

Escher goes ML: Completing The Print Gallery With Image Inpainting

Machine Learning and
Mathematics Applied to Art

Lucia Cipolina
Simone Caenazzo
Gaston Mazzei

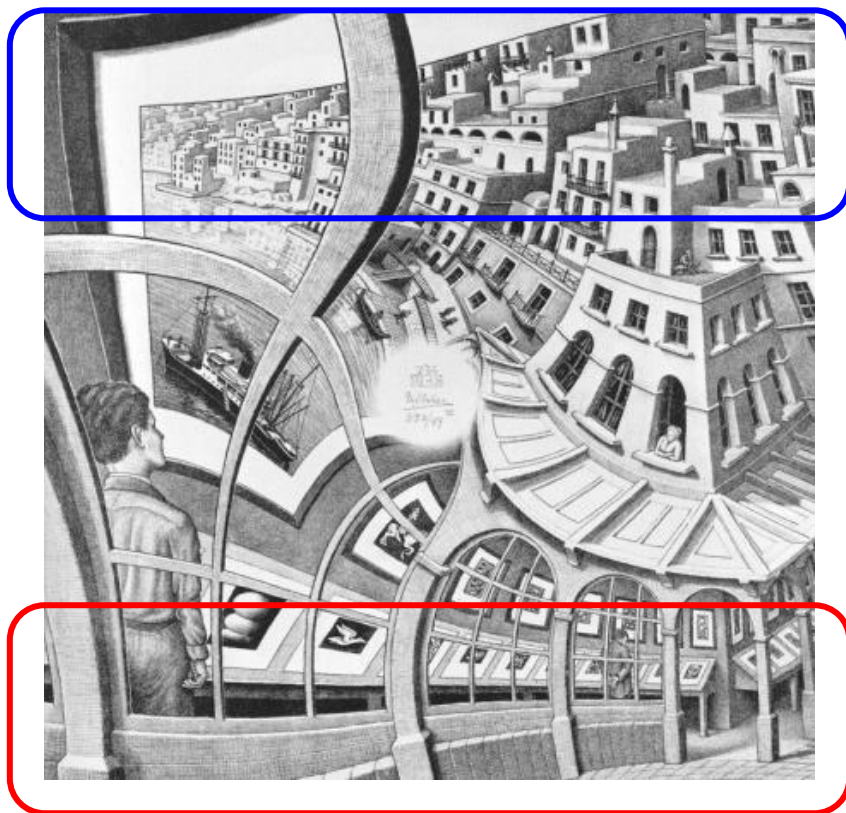
March 31, 2021

What is the Project About

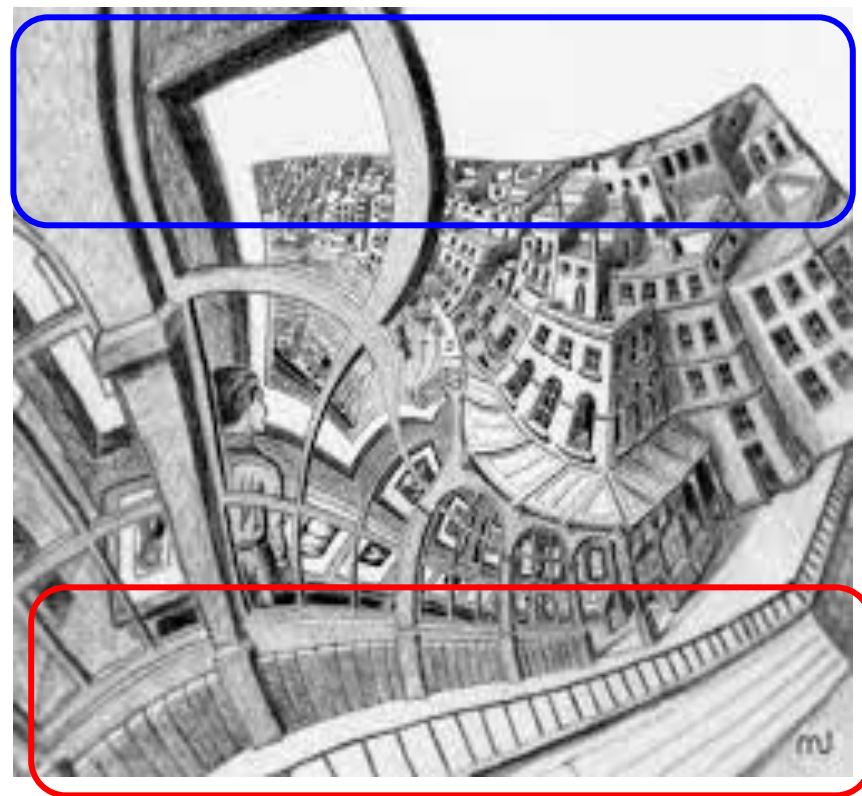


Why this is new?

Original Painting



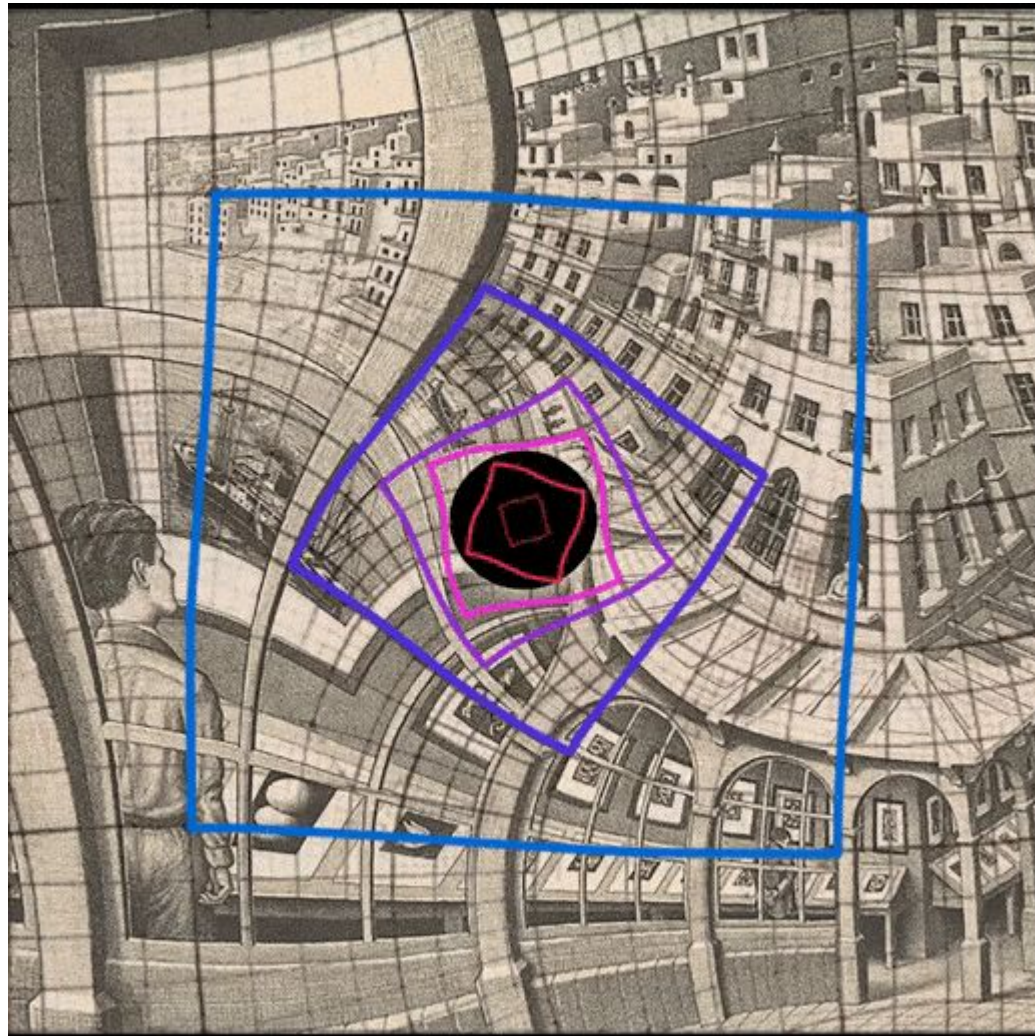
Previous best effort [1]
(no ML)



Print Gallery: A 2 Stage Problem

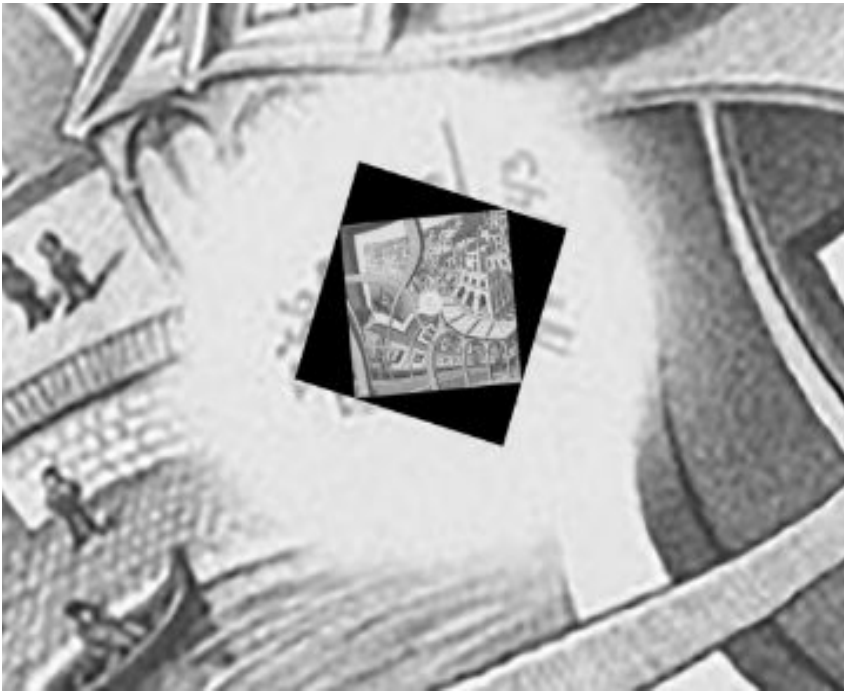
Stage 1: Unveiling the Underlying Math Structure - no ML -

The Droste Effect....

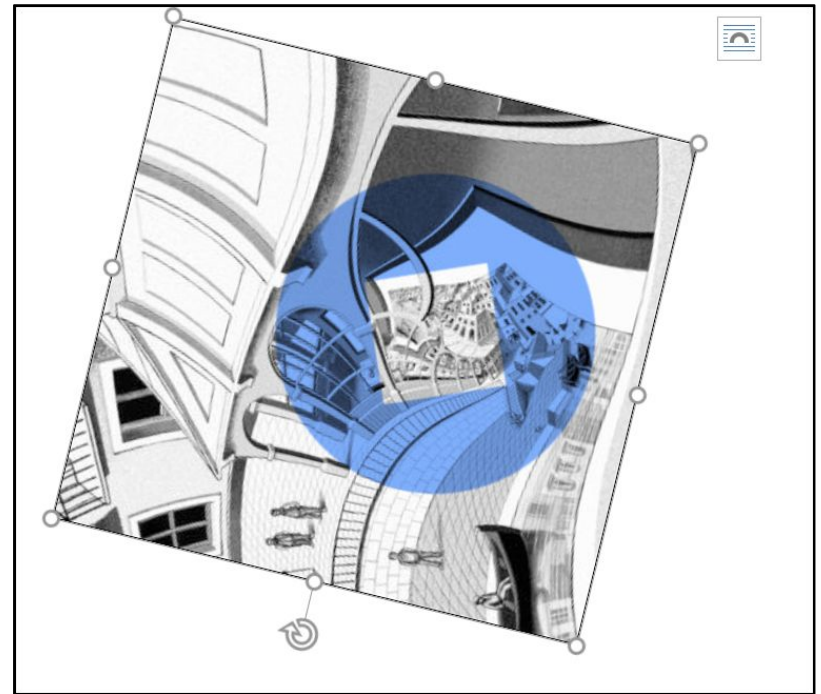


The Center With the Droste Picture

Our solution so far, (this is what we need to complete)



Sample solution from [1]

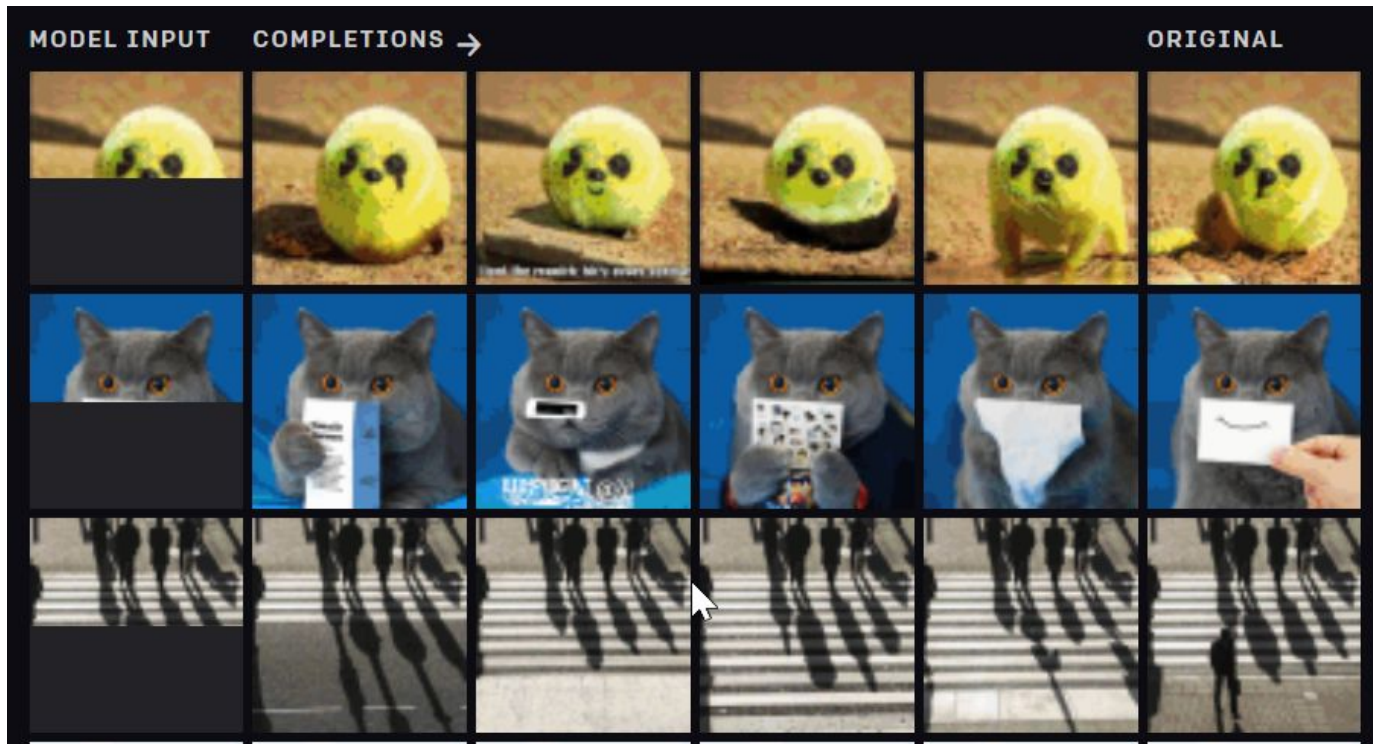


Stage 2: Image Inpainting

..... and this is the target for the incubator...

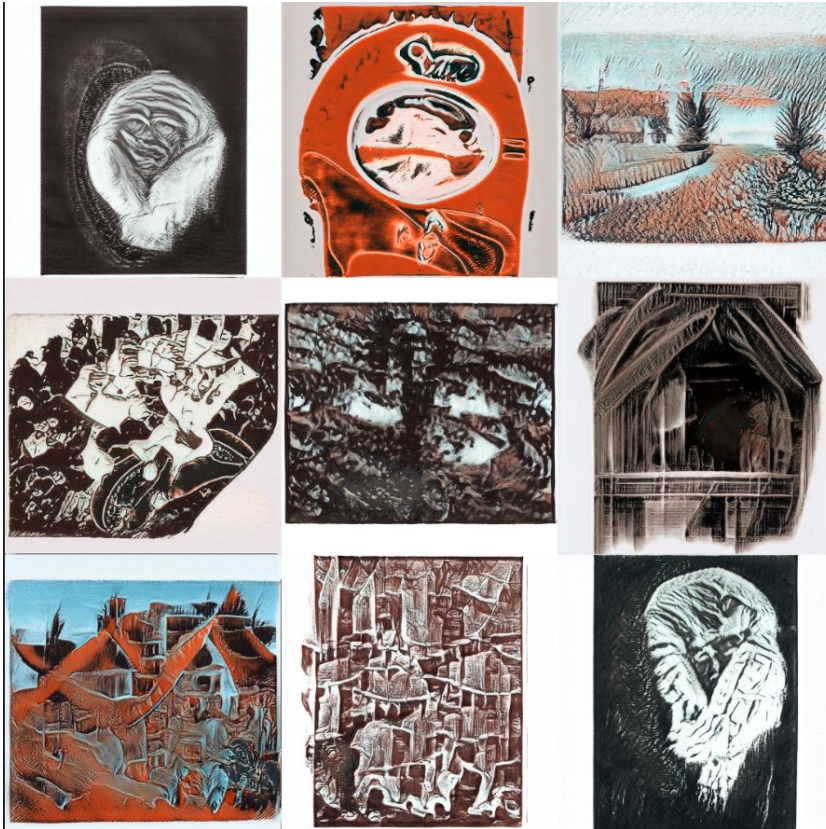
Preliminary Idea...

1. Use an inpainting algorithm like *Image GPT* [3] or *Taming Transformers* [4]



Second: fine tune the PT model..

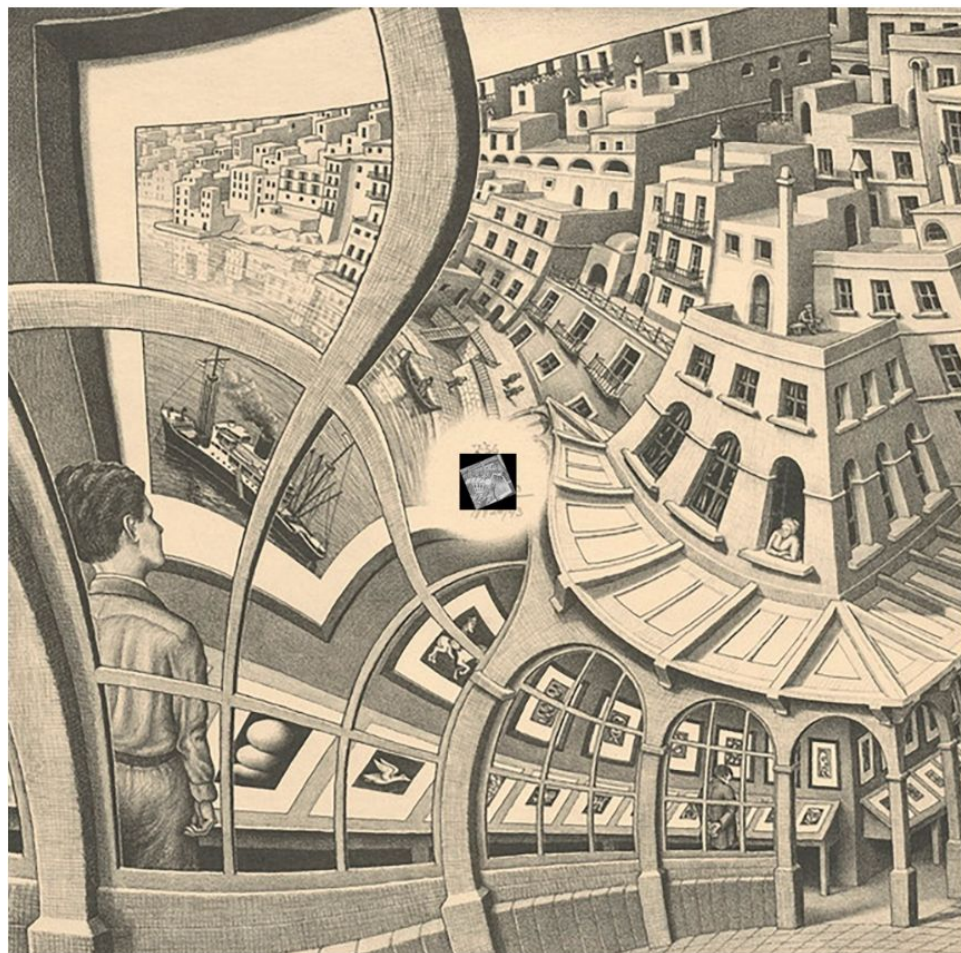
2. Train it with Escherized images...



Print Gallery: An Exciting Research Opportunity on a New Field!

Why this is exciting!

- Worthy opponent !!
It exceeds the current SoTA in image inpainting
- Major contribution to ML in art reconstruction
- Great potential for scientific outreach since it brings ML closer to people's interest.



The team

- Lucia Cipolina

<https://www.linkedin.com/in/luciacipolina/?originalSubdomain=uk>

- PHD Candidate in Electrical Engineering.

- Simone Caenazzo

- BEng in Mechanical Engineering, MSc in Complex Systems Modelling.

- Gaston Mazzei

- Msc in Physics.



Bibliography

1. B. de Smit and H. W. Lenstra Jr. The mathematical structure of escher's print gallery. Notices of the AMS, 50(5):446–451, 2003.
2. P. Esser, R. Rombach, and B. Ommer. Taming transformers for high-resolution image synthesis, 2020
3. Mark Chen, Alec Radford, Rewon Child, Jeff Wu, Heewoo Jun, Prafulla Dhariwal, David Luan, Ilya Sutskever. Deep Generative Pretraining from Pixels
4. K. Nazeri, E. Ng, T. Joseph, F. Qureshi, and M. Ebrahimi. Edgeconnect: Structure guided image inpainting using edge prediction. In the IEEE International Conference on Computer Vision (ICCV) Workshops, Oct 2019