

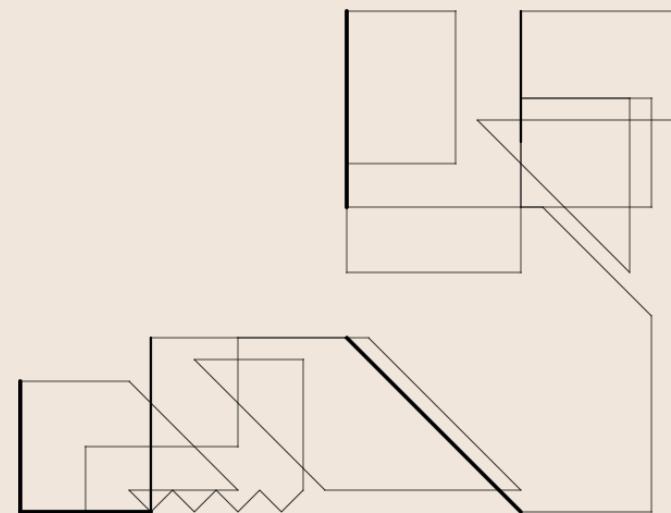
# ALGORITHMIC AESTHETICS

## GAN : Dataset - Training - Generator

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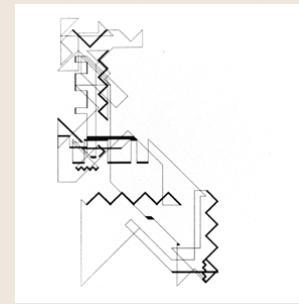
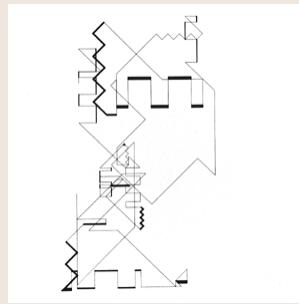
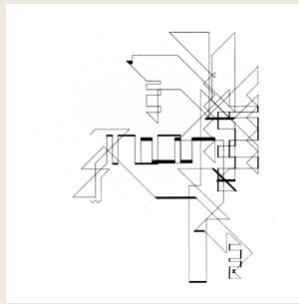
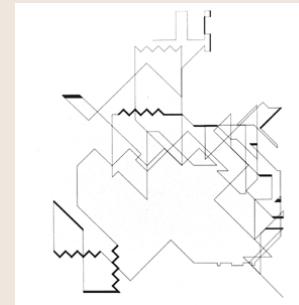
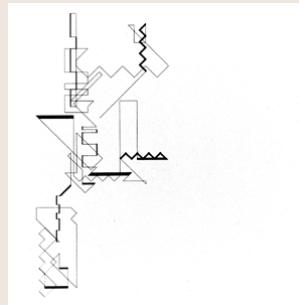
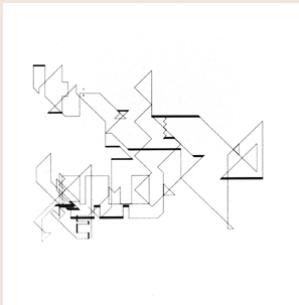
COUARD Théo - GELEBART Lauriane

IMAC - APRIL 2022

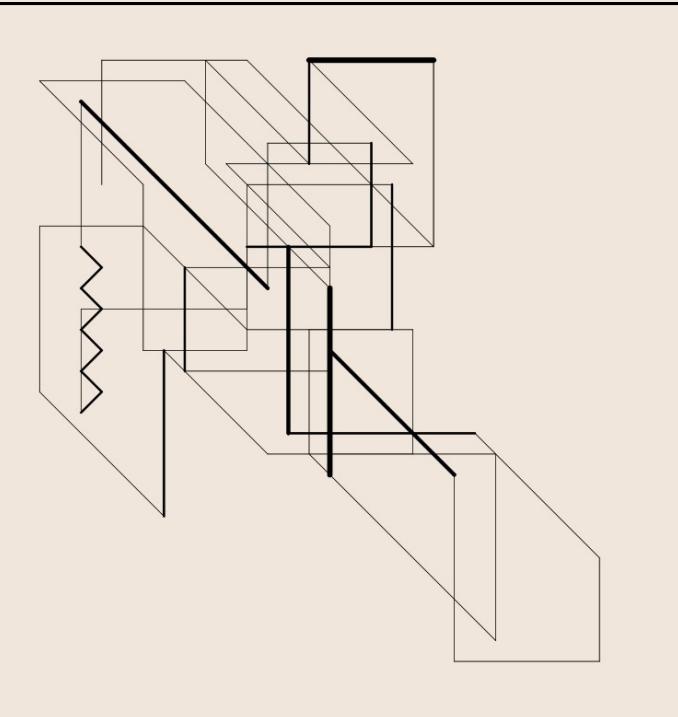


## Orientation towards Mohr

At the beginning of this course, we had to choose among several **artworks** made by artists. The idea was to have a first look at the results coming from such domain. What piqued our curiosity, to both of us, was the work from **Mohr**. It had clean shapes and lines which had different thicknesses and directions. Thus, we chose him and his works for the lesson, especially his serie of *Random Walk*. The next section is dedicated to the experiment of Generative Adversarial Networks, shortened as **GAN**.



## Simplifying



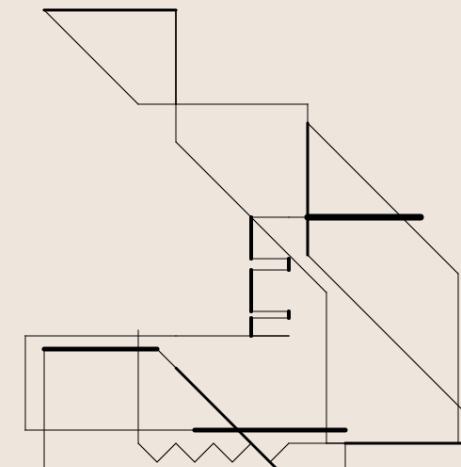
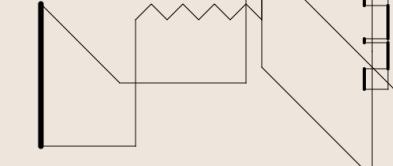
Example of our recording project work

In order to generate a fine amount of samples for the dataset, we **revised our code** as such in order to have balanced samples, widths and strokes wise.

To do so, we **reduced the number of movements** from 150 to 30, then the **thickness** by allowing only one value for it against six previously.

For the purpose of not exceeding the new frame size (64x64), the **length of the strokes** are also balancing between six possible values against twenty.

At the end of the day, we did not really had to change our code from the recoding project that much. The generated images which will follow in the next section are **pretty clean**, and the **stroke are thick enough** to be interpreted later with a GAN.



## Code structure

**PROGRAMME BEGIN**

```
|  
| movement <- 0  
| x <- random number contained in the width of the frame  
| y <- random number contained in the height of the frame  
|  
| WHILE mouvement<30 :  
| | oldX <- x  
| | oldY <- y  
| | length <- random number contained between 10 and 40  
| | nb <- random number contained between 1 and 26  
| |  
| | IF nb<=12 :  
| | | x <- x+length  
| | | Draw a line from (oldX;oldY) to (x;y)  
| | END IF  
| |
```

**| | IF nb>12 ET nb<=24 :**

```
| | | y <- y+length  
| | | Draw a line from (oldX;oldY) to (x;y)  
| | END IF  
| |
```

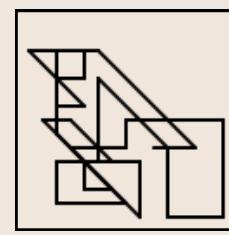
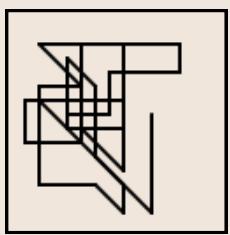
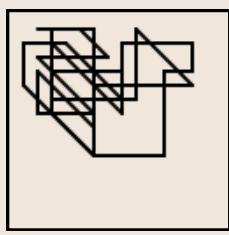
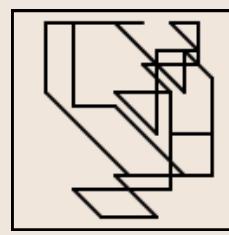
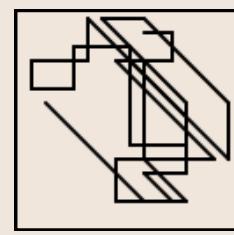
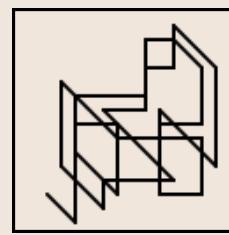
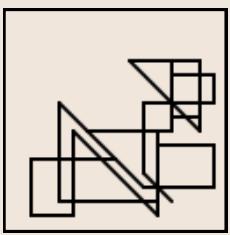
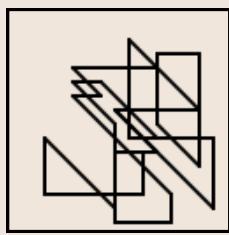
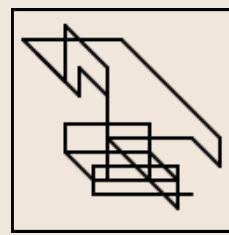
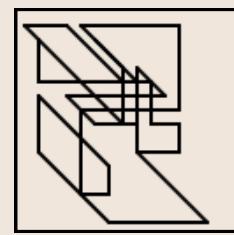
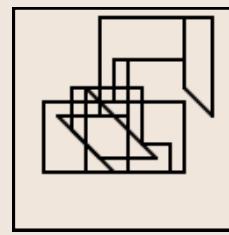
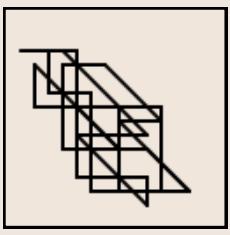
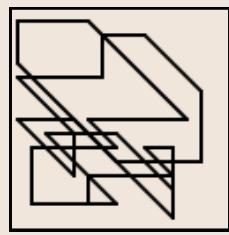
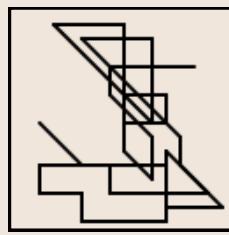
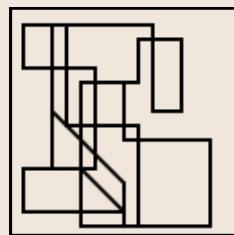
**| | IF nb>22 ET nb<=36 :**

```
| | | x <- x+length  
| | | y <- y+length  
| | | Draw a line from (oldX;oldY) to (x;y)  
| | END IF  
| |
```

**END WHILE**

**END PROGRAM**

## Extract of our dataset



# MOHR RECODED WGAN TRAINED

(6000 EPOCHS)

## Training & conclusion

We trained the WGAN with our freshly generated dataset of **twenty thousand pictures**. We let it print the result every two-hundred samples. It tooks quite the time, we let it **runs for six thousand passes**.

We can observe the results in the next section.

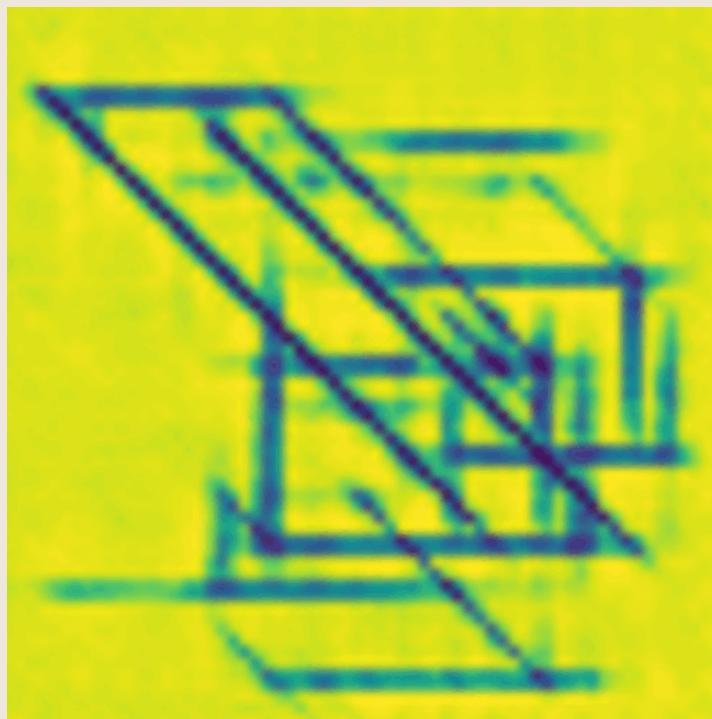
We can notice a **great evolution** around the thousandth sample. Before it, we have something very blurry which looks like **noise** or like a **dribble**.

It gets more accurate after the two thousandth sample. The WGAN was able to reproduces the scheme of our specific **strokes**. Though, it is a bit dirty and blurry around the edges. It is even more noticeable with the background color which tends to differ near the strokes. **It is not uniform**.

Nevertheless, the WGAN was fast enough to analyze our set, thus it delivered similar results quite rapidly. (despite the draft aspect of the drawings).

## Results from the training





## Generator

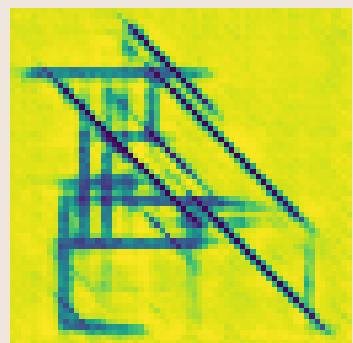
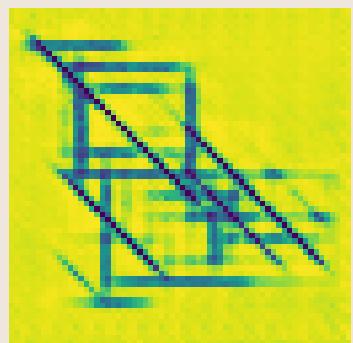
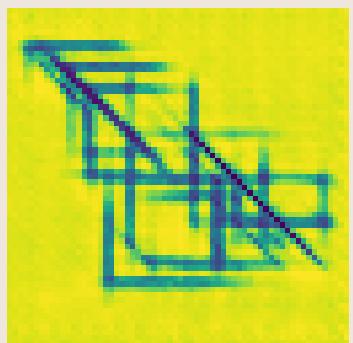
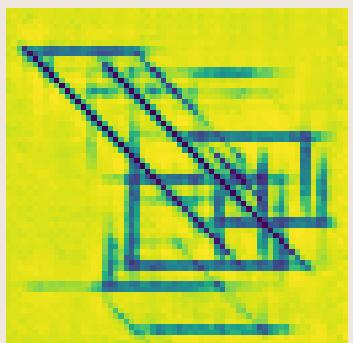
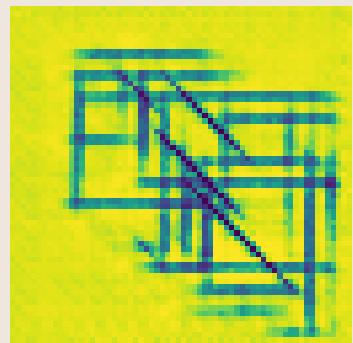
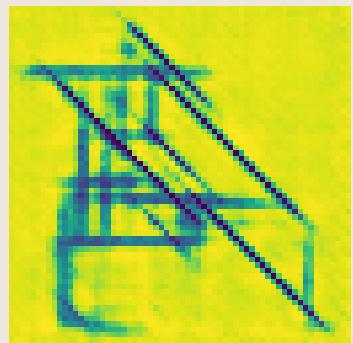
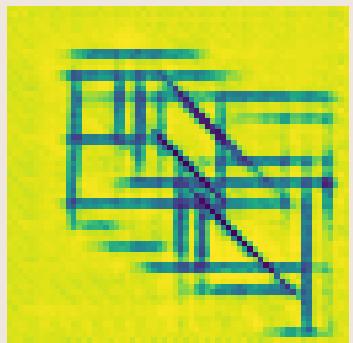
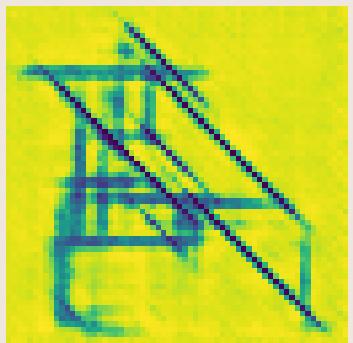
After the training steps, the WGAN has seen its **generator** part enhanced. Through its previous training, it is now able to render numerous more samples, in faster way. It is the **inference** step.

We took the the generator file (a .h5 file, which contains all the data) and uploaded it in a [Google Colab environment](#).

We noticed that the results were definitely alike the original work, and this in no time at all. However, with this collab, it lacks **diversity**. We almost have the same samples each time. It would need an animated sequence to perceive the **evolution** of the drawings over time.

Hereinbelow are the results we obtained with the generator.

## Results from the generator



# Essay focused on Art and Deep Learning

Arts, to a large extent, are a lot of things. Artists used a lot of different techniques, so much that nowadays we possess a colossal diversity of fields, from rupestrian paints to numerical ones. And a great thing about this is the possibility to combine them together, which results in even more content.

Developing a technique, mastering what an artist is, takes a lot of time. Years to be accurate. We could not wake up one day and instantly revolutionize the whole world. It relies on a certain creativity. The latter has been developed since our birth. What we saw, touched or smelled contributed and enhanced it. Yet here we are, with very powerful units that kind of reduced this long processus. Going deeper and deeper, in order to encounter the unexpected, that is what deep learning is.

Thus, we can state and expose an interesting reflection : can we use deep learning in a creative process?

This question could be reformulated as "Is employing deep learning in a creative process still art?"

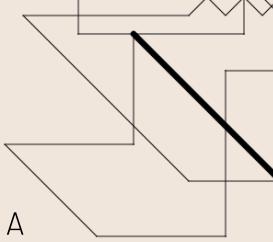
We would rather focus on its potential and its limits. However, we first have to look at the definition of art.

It certainly differs from one individual to another. It could be the feelings or the motivation put in the work from the creator himself or rather the aesthetic if it. Indeed, we cannot have a perfect and well-established definition. It leads to too many parameters and sensitivity. Nevertheless, it contains creativity.

As for innovations in this domain, we now have Artificial Intelligence. But the art industry already faced several changes. When photography appeared, it completely revolutionized the realm of painting. To a certain extent, we would definitely say the same with Artificial Intelligence at first. Though, our sharped-eye noticed that despite this revolution, those medias are still present and do not tend to vanish.

With numerous goals on its own, the concept of Art mostly focused on innovation and inventing new things. It enters into a context, a period of time. Hence creating with the help of an Artificial Intelligence seems coherent today. According to surveys, around 59% of people preferred the AI work over Mondrian's in the experience from Noll. Regarding this, the AI is at the same level as an artist. A logical conclusion would be that AI equals an artist : it is art. Furthermore, if the AI is doing better than the artist himself, it would call the latter into question.

We cannot avoid it now and it is settled in our world, deep learning is among us and does not seem to be a problem for the majority of humans. What would it or already provide to us in terms of creativity and aesthetics?



As an organism, independant and efficient, AIs are included in our editing software. A well-known example is the Adobe Suite and its retouch programs such as Lightroom and Photoshop. Those are used by several artists for their abilities to get rid of repetitives tasks. It is a significant improvement. As for our phone cameras which allows us, amateur or not, to take wonderful pictures. We just have to press one icon and let the AI system analyze the environment around us and grab the best configuration.

What if it could prevent a new artistic wave instead of a human, something we could not even have imagined, because our ways of thinking and perceiving are different. Creating new genres, and better scenarios that will lead to polished films. As AI does not have a brain and does not reflect as a human, it is able to create astonishing creations. We could quote the results from alphaGo.

The limits of AI rely on the human perception of things.

Let's take an example : I just finished reading "La vie devant soi" by Romain Gary. If it actually was written by an AI, we would have difficulties, knowing it was AI written. After discussing it around us, everybody seems to agree about it. While being morally engaged in a word, it is harder to believe that the one who wrote it felt nothing. On the other hand, Malevitch stated that what matters are the feelings we developed. The emotional part comes from the observer, regardless of the author's motive.

Another aspect of AI is its meaning. We heard of them without having a precise idea, images of them in our mind. For the majority, it is a term used in the science fiction field, where the term "intelligence" is absurd and results in nothing.

We worked on Mohr and created a dataset with a simple form of Artificial Intelligence : a Generative Adversarial Network. With a great amount of samples of our recoded project, the GAN was able to produce interesting outputs. But as powerful as it was, we noticed that after a certain amount of training, the results did not really differ nor did they were new. It reached its limit. GANs are very interesting to study, but we came to the conclusion that it needs a sample at the beginning of the process. Thus it is dependent, and that is a limit. In addition to that, a GAN must be balanced in order to prevent overfitting, which is another limit.

At the end of the day, the concept of Art is divided between its meaning and its application. As we have several formats and fields, it is difficult to control every branch. With the arrival of new technologies, we are now able to reproduce and even produce astonishing things. We are then using deep learning in a creative process if said artists are using them. That means they are considered as a powerful support, but still a support which is subject to limits. Seeing two different minds working together is pioneering and promising yet divided because AI are "invisible" to a majority of people. We could support the "The time will do the job".

As an opening, we wondered about a very plausible event during our course. A comic generated by a GAN. It is theoretically possible with a ton of samples. What is really questionable though, remains in human replacement. It is really scary, but we would be totally impressed to encounter such a comic at the same time.

