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STUDIENGANG DIGITAL IDEATION, BACHELOR  
4. SEMESTER

# **Procedural Generation in the age of AI**

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# 1 Abstract

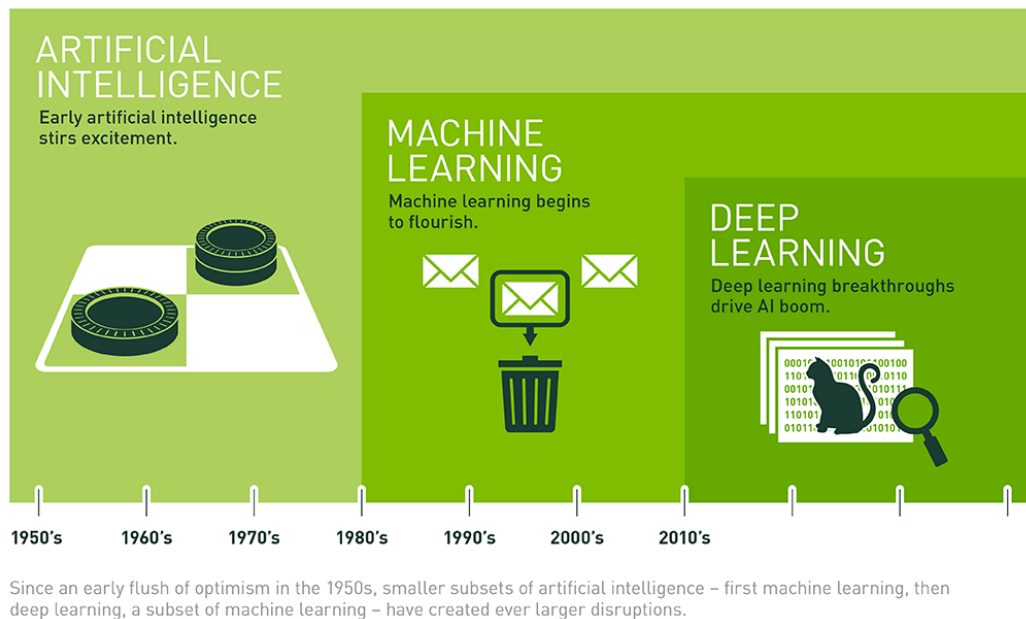
bliblablup todo

# 2 Procedural Generation

The term [Procedural Generation \(PC\)](#) ..

# 3 AI, Machinelearning, Deeplearning

blibla [? ] TODO: research definitions



§

Figure 1: Levels of AI as Image. [? ]

# 4 Motivation

Games that are meant to be replayed a lot benefit from Procedural Generation

# 5 Recurrent Neural Networks

As explained in [section 3 Machine Learning \(ML\)](#) is a broad term and includes a variety of models. The [Recurrent Neural Networks \(RNN\)](#) are networks for tasks where we need some

kind of persistence. If we want to classify video frames the network should have some kind of consistency.[?] A network should persist the last seen data and not reclassify items every frame. Reclassifying without previous context could lead to different recognitions in every frame for the same object.

## 6 Long short-term memory

RNN are good for persisting very recent information. Sentences are a great example: "Ships are built to float on *water*". The RNN is great in filling the end of this sentence. Problems arise when the information is needed a lot later. The more information is in between the contextual references the more unreliable a basic RNN gets. Books for example can have references on the last page to the very beginning. For such tasks a Long short-term memory (LSTM) model is the perfect fit. The LSTM network was introduced by Hochreiter Sepp and Jürgen Schmidhuber[?]. A LSTM is a specialized version of a RNN which is designed for these kind of tasks. Almost all RNN tasks can be achieved with a LSTM RNN [?]. to read: [https://en.wikipedia.org/wiki/Long\\_short-term\\_memory](https://en.wikipedia.org/wiki/Long_short-term_memory) <https://colah.github.io/posts/2015-08-Understanding-LSTMs/>

## 7 OLD:

## 8 TensorFlow.js

As of April 2018 Google released a new JavaScript ML library called TensorFlow.js. TensorFlow.js is built on deeplearn.js and can be used for a broad variety of ML tasks. The library allows to train and run models in the web browser. Models can be pre-trained on a server or offline computer and then be used on the website.

## 9 Challenges

various challenges:

- level is playable
- Levels getting harder
- build up, learn new thing and then master it

## 10 Goal

The goal of this work is to generate maps for games. Maps from "Super Mario" or "Super Meat Boy" contain mostly solid or empty blocks. With that knowledge, the levels can probably be represented in an easy to read text format instead of an image format. The text can probably be feed into an ML system and new maps can be generated with the assistance of a ML model.

## 11 examples

We can Cite [? ], [? ], [? ], [? ], [? ], [? ] etc. If we want to have terms and shortcuts we can introduce them once: [Long Glossary Entry](#) and [Open Source Software \(OSS\)](#). If we refer to [Long Glossary Entry](#) and [OSS](#) later it will only use the short version.

## 12 Examples

## 13 Examples of Images

Images are possible aswell:

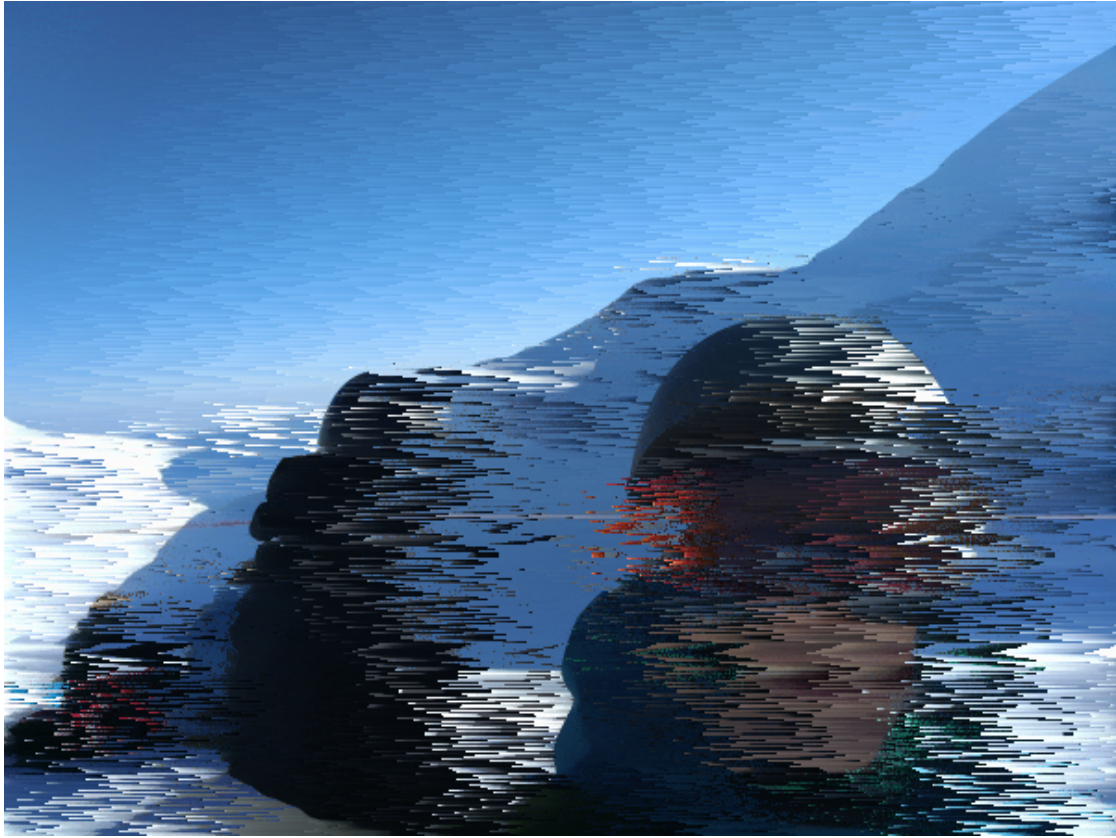


Figure 2: Thats me. Source: <https://thecell.eu/>

and even multiple images are possible

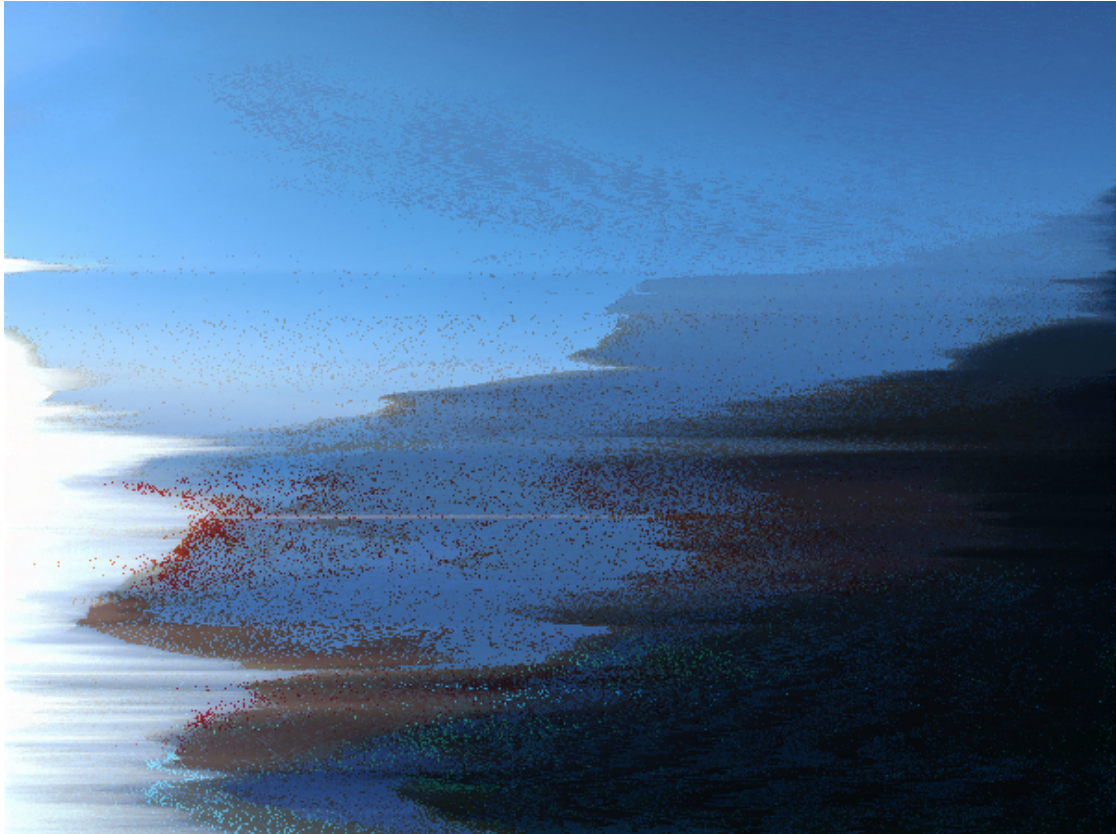
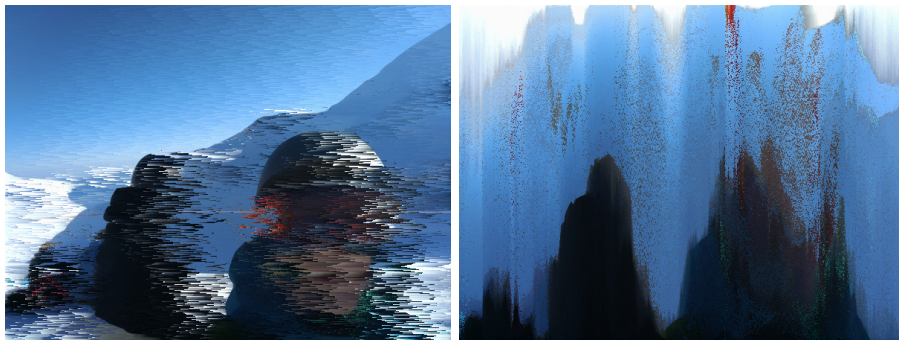


Figure 3: multiple images as an example

Figure 4: if needed to reference separate it's possible like this

## 14 Script code

A simple codeblock is possible take a look at this:

---

```
<script>
let aVar = "this is a JavaScript variable";
console.log(aVar);
</script>
```

---

## 15 Tables etc.

**Lists** can be made as following:

- List an item once
- or twice
- just add more if needed
- sublists are possible aswell:
  - List an item once
  - or twice
  - just add more if needed

If you are looking for tables, here it is:

	1	2	3	4	5	6
Dota 2	31 min	H	++	Z	<40\$	Kosmetisch
PoE	$\infty$	H	++	Z	<\$440	Shoppunkte
The Witcher 3	48.5h	H & C		Z	\$24	AddOn

Table 1: Statistik Spiellänge wurde erfasst von <https://howlongtobeat.com> und <http://steamspy.com/>.

## 16 Referenzen und Akronyme

### Glossary

**Long Glossary Entry** Here is the description of a long entry [4](#)

**Tensorflow.js** The Tensorflow software released as a JavaScript library for websites and web-applications [3](#)

### Acronyms

**LSTM** Long short-term memory. [3](#)

**ML** Machine Learning. [2](#), [3](#)

**OSS** Open Source Software. [4](#)

**RNN** Recurrent Neural Networks. [2](#), [3](#)



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