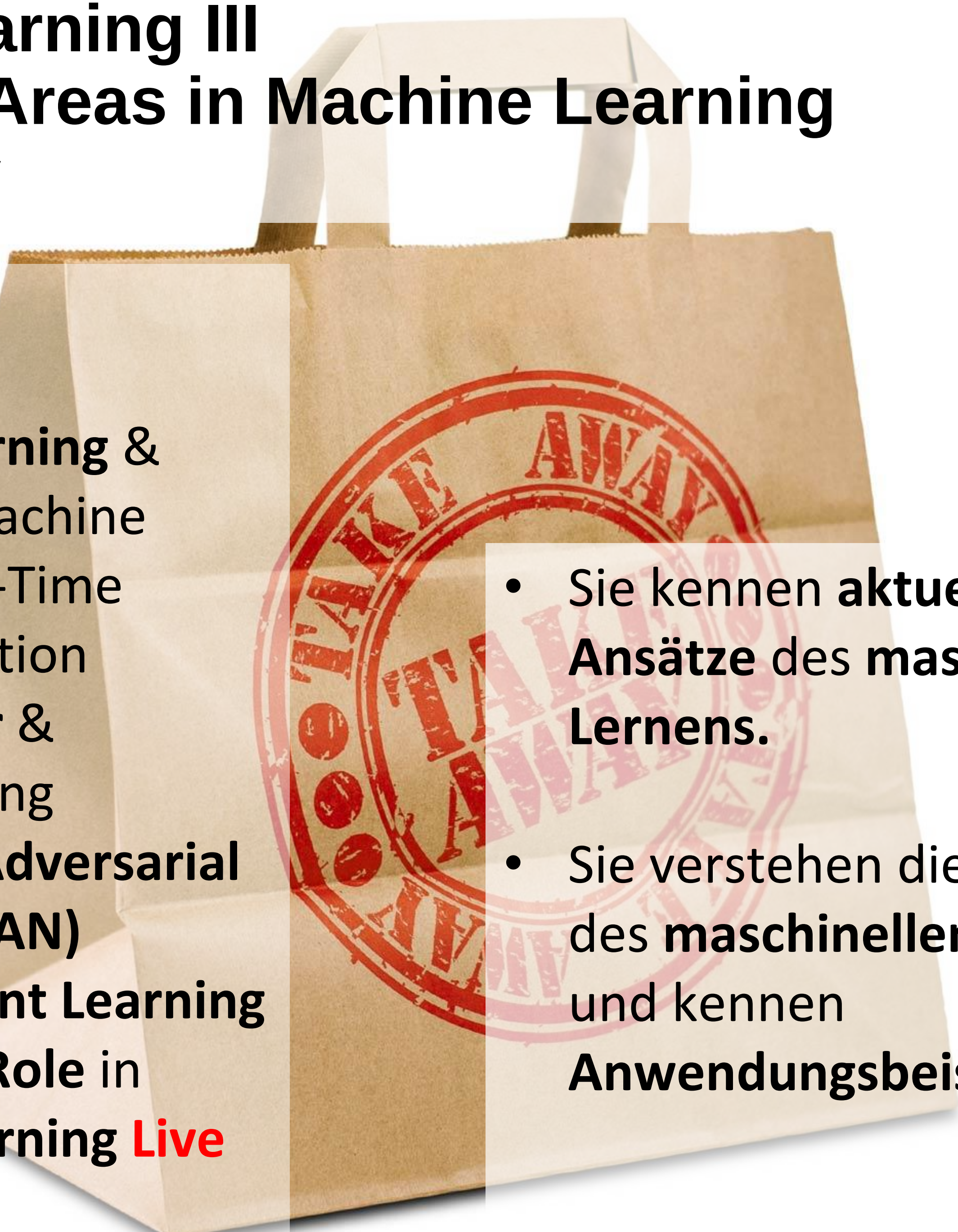
(7) Summary



Content:

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- Sie kennen **aktuelle Ansätze** des **maschinellen Lernens.**
- Sie verstehen die **Ansätze** des **maschinellen Lernens** und kennen **Anwendungsbeispiele**.

Michael Amberg

Todays Content:

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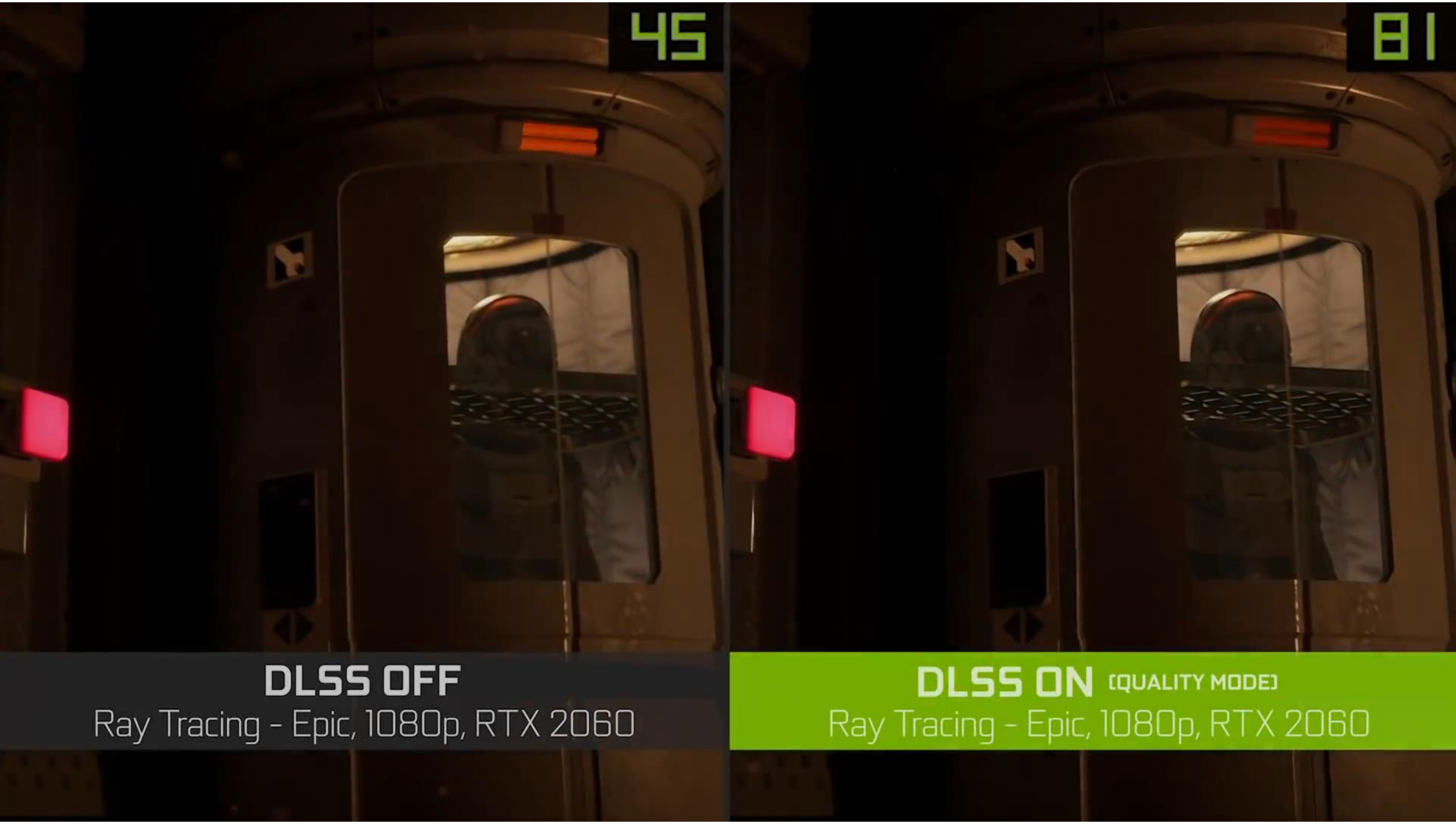
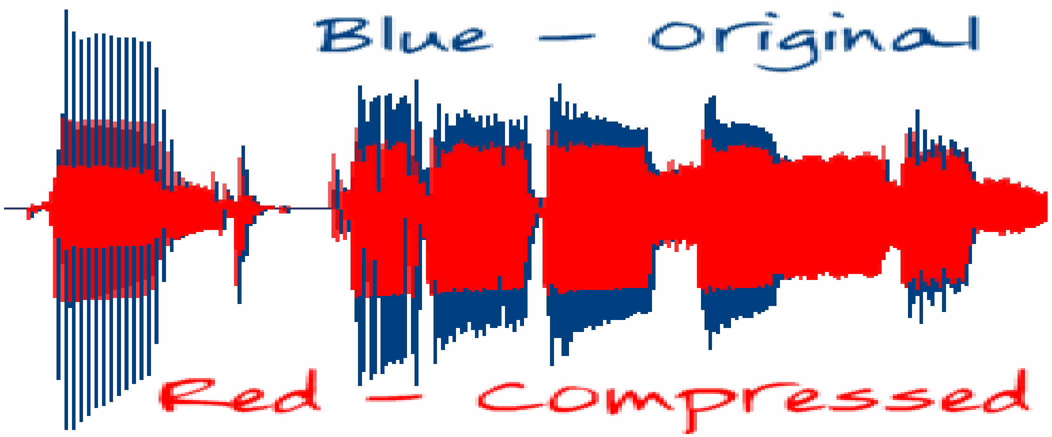
3. Autoencoder



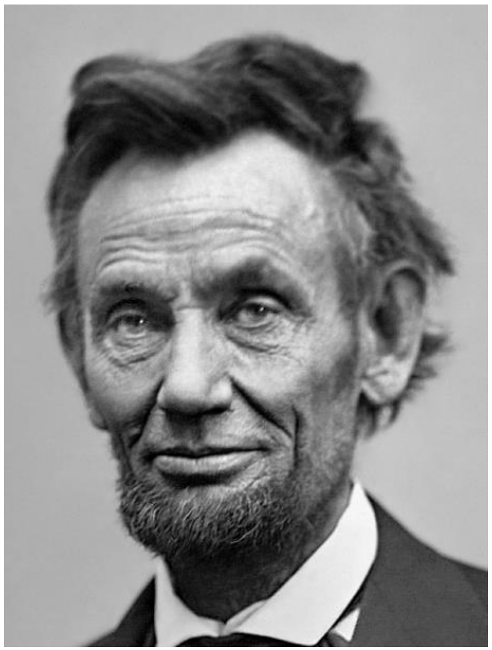
Deliver Us The Moon | NVIDIA DLSS Performance & Image Quality Boost, 2020
www.youtube.com/watch?v=via-LSKo_q4

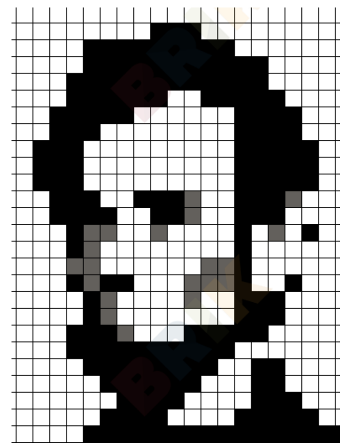
Motivation Autoencoder

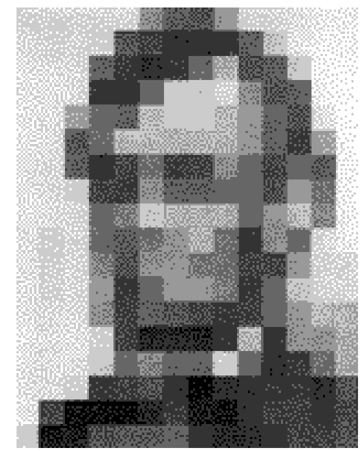
MP3 Audioformat: Verlustlose Kompression



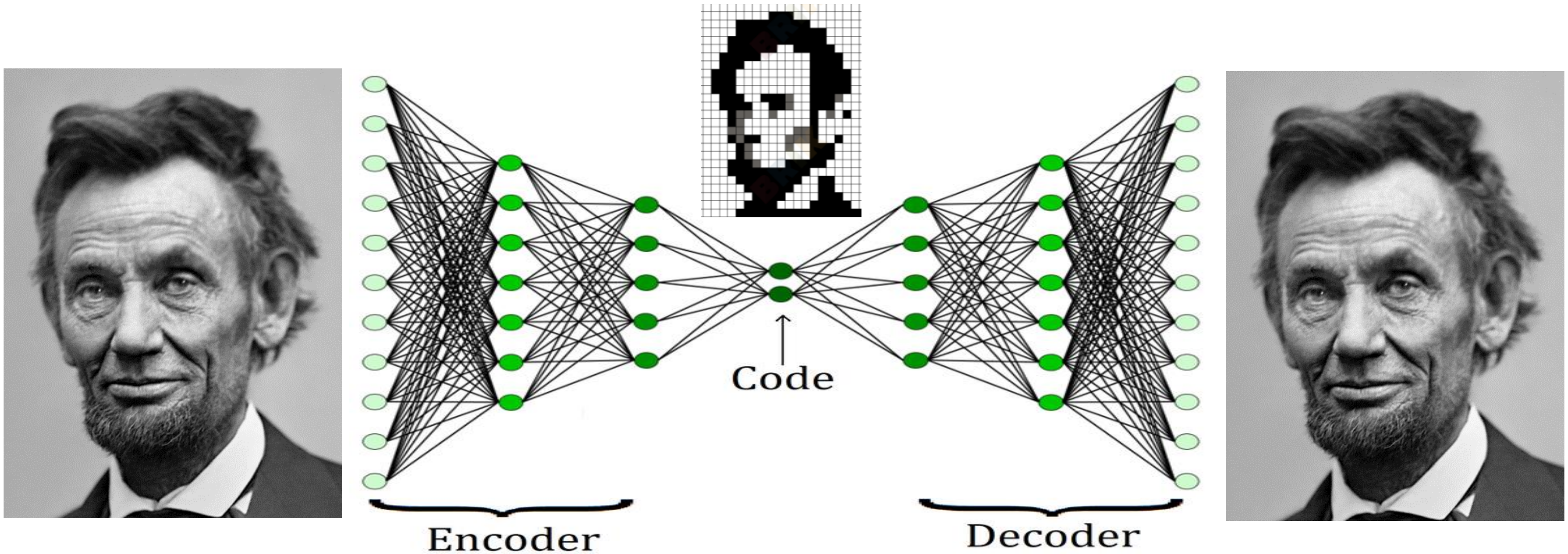
Motivation Autoencoder







Autoencoder

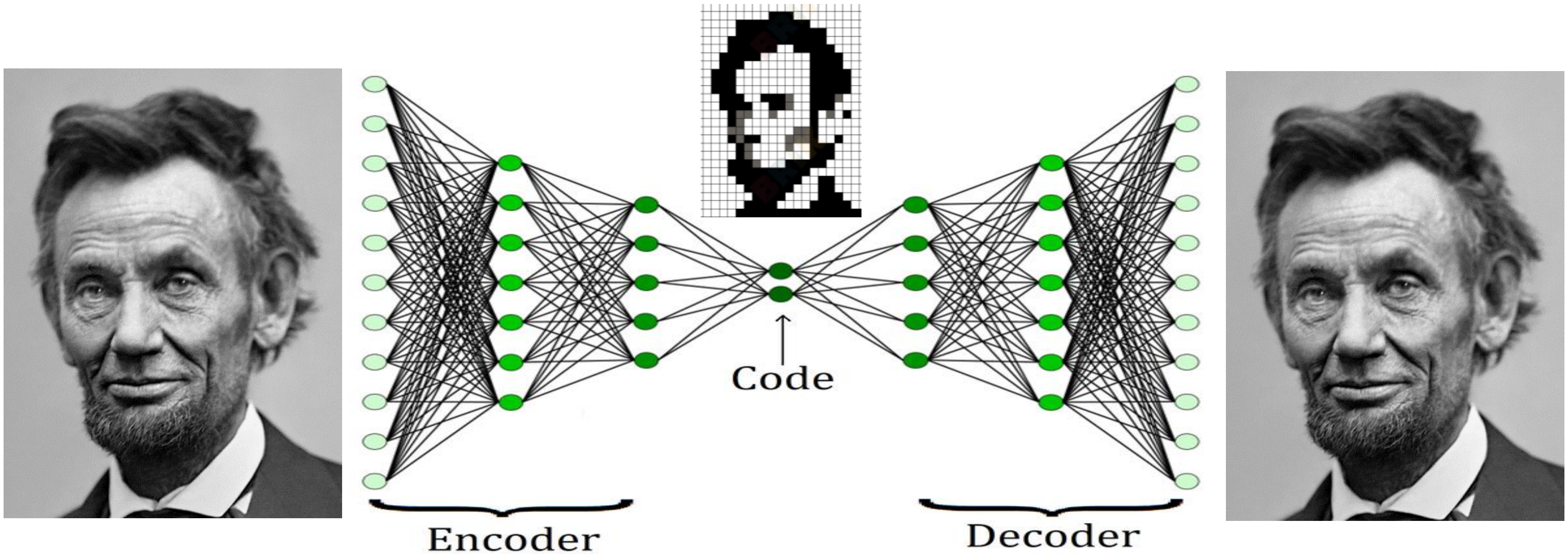


An **Autoencoder** is a type of artificial **neural network** used to **learn efficient data codings** in an **unsupervised manner**.

The aim of an **Autoencoder** is to learn a **representation** (**encoding**) for a **set of data**, typically for **dimensionality reduction**, by training the network to **ignore signal "noise"**.

Along with the **reduction side (Encoder)**, a **reconstructing side (Decoder)** is learnt, where the **Autoencoder** tries to **generate** from the **reduced encoding** a **representation** as **close as possible** to its **original input**, hence its name. (**Wikipedia**)

Autoencoder

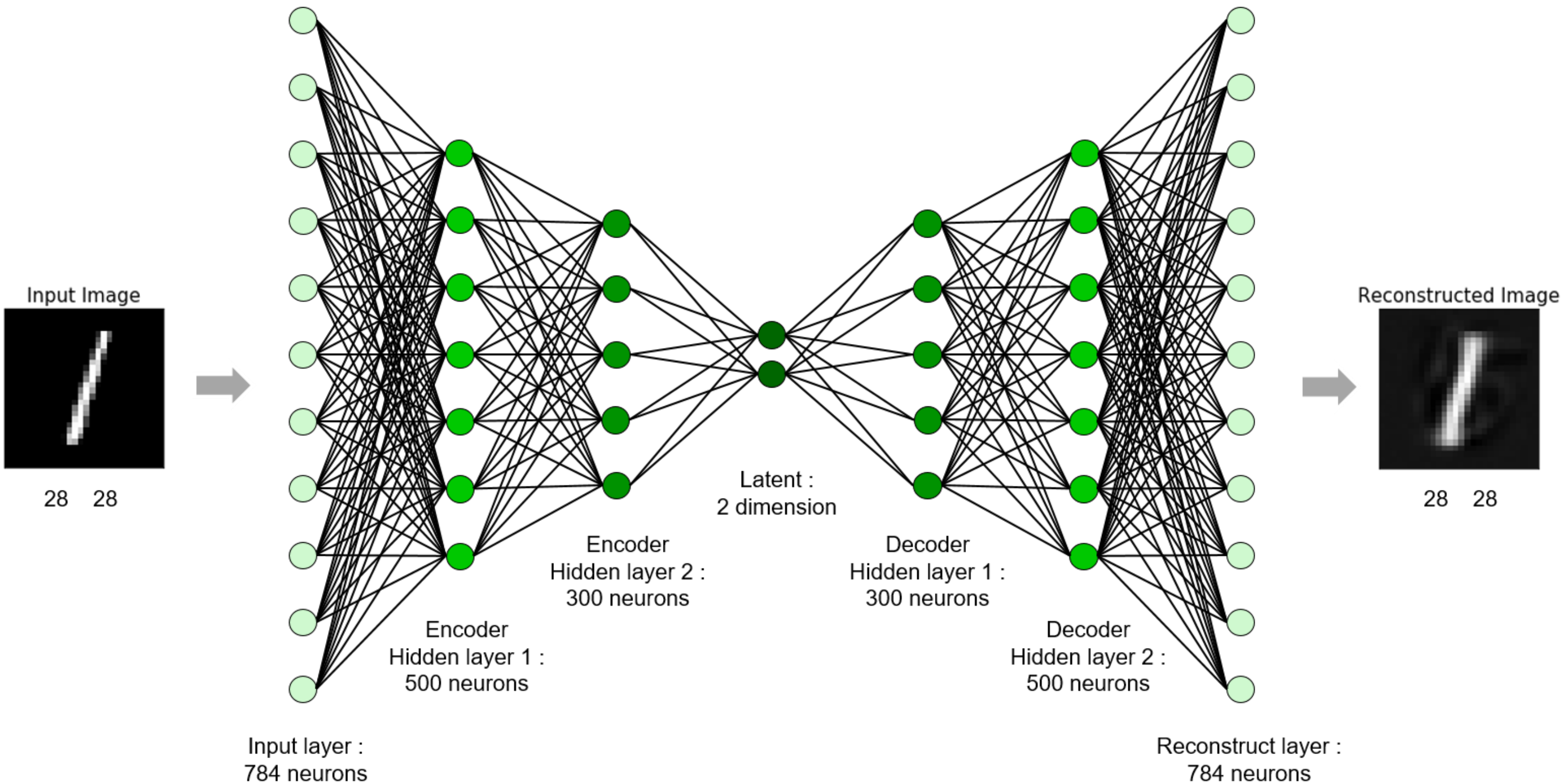


Der **Encoder** nimmt **Rohdaten** (z.B. Bilder oder Audio) und komprimiert die **Daten** auf eine **mehrfach kleinere Menge**.

Der **Decoder** nimmt diese **kleine Menge an Daten** und versucht daraus das **Original** wieder herzustellen.

Weil das **Modell Ende-zu-Ende trainiert** wurde, funktionieren sowohl **Decoder** und **Encoder** auch einzeln, z.B. nur **Encoder** oder **Decoder**, (vgl. **MP3, Video-Upscaling**).

Autoencoder

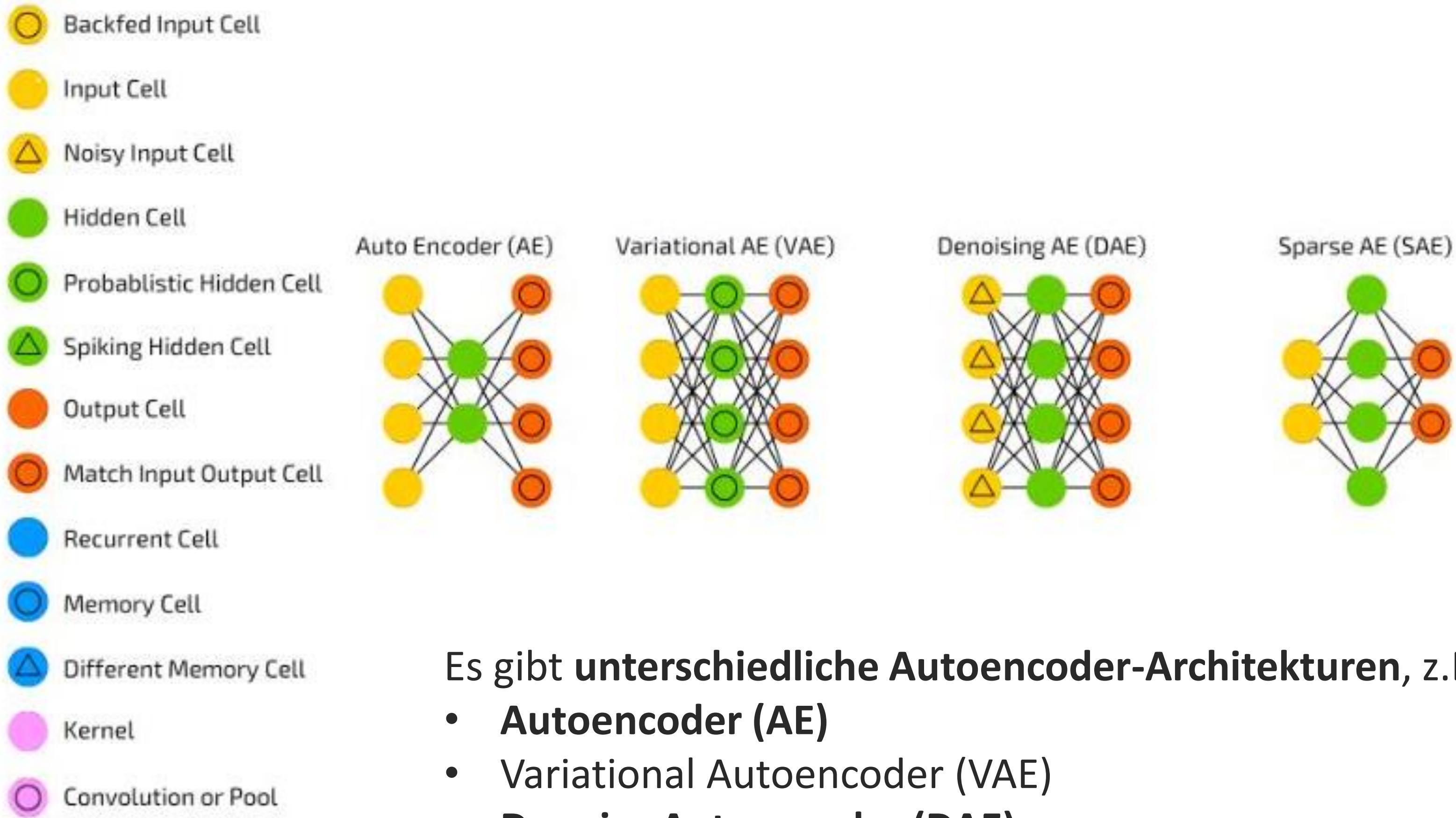


The ideal **Autoencoder** model balances the following:

- **Sensitive** to the **inputs enough** to **accurately** build a **reconstruction**.
- **Insensitive enough** to the **inputs** that the **model** doesn't simply memorize or **overfit** the **training data**.

Introduction to Autoencoders, 2018
www.jeremyjordan.me/autoencoders/

Autoencoder Architectures



Es gibt **unterschiedliche Autoencoder-Architekturen**, z.B.:

- **Autoencoder (AE)**
- Variational Autoencoder (VAE)
- **Denoise Autoencoder (DAE)**
- Sparse Autoencoder (SAE)
- **Convolutional Autoencoder**

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medium.com/@goyal.shubhangi/a-brief-study-autoencoders-517845d51ebd

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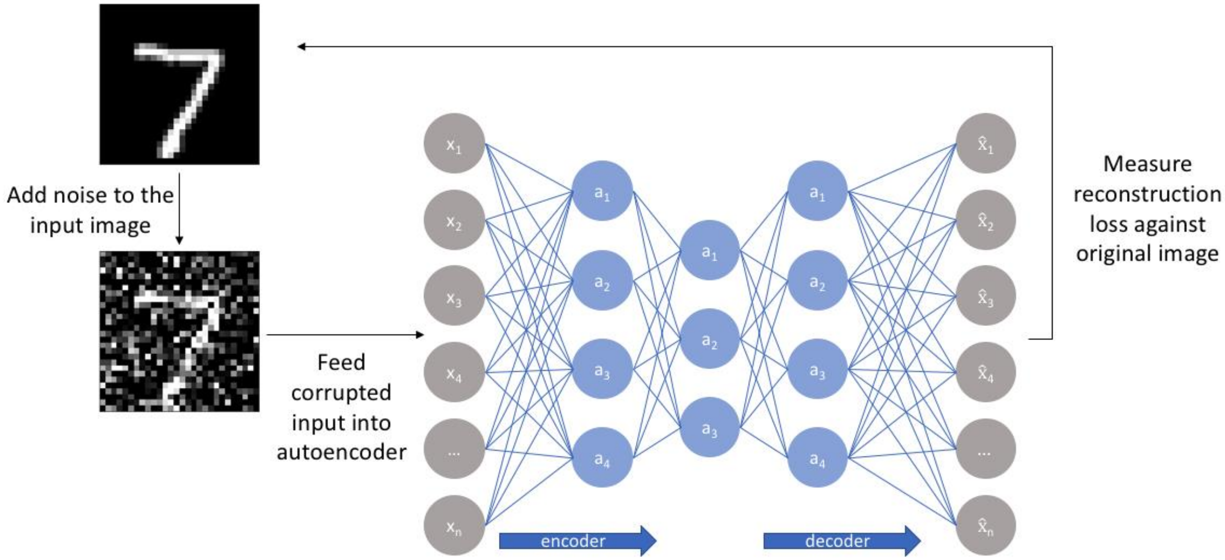

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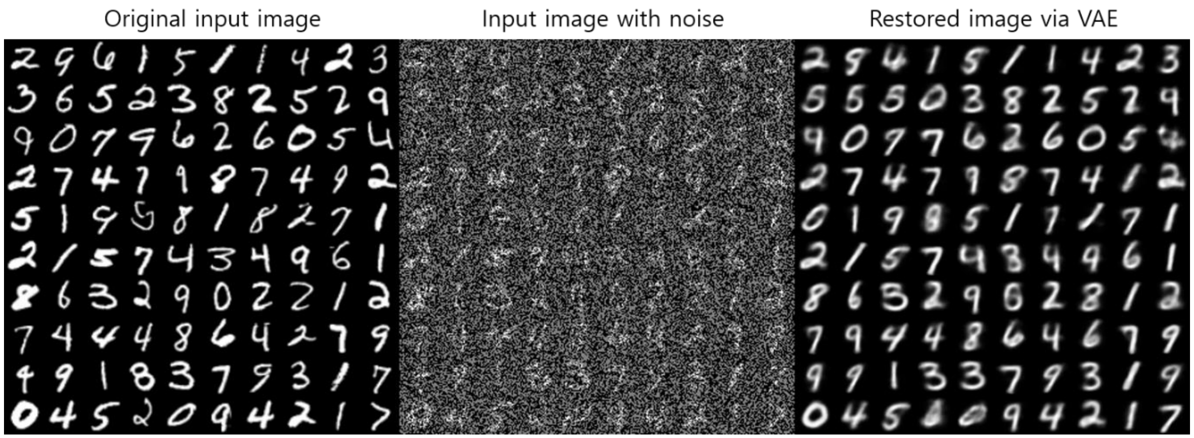
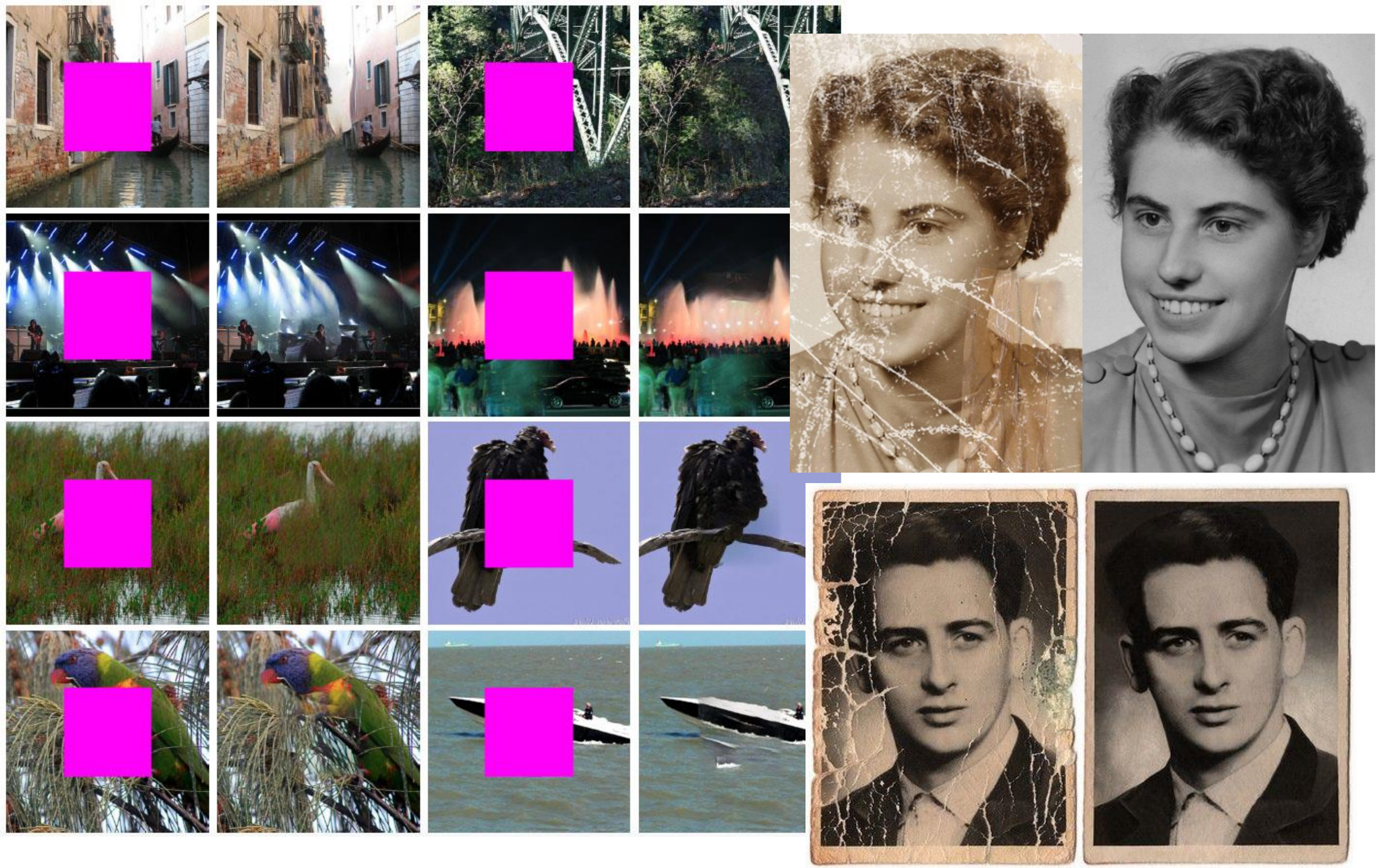


Autoencoders : A Brief Study, 2020
medium.com/@goyal.shubhangi/a-brief-study-autoencoders-517845d51ebd

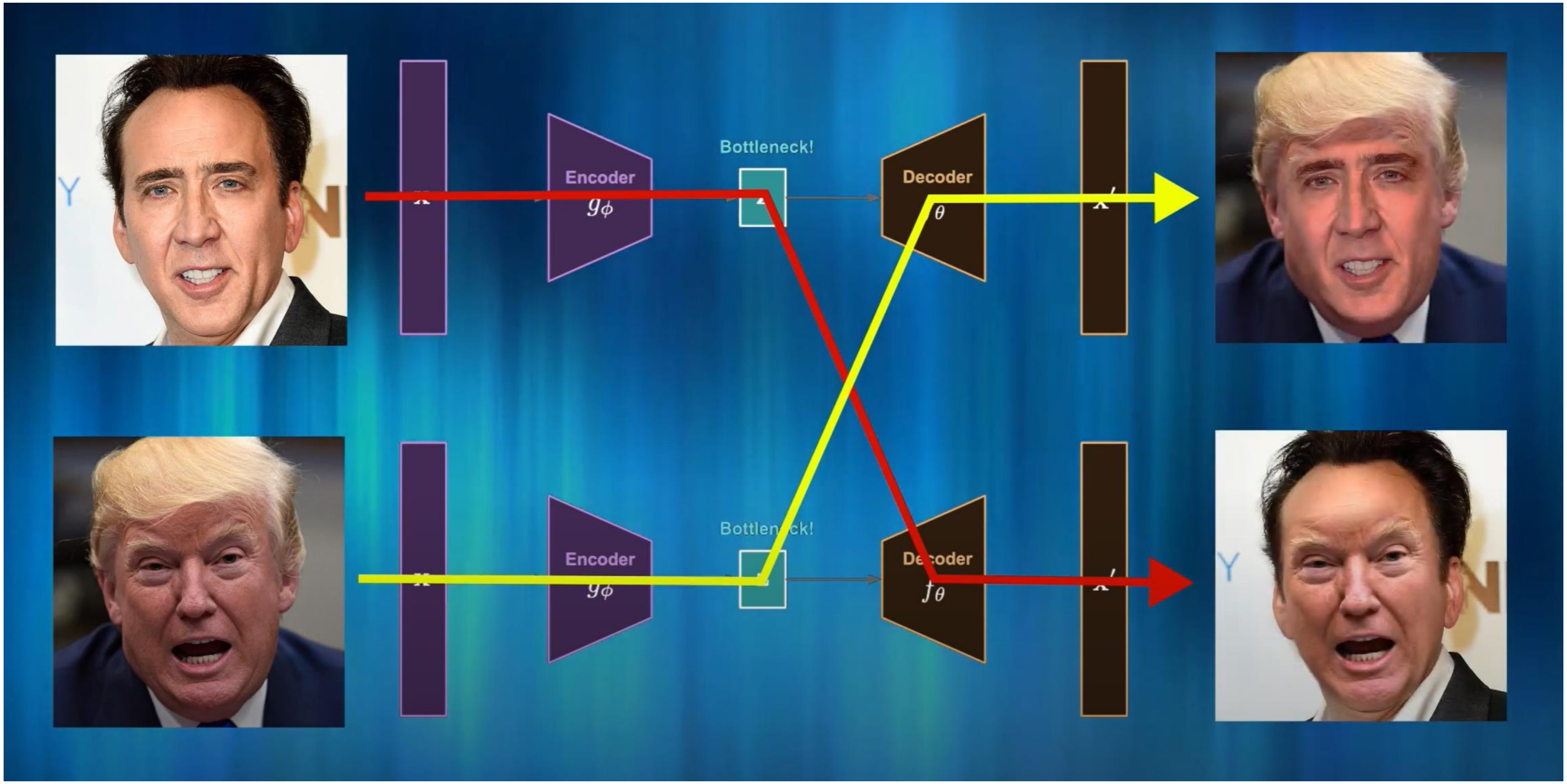
Autoencoder for Image Inpainting



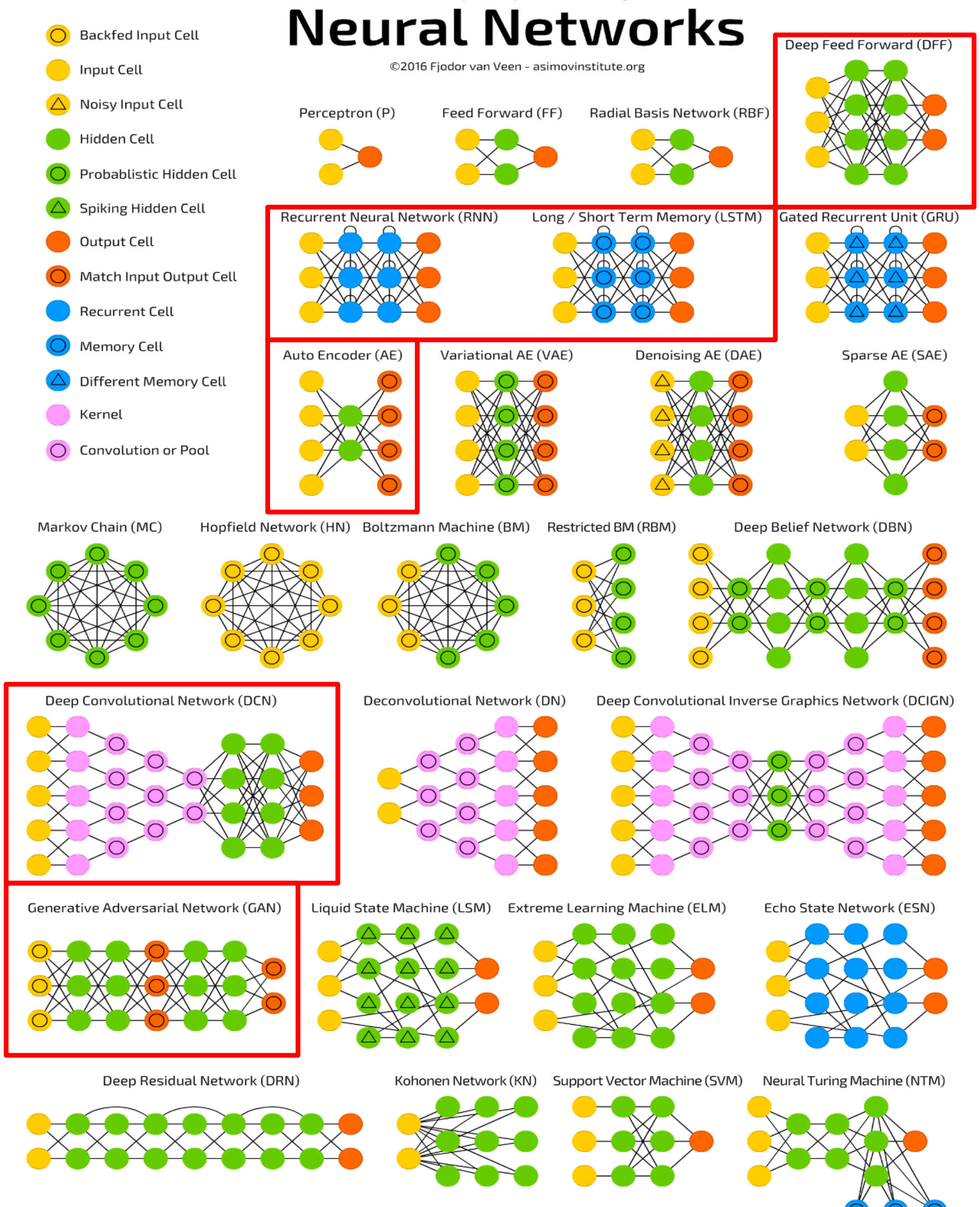
Guide to Image Inpainting: Using machine learning to edit and correct defects in photos, 2019

heartbeat.fritz.ai/guide-to-image-inpainting-using-machine-learning-to-edit…

Autoencoder & Deep Fakes am Beispiel



Fun With Autoencoders (Deep Fakes, Recommendation Engines & more), 2019
www.youtube.com/watch?v=LeeBnlZLTBs



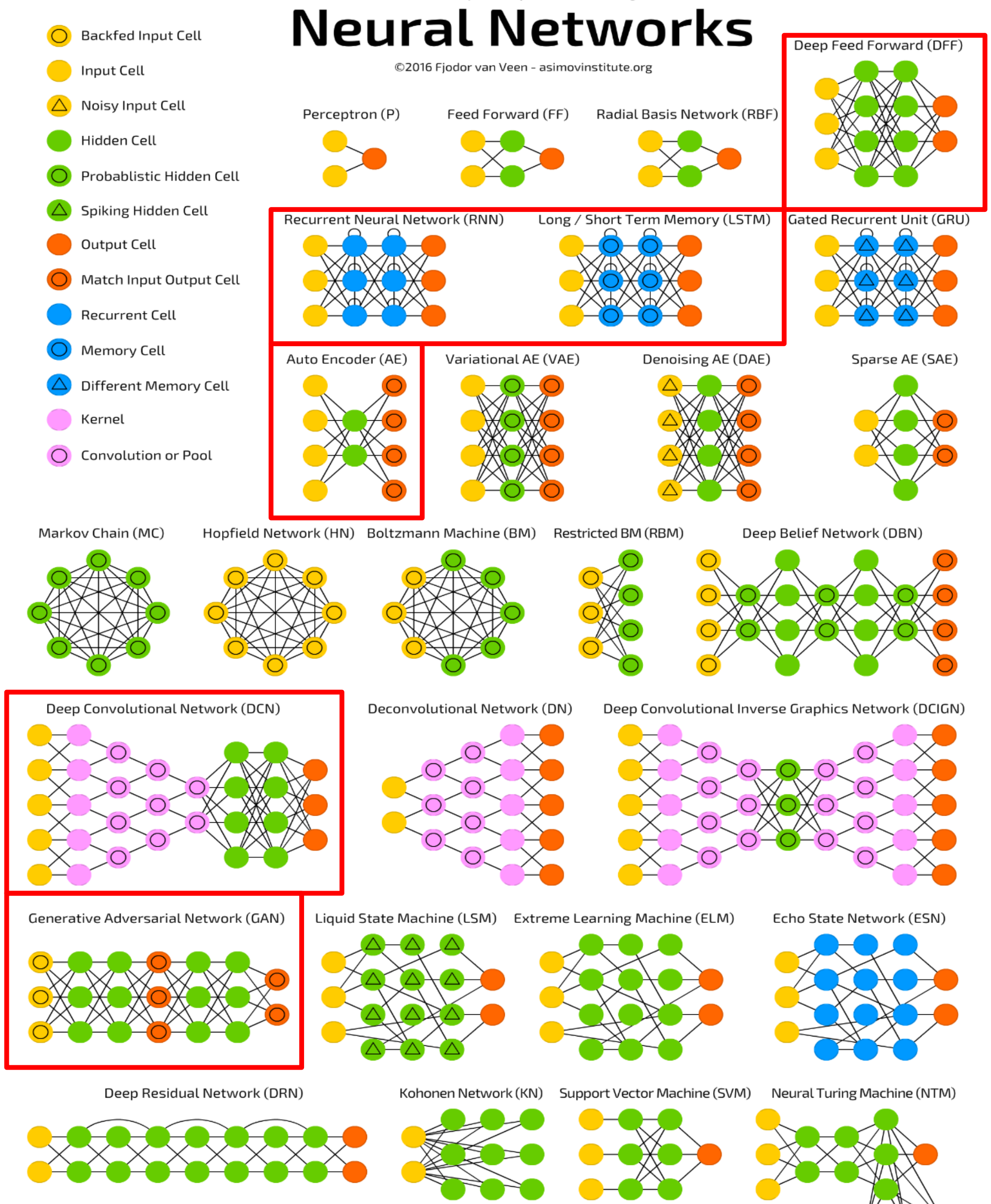
Neuronale Netze stellen einen zentralen **Baustein** für **Deep Learning** dar.

Im Laufe der Jahre wurden zahlreiche **Architekturen** für Neuronale Netze entwickelt.

Die Wahl der **Architektur** hängt von der **Datenstruktur**, den **Dateninhalten** und der **Aufgabenstellung** ab.

Aktuell wichtige Klassen sind u.a. **Convolutional Neural Networks (CNN)**, **Recurrent Neural Networks (RNN)**, **Autoencoder**, **Generative Adverserial Networks (GAN)**.

THE NEURAL NETWORK ZOO, www.asimovinstitute.org/neural-network-zoo/



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THE NEURAL NETWORK ZOO, www.asimovinstitute.org/neural-network-zoo/

OpenAI: Image GPT, Juni 2020

Generative Pretraining from Pixels

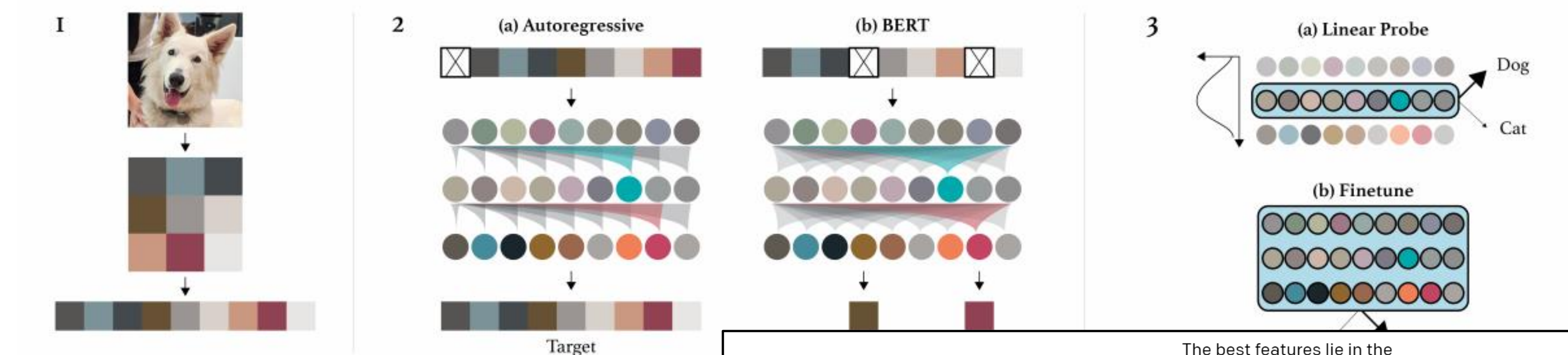


Figure 1. An overview of our approach. First, we pre-process r
We then chose one of two pre-training objectives, auto-regres
the representations learned by these objectives with linear pro

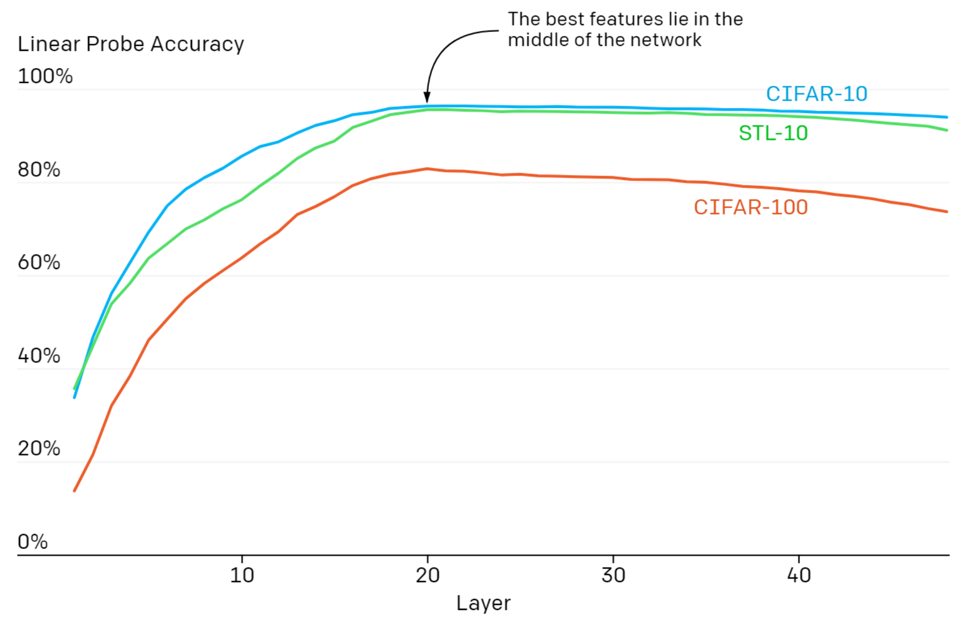
ture of ImageNet and web images is competitive with self-supervised benchmarks on ImageNet, achieving 72.0% top-1 accuracy on a linear probe of our features.

1. Introduction

Unsupervised pre-training played a central role in the resurgence of deep learning. Starting in the mid 2000's, approaches such as the Deep Belief Network (Hinton et al., 2006) and Denoising Autoencoder (Vincent et al., 2008) were commonly used in neural networks for computer vision (Lee et al., 2009) and speech recognition (Mohamed et al., 2009). It was believed that a model which learned the data distribution $P(X)$ would also learn beneficial fea-

prediction of corrupted inputs, clos
Denoising Autoencoder, which was
images.

As a higher dimensional, noisier, ar
ity than text, images are believed t
tive modeling. Here, self-supervise
encourage the modeling of more g
et al., 2015) have shown significant
of new training objectives (Oord e
architectures (Gomez et al., 2017),
pacity (Kolesnikov et al., 2019) ha
to achieve state of the art perform
(Hénaff et al., 2019) and sometime
vised representations in transfer le
2019; Misra & van der Maaten, 20



Feature quality depends heavily on the layer we choose to evaluate. In contrast with supervised models, the best features for these generative models lie in the middle of the network.

cdn.openai.com/papers/Generative_Pretraining_from_Pixels_V2.pdf