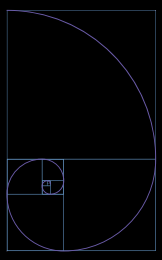
APPENDIX



Shuyue Jin
02/2022 - 07/2022
TU Delft
Design for Interaction

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name	[redacted]
initials	
student number	
street & no.	
zipcode & city	
country	
phone	
email	

Your master programme (only select the options that apply to you):

IDE master(s): ( ) IPD (★) DfI ( ) SPD

2nd non-IDE master: _____

individual programme: __-__-____ (give date of approval)

honours programme: ( ) Honours Programme Master

specialisation / annotation: ( ) Medisign

( ) Tech. in Sustainable Design

( ) Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Derek Lomas — dept. / section: HCD,DA

** mentor: Jun Wu — dept. / section: SDE,MM

2nd mentor: _____

organisation: _____

city: _____ country: _____

comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Derek Lomas date 25-02-2022 signature James Derek Lomas Digitally signed by James Derek Lomas Date: 2022.02.28 09:51:27 +01'00'

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 32 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 32 EC

List of electives obtained before the third semester without approval of the BoE

★ YES all 1st year master courses passed

○ NO missing 1st year master courses are:

name K. Veldman date 01 - 03 - 2022 signature Kristin Veldman Digitally signed by Kristin Veldman Date: 2022.03.01 09:55:55 +01'00'

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ★ APPROVED ○ NOT APPROVED

Procedure: ★ APPROVED ○ NOT APPROVED

comments

name Monique von Morgen date 15 - 03 - 2022 signature

Initials & Na [redacted]

Title of Project Explore How to Inform AI Systems of Human Experience

Explore How to Inform AI Systems of Human Experience — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 24 - 02 - 2022 — 16 - 07 - 2022 end date

INTRODUCTION **

Please describe the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...)

Today, artificial intelligence has brought changes in all areas of people's lives. However, many aspects of human experience, like aesthetic beauty, are not accessible to AI systems, like Generative Adversarial Networks (GANs). When it comes to AI systems, AI designers like GANs do not have access to user experience and have no chance to consider it. So, how can an AI system like GANs optimize for meaningful human values, like beauty? How can we inform AI systems to efficiently use the user experience and improve its products' aesthetics?

As we all know, in the traditional design process, user experience like aesthetics plays a vital role in building relationships between users and products and closely relates to established users' viewpoints.[1] For instance, Laurie and Christine found the role aesthetics plays in website usability to provide designers with more practical guidelines to consider aesthetics during the design process.[2] Also, some experiments and theories have been put forward for using the feedback and ranking from users to iterate the aesthetics for human designers. In the visual arts, using the theory of the H-C plane, the artistic style of the picture can be more accurately distinguished according to the elements of the picture itself [3].

Compared with the traditional design process, AI-based design systems have unique attributes. On the one hand, unlike human designers who can use their own experience as inspiration, the only source for AI systems is the dataset.[4] So when it comes to improving the aesthetics of the output from an AI system, the quality of its dataset is what we should consider. On the other hand, the essential ability of an AI system is its algorithms. For instance, the Machine Learning model, including generator and opposing discriminator, enables GAN to produce images.[5] However, for the description for aesthetics, the information is abstract like "creativity" "originality," which are impossible for algorithms to understand and use. And what factors are crucial for humans when they appraise the works from AI systems?

This graduation project will focus on the GANs to identify elements that affect aesthetic beauty and investigate how to efficiently inform GANs of the feedback from people to steer its output. By comparing the average ratings of images generated by two different GANs (One set of images produced by a GAN trained using random images, another set of images produced by a GANs trained using images selected based on human ratings.), the goal is to prove the importance of user experience in AI systems.

space available for images / figures on next page

introduction (continued): space for images

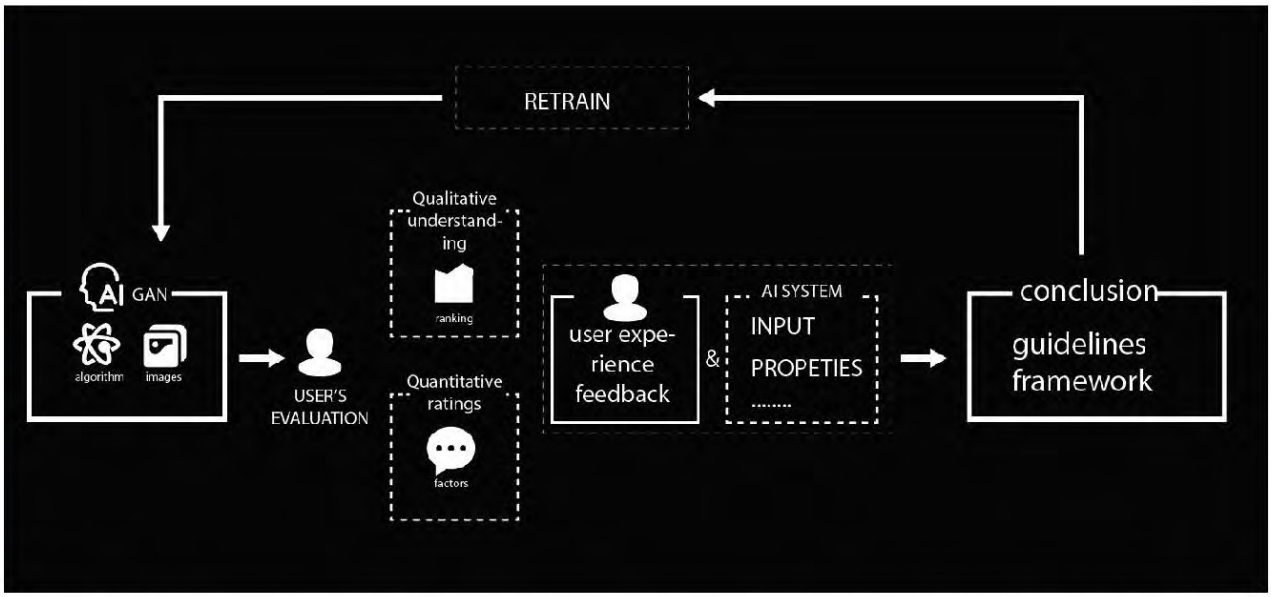


image / figure 1: the overview of the AI evaluation system based on GAN (Generative Adversarial Networks)

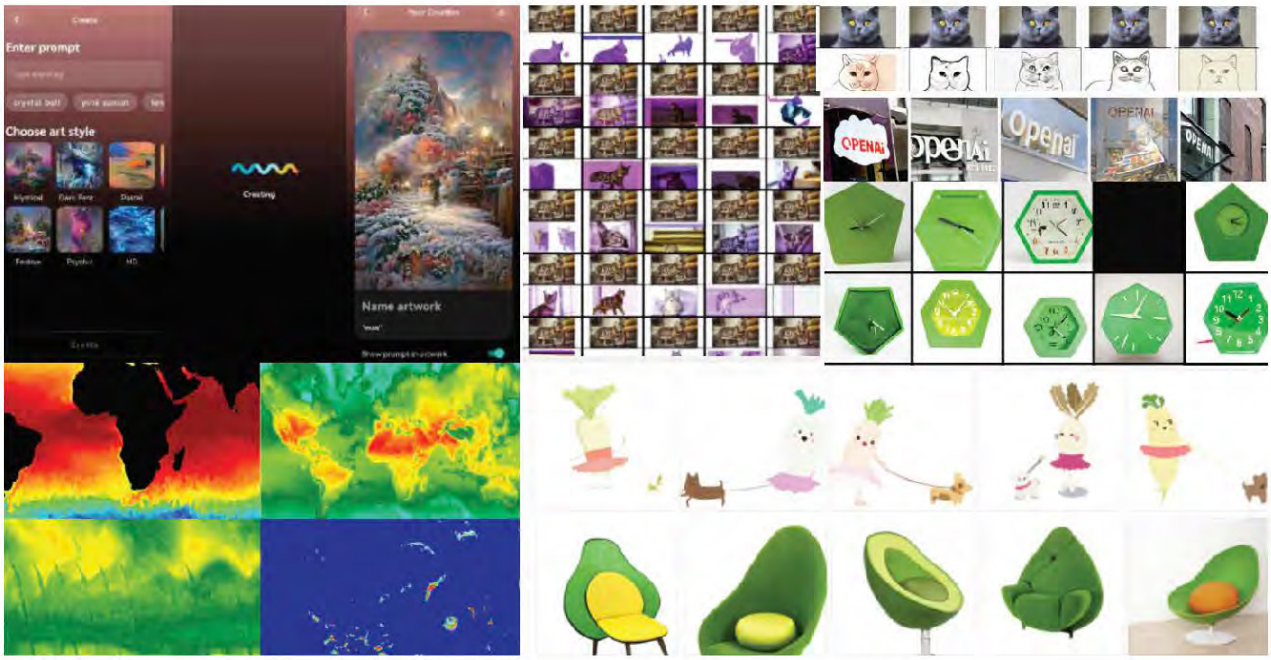


image / figure 2: the practical application of GANs(Generative Adversarial Networks)

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Artificial Intelligence has impacted people's lives in various fields like AI Music, AI artworks, etc.[6] This graduation project limits the scope to the different images generated by GAN. It aims to investigate how to transform the human evaluation of aesthetic beauty to GAN accurately and enable GAN to fully use people's feedback . While improving AI's product, the user experience's significance for AI systems will be proved.
There are mainly two aspects to the problem that we want to solve:

1. When people evaluate the aesthetic beauty of images generated by GAN, what factors are most essential for them? What are the key elements affecting the user experience for the aesthetics and beauty of the images from GAN?

2. Based on those evaluations, how can we fully inform GAN of the outcome from users? How can the ratings be used to inform the GAN? How can we transfer the information from people to GAN and improve its work? How can the user experience influence AI systems in a more efficient way? How can computers make aesthetic judgments, and could this inform the GANs?

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

For my graduation project, I will figure out a system that allows the user experience to inform AI systems.The main outcome will be a research about how we can inform the AI system like GAN about user experiences like aesthetic beauty, some guidelines, and a framework about how to transfer the user experience feedback to an AI system in a more efficient way will be conducted to improve its products and build a bridge between user experience and AI systems.

For this graduation project, I will focus on the scope of GAN. Based on the evaluation outcomes from users, to investigate how they can fully and efficiently be informed to GAN. I will consider two main directions for my project: First, after getting plenty of messy feedback from people, what factors do people want and consider when evaluating the images from GAN? Second, for GAN, what information is valuable and essential for them to iterate their ability to produce better works? Combining those two aspects, research will conclude how to build a bridge between the user experience and AI system. Some guidelines will be conducted for GAN to understand user experience better.

What's more, according to the research, I will retrain the GAN to get another set of images based on the human ratings. The comparison about the outcome from two different GANs (One set of images produced by a GAN trained using random images, another set of images produced by a GAN trained using images selected based on human ratings.), to prove the importance of user experience in AI systems.

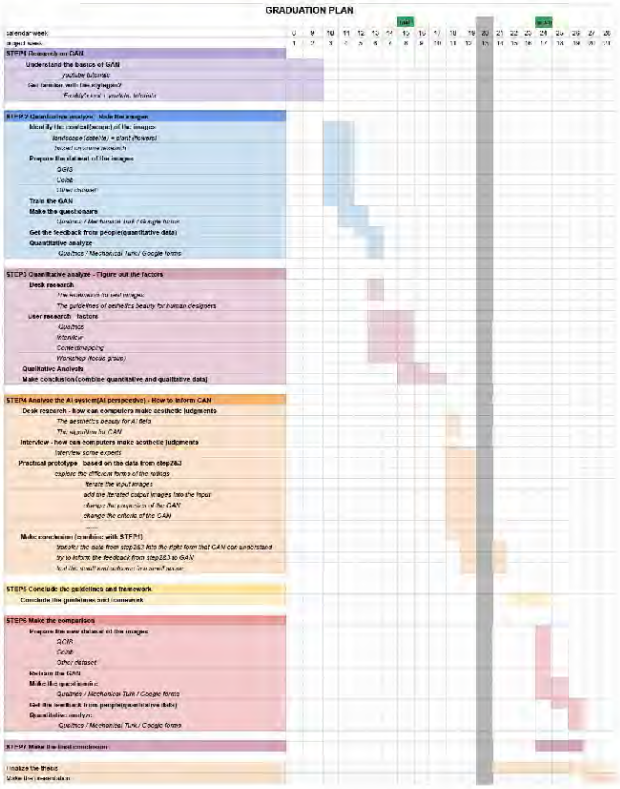
Initials & Nar [redacted]

Title of Project Explore How to Inform AI Systems of Human Experience

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 24 - 2 - 2022 16 - 7 - 2022 end date



This process will mainly include seven steps.

The first and second step is to get the quantitative rating outcome from people. We will design a system to gather human rating data (e.g., beauty) and think of some ways to optimize this experience? The third step is to get the qualitative outcome from people's perspective via some research and design methods like contextmapping etc. It aims to determine what factors people attend to in making aesthetic judgments of GAN output.

The forth part is to research from the perspective of an AI system. Understand the basics of GAN, Through the practical operations, theoretical research, etc., to have an in-depth knowledge of how GAN generates pictures and figure out what processes and methods are used to provide the images people expect under the current algorithms.

The fifth step is to analyze from the AI perspective and think about how to inform the outcome to GAN. By some prototype, to figure out how the ratings can be used to inform the GAN? And how can computers make aesthetic judgments, and could this inform the GANs?

Finally, we will conclude some guidelines and design principles about how to inform AI systems of the user experience better and enable AI systems to understand people's feedback and make full use of them.Then, we hope to compare the average ratings of images generated by two different GANs. A GAN will produce one set of images trained using random pictures, while another set of images will be made by a GAN trained using images selected based on human ratings.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

As an AI Designer who is looking forward to exploring the field of AI in the future, whether it is in-depth in the field of AI through ITD and other courses at TU Delft for a year and a half or being fortunate to enter the AI apartment of Alibaba as an intern as an interaction designer, these experiences have made me look forward to the changes that AI will bring to people's lives in the future.

On the one hand, with the deepening of AI technology, the products generated by AI for people will gradually penetrate people's lives. Whether virtual people, AI music, or AI artworks, they will inevitably occupy every aspect of people's lives. In the ITD course, I also had the opportunity to learn about GAN. As we explore the course, we leverage AI GANs to provide designers with inspirational images and mood boards that can be generated based on their ideas. This process made me feel the practical application value brought by the technology of GAN. But at the same time, because the current exploration of AI is mainly at the algorithm level, when it develops to a particular mature stage, people's experience and feelings about the information generated by AI will be a significant driving force for AI to improve. Therefore, I hope to start from the context of GAN to explore the role and importance of people's experience to the AI system.

On the other hand, using user experience to help designers mainly concentrates on a traditional design, including physical design and Internet products. In the future, with the advent of the metaverse era, how will user experience play its role in an AI-led world, and will AI user experience has new improvements at different latitudes? I also look forward to answering this question through my graduation project.

Reference

[1]Chen, T., Guo, W., Gao, X., & Liang, Z. (2021). AI-based self-service technology in public service delivery: User experience and influencing factors. Government Information Quarterly, 38(4), 101520.
[2]Brady, L., & Phillips, C. (2003). Aesthetics and usability: A look at color and balance. Usability News, 5(1), 2-5.
[3]Perc M. 2020 Beauty in artistic expressions through the eyes of networks and physics. J. R. Soc. Interface 17: 20190686. http://dx.doi.org/10.1098/rsif.2019.0686
[4]Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., ... & Bengio, Y. (2014). Generative adversarial nets. Advances in neural information processing systems, 27.
[5]Luc, P., Couprie, C., Chintala, S., & Verbeek, J. (2016). Semantic segmentation using adversarial networks. arXiv preprint arXiv:1611.08408.
[6]Harrison, P., Marjieh, R., Adolfi, F., van Rijn, P., Anglada-Tort, M., Tchernichovski, O., ... & Jacoby, N. (2020). Gibbs sampling with people. Advances in Neural Information Processing Systems, 33.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

02 GANs' factors

2.2.3 OUTDIR

Definition
The starting point of our fake images.

figure10. The different outdir

SEED

Definition
Get the specific image

2.2.5 RESUME

Definition
Set the base dataset

SNAP

Definition
How often a fake image and .pkl file should be output
(snap value = per tick count, four means every four ticks)
snapshot: show the process of the fake images

FREEZED

Definition
How many layers of the discriminator to freeze during the resume process

MIRROR

Definition
Add to the dataset by flipping the images during trainning (left-to -right, top-to-bottom)

CFG

Definition
The network configuration to use.

03.GANs' pipeline

Pipeline

This documentation describes the preparation and training process for StyleGan2 based on the resources from the landscape.

Dataset resources
landscape

GAN
StyleGan2

Platform
1.QGIS
https://www.qgis.org/en/site/

2. Earth Engine
https://code.earthengine.google.com/6ff-9098c905a8cd57be548baf4f2835f

3. Colab1 - Get the dataset
https://colab.research.google.com/github/dvschultz/stylegan2-ada-pytorch/blob/main/SG2_ADA_PyTorch.ipynb

4. Colab2 - Stylegan2
https://colab.research.google.com/github/dvschultz/
[https://colab.research.google.com/github/dvschultz/
stylegan2-ada-pytorch/blob/main/SG2_ADA_Py-
Torch.ipynb](https://colab.research.google.com/

5. Google drive h
ttps://drive.google.com/drive/u/0/my-drive

Process

The training of stylegan for landscape mainly consists of three parts.(figure 9) First, use QGIS and earth engine to get the input ; then get the input and upload it to Google drive. When the drive and stylegan are linked, stylegan uses the input for training; finally export to drive folder.

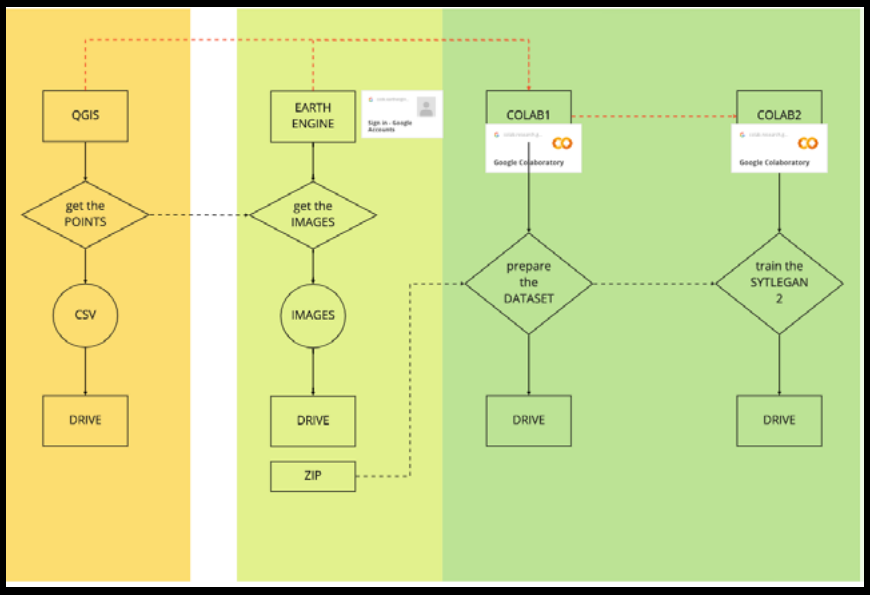
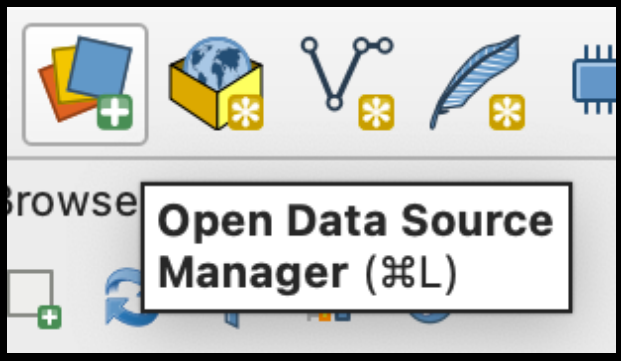


figure12. The process of SYTLEGAN2

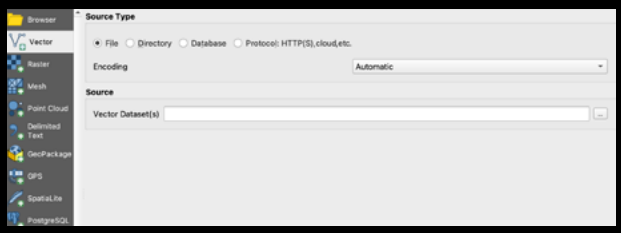
Input preparation
For landscape data collection, there are mainly the following steps

1. Get random latitude and longitude (QGIS)

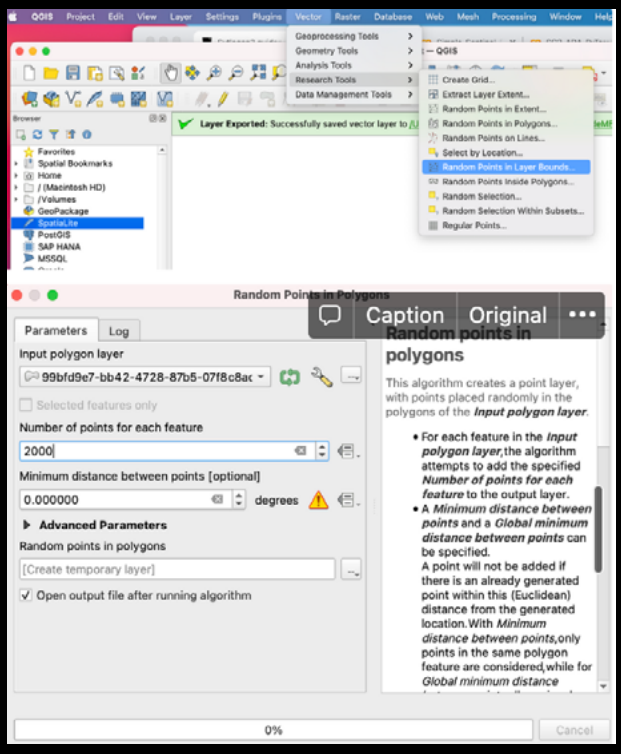
- Get maps in shp format from the website
- click open data source



Upload files in shp format in the category of vector



Get random points and set the number of random. points (for stylegan, 1000-2000 pictures are generally needed, so 1000-2000 random points are generally selected)



2.Get specific pictures based latitude and longitude (colab & earth engine)

In the colab, it has been connected with the relevant code of the earth engine, and the process of obtaining specific pictures only needs to be completed in the colab

Click the “play” button to connect the drive and colab, so that colab can directly read the content in our drive

Point to the location of your CSV with the locations you would like to export. After clicking the “play” button, colab will extract the points from our CSV.

Change the location where the images are saved by replacing “content” with the location in your Google Drive. Then click the “play” button. Colab will extract the landscape of the corresponding location to the location folder specified by drive according to the data in the CSV

figure14. Get specific pictures

Training process

After preparing the dataset, we already have input in our Google drive. We need to use these inputs in stylegan's colab to complete the training and export the output we need.

1. Connect colab to drive.

Click the "play" button to view the system's GPU and connect the drive to the colab.

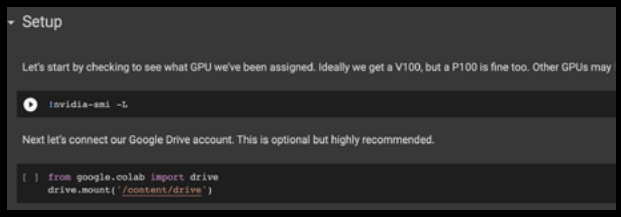


figure15. Connect colab to drive

2. Upload the input folder.

We need to compress the image obtained through earth engine and upload it to drive.

3.Train model

Enter the location of the compressed file into “dataset”, and “resume_from” will determine the final training result to a certain extent. Under this model, if it is new train, you can choose ‘ffhq1024’ or ‘./pretrained/wikiart.pkl’. Click the “play button” after making changes

Click the “play button” again, the model will start training to generate images and upload them to the drive

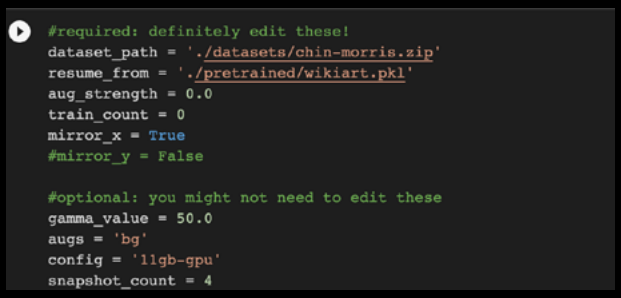


figure16. Train the model

4.Generate Single image

-network: Make sure the -network argument points to your .pkl file. (My preferred method is to right click on the file in the Files pane to your left and choose Copy Path, then paste that into the argument after the = sign).

-seeds: This allows you to choose random seeds from the model. Remember that our input to StyleGAN is a 512-dimensional array. These seeds will generate those 512 values. Each seed will generate a different, random array. The same seed value will also always generate the same random array, so we can later use it for other purposes like interpolation.

-truncation: Truncation, well, truncates the latent space. This can have a subtle or dramatic affect on your images depending on the value you use. The smaller the number the more realistic your images should appear, but this will also affect diversity. Most people choose between 0.5 and 1.0, but technically it's infinite.

After setting the parameters, click the play button to get the images

04.The measurement of GANs

2.2.8 GAMMA

Definition
Adjust this(50,100) if the dataset is noisy , but it will affects the sample quality

2.2.9 Kimg

Definition
Set a max kimg(once reached the model will stop trainning

2.2.10 AUG

Definition
Set augmentation

2.2.11 TARGET

Definition
Allows people to specify a different dataset to base augmentations of reals on

2.2.12 augpipe

Definition
Sets the augmentation types to be used in the augmentation process

2.3.2 FID : Frechet Inception Distance

Definition
Score the generated images compared to your results

Value (0-300)
The smaller: better image quality and diversity
The higher:, the less realistic & less like the results dataset

Evaluation Metric
Fidelity: The high quality of the imagesthat we want our GAN to generate.
Diversity: Our GAN should generate images that are inherent in the training data-set.

Exact factors

Pixel Distance: This is a naive distance measure where we subtract two images' pixel values.

Feature Distance: We use a pre-trained image classification model and use the activation of an intermediate layer. This vector is the high-level representation of the image. Computing a distance metric with such representation gives a stable and reliable metric.

Frechet Inception Distance is a distance metric that is best fit for curves polygons and it is perfect for better matching and shape matching. It doesn't require the two curves to be identical and it allows them to be within a given approximation range from each other as an example of this. For example ,if we are going to walk our dog outside, we have a leash and the dog is on the leash. It is allowed to be in the same path with us but it can also go on its own bath. As long as the leash allows for it, the shortest leash that is going to allow us and our dog to walk on the same path on the same curve without diverging from each other.

By computing the FID between a training dataset and a testing dataset, we can expect the FID to be zero since both are real images. However, running the test with different batches of training sample shows none zero FID.

Lower FID values mean better image quality and diversity.The metric score are usually between like 0-300 . The higher the number is, the less real or the less like your the data set.

Shortcomings

- It uses a pre-trained Inception model, which may not capture all features.
- It needs a large sample size. The minimum recommended sample size is 10,000. For a high-resolution image(say 512x512 pixels) this can be computationally expensive and slow to run.
- Limited statistics(mean and covariance) are used to compute the FID score.

Metric	Time	GPU mem	Description
fid50k_full	13 min	1.8 GB	Fréchet inception distance[1] against the full dataset
kid50k_full	13 min	1.8 GB	Kernel inception distance[2] against the full dataset
pr50k3_full	13 min	4.1 GB	Precision and recall[3] againt the full dataset
is50k	13 min	1.8 GB	Inception score[4] for CIFAR-10

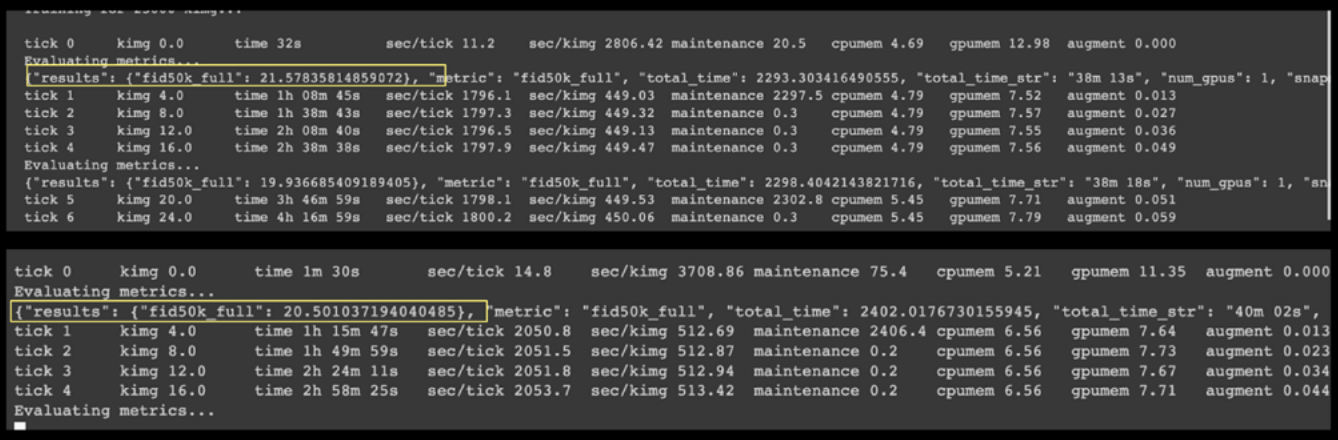


figure11. The exploration in FID

2.3.3 IS: Inception Score : the quality & diversity

Definition
The Inception score shows a reasonable correlation with the quality and diversity of generated images

Value (0-∞)
The higher : better image quality and diversity
The lower: the less realistic & less like results dataset

Inception Score is one of the most widely adopted scores for the evaluation of GAN. There are two criteria to measure GAN's performance. First, is the quality of the outcome(generated images. Second, is the diversity of the outcome.

For the quality of the generated images, it means each image is easy to be distinguished to look like something. For it, an pre-trained neural network (an inception net) is used to evaluate the generated images and the conditional label distribution P(y|x) is predicted.If P(y|x) is low entropy, it means it is easy to classify and better sample quality.

For the diversity of the generated images, which represents the variety of all the images, the marginal distribution p(y) is obtained. If p(y) has high entropy, all the classes are equally represented in the set of samples which mean the higher diversity. So, the low entropy of p(y|x) but large entropy of p(y) means the outcome is good. All in all, if the score if IS is high, it means the GAN is able to generate a lot of various good images which is easy to distinguish. For the scope of the score, the lowest score is 0, the highest is infinity.

2.3.4 Low-level Image Statistics.

Definition
Low-level image statistics can be used for regularizing GANs to optimize the discriminator to inspect whether the generator's output matches expected statistics of the real samples

2.3.5 Rapid Scene Categorization

Definition
Participants are asked to distinguish generated samples from real images in a short presentation time (e.g. 100 ms); i.e. real v.s fake

2.3.6 Preference Judgment

Definition
Participants are asked to rank models in terms of the fidelity of their generated images (e.g. pairs, triples)

After determining the scope of aesthetics in the project, I investigated some current methods of translating human experience into computers. Understanding the pros and cons of these approaches can help us better find informing AI systems human experience

3.6.1 Computational Aesthetics

In 1933, George David Birkhoff wrote the first quantitative theory of aesthetics in his book Aesthetic Measure. Since it involves computational methods, this work is often regarded as the beginning of Computational Aesthetics.

Computational Aesthetics is the research of computational methods that can similarly, make applicable aesthetic decisions as humans can

Moreover, there are many measurements for computational aesthetics.

3.4.2 Order/Complexity

Definition
It represents the reward one experiences when putting effort by focusing attention (complexity) but then realizing a certain pleasant harmony (order).

Complexity
Complexity is the effort the human brain has to put into processing an object. The complexity of a signal transmitted by the environment and received by the human perceptual system

Order

Order perceptually reward the effort of focusing attention on something complex.
Usually, it contains those factors.
Redundancy represents a perceiver's priori knowledge of a received stimulus
and keeps complexity down to an exciting or aesthetically pleasant level.
Apply fractal image compressibility as an element of order in their aesthetic measure,
assuming that self-similarities can be more easily perceived
A color order system named Coloroid.
What is more, there also exist elements of order such as symmetry, rhythm, repetition,
contrast, etc. which psychologically cause a positive tone of feeling, and cause negative tones, such as ambiguity or undue repetition.

3.4.3 Rooke - expression trees

Definition
The ability of the expression trees to make aesthetic rankings is explained by the the fact that the underlying primitives in the nodes of the trees were able to make statistical assessments of the images.

3.4.4 Sprott - global complexity measurement

Definition
For aesthetically evaluating fractal-like images

3.4.5 Baluja et al - categorizing the user rankings of imag-

Definition
These researchers attempted to train a neural net to perform this evaluation task using as training sets images that were obtained by categorizing the user rankings of images evaluated while users were running an interactive version of their generative system.

05. Qualitative research data

Materials

Type: landscape
Resource: 20 from Stylegan2 + 20 from thecitydoesnotexist

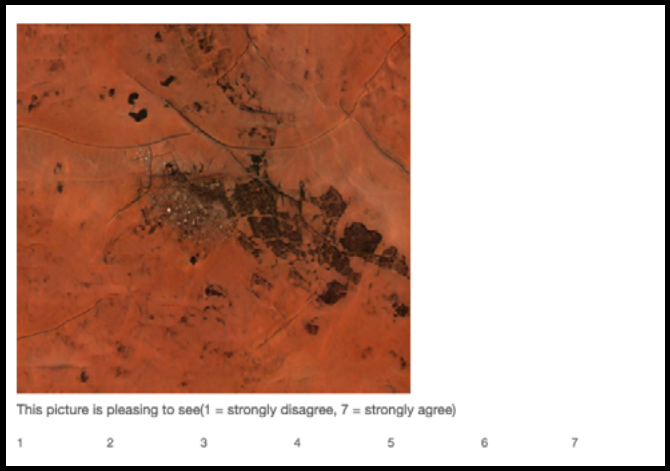
figure29. The materials for the research

Steps

The research will be conducted in a workshop where users are interviewed individually. The overall process is as follows:

Step1-Rate the aesthetics

The question is “whether the image is pleasing to see.”This is one of the items from “The Aesthetic Pleasure in Design (APiD) Scale.” Meanwhile, based on the theory of APiD, The optimal number of rating bars are ‘1~7’. (1 = strongly dis-agree, 7 = strongly disagree agree)

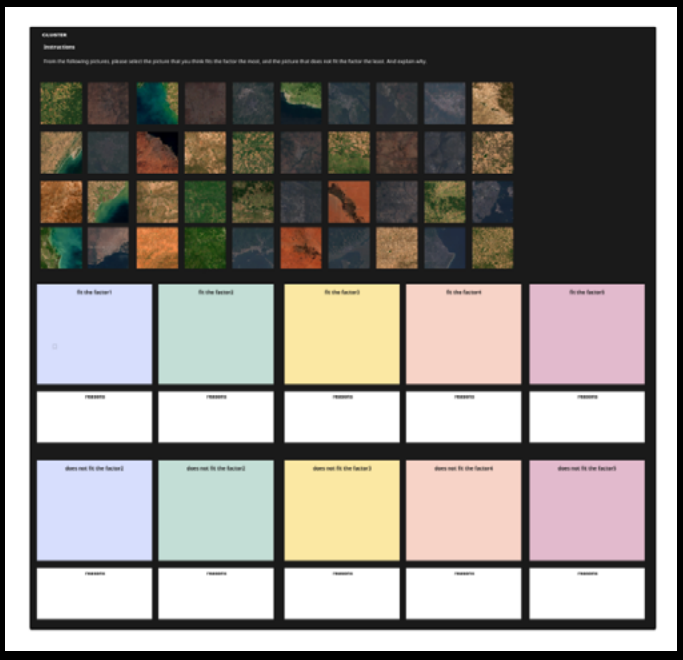


Step2-The factors that influence the aesthetics

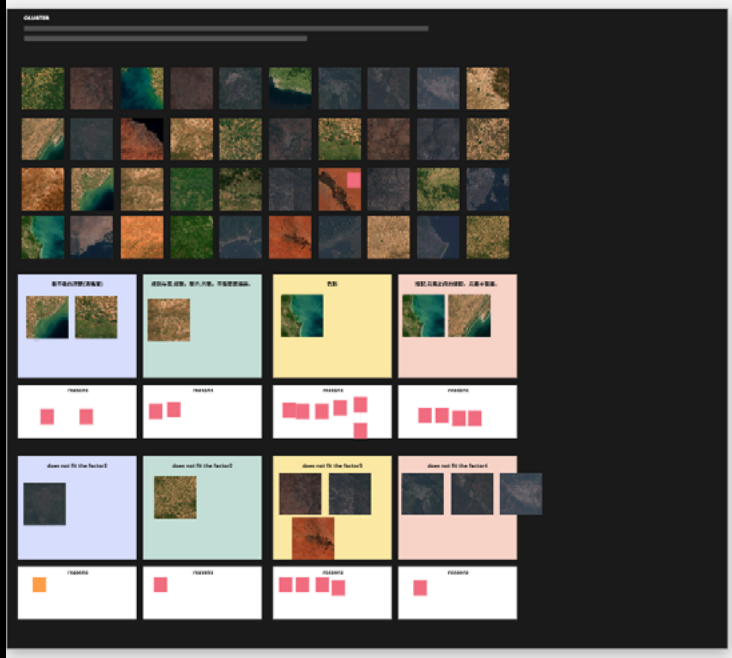
After rating, all the images are shown at the same time. Participants are asked to “Write down 4-5 factors that influence your ratings for those images.”

Step3-Cluster the images into the “factor”

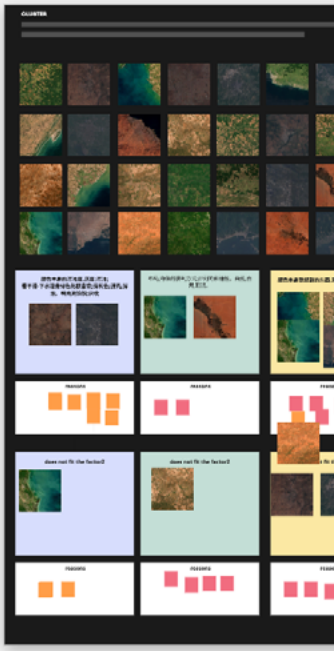
Participants are asked to cluster the images into the “factor.”It is used to understand people’s definitions of the factors. The instruction is: From the following pictures, please select the image that fits the factor the most and the picture that does not match the factor the least. And explain why.



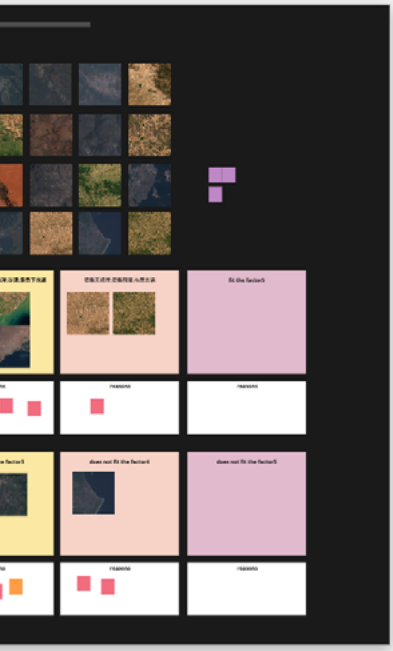
zifei

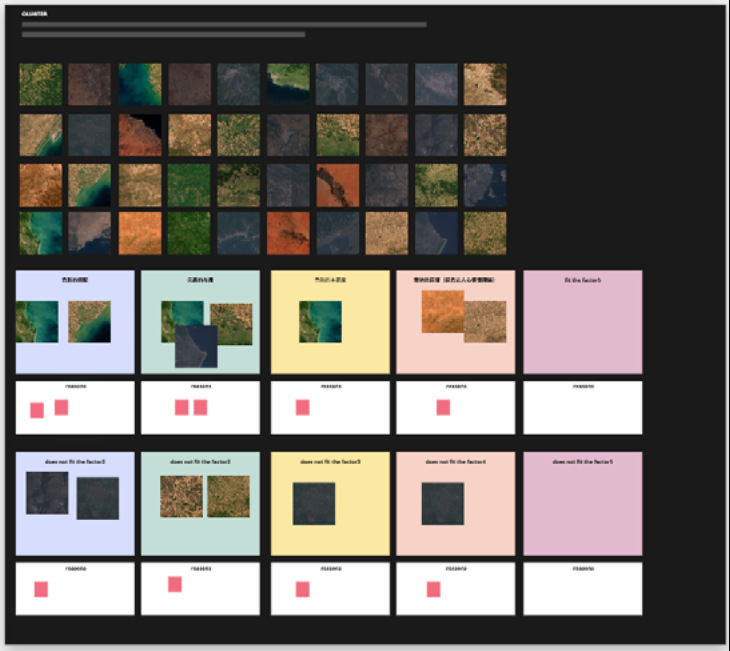


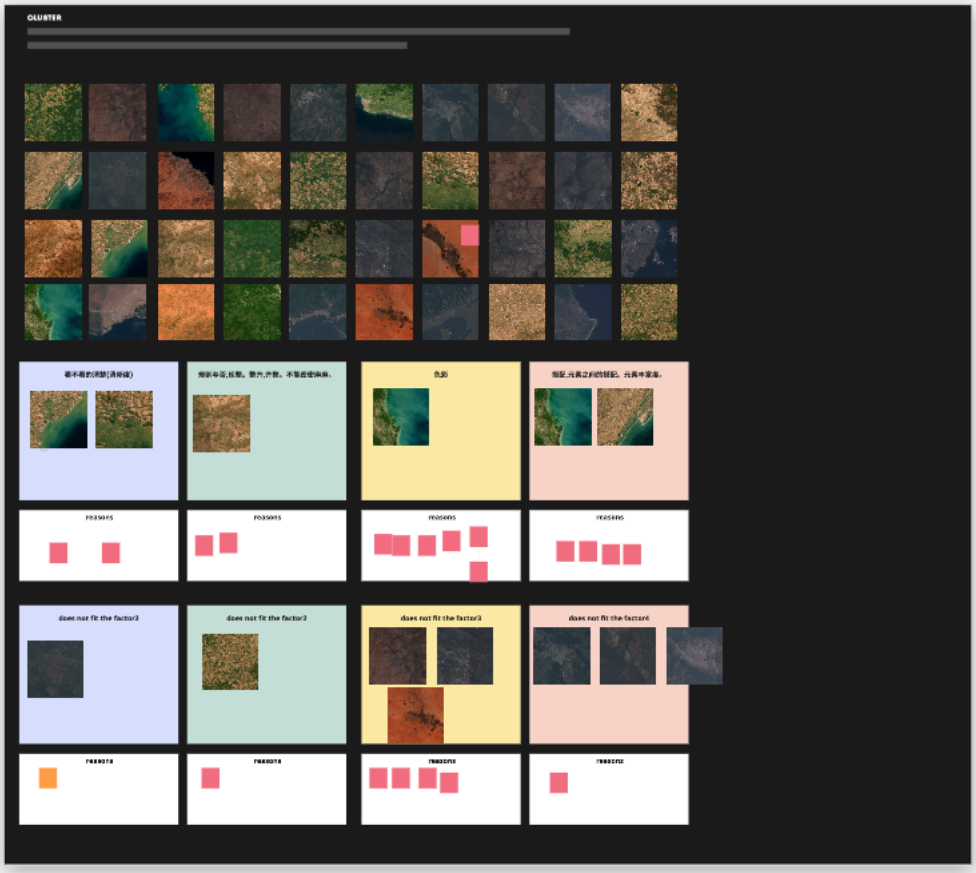
Melody



Sophia






CLUSTER
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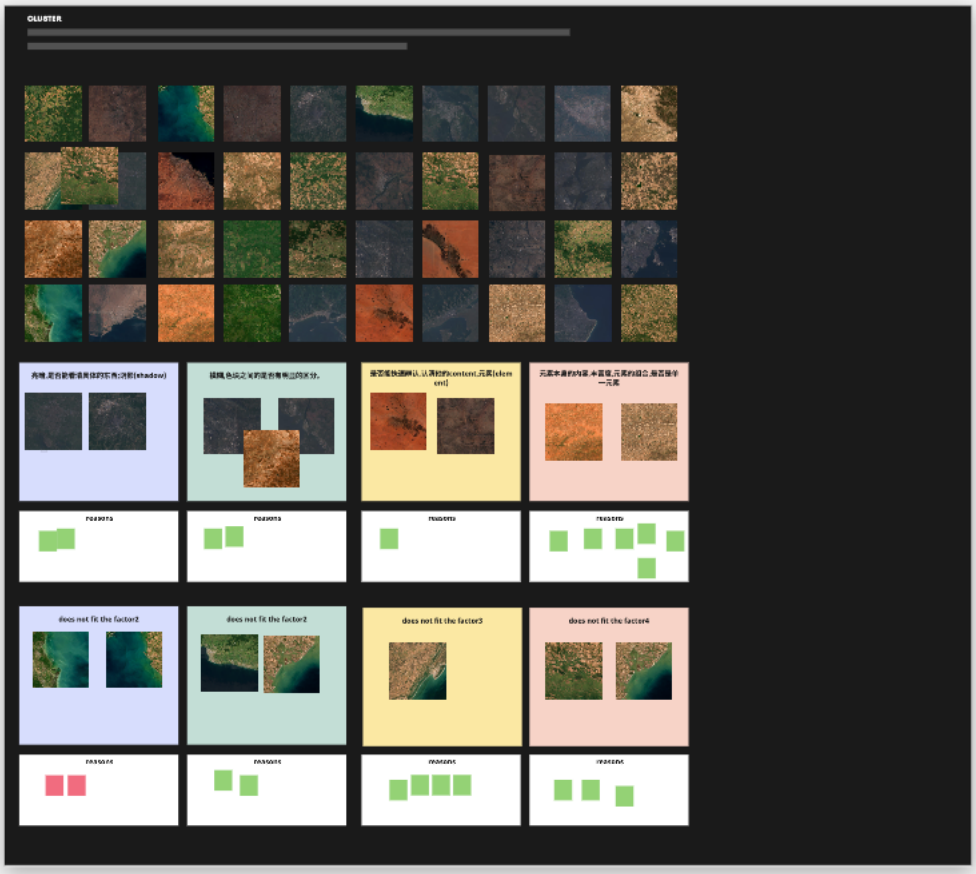
Sophia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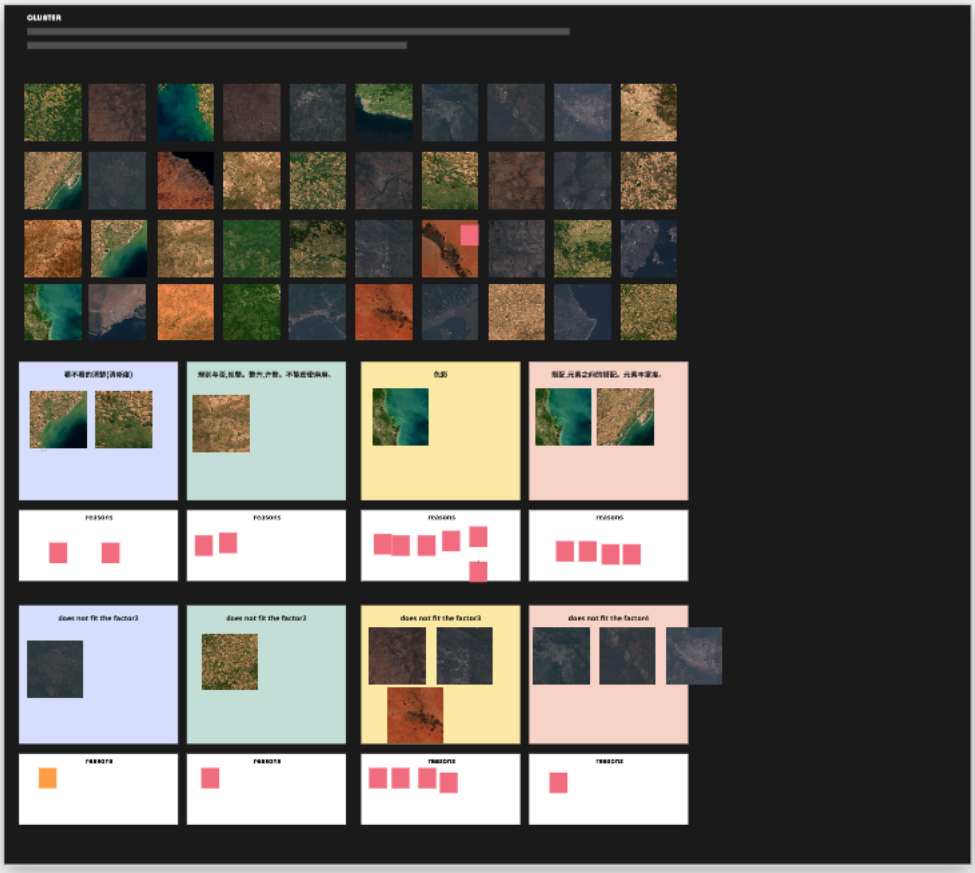
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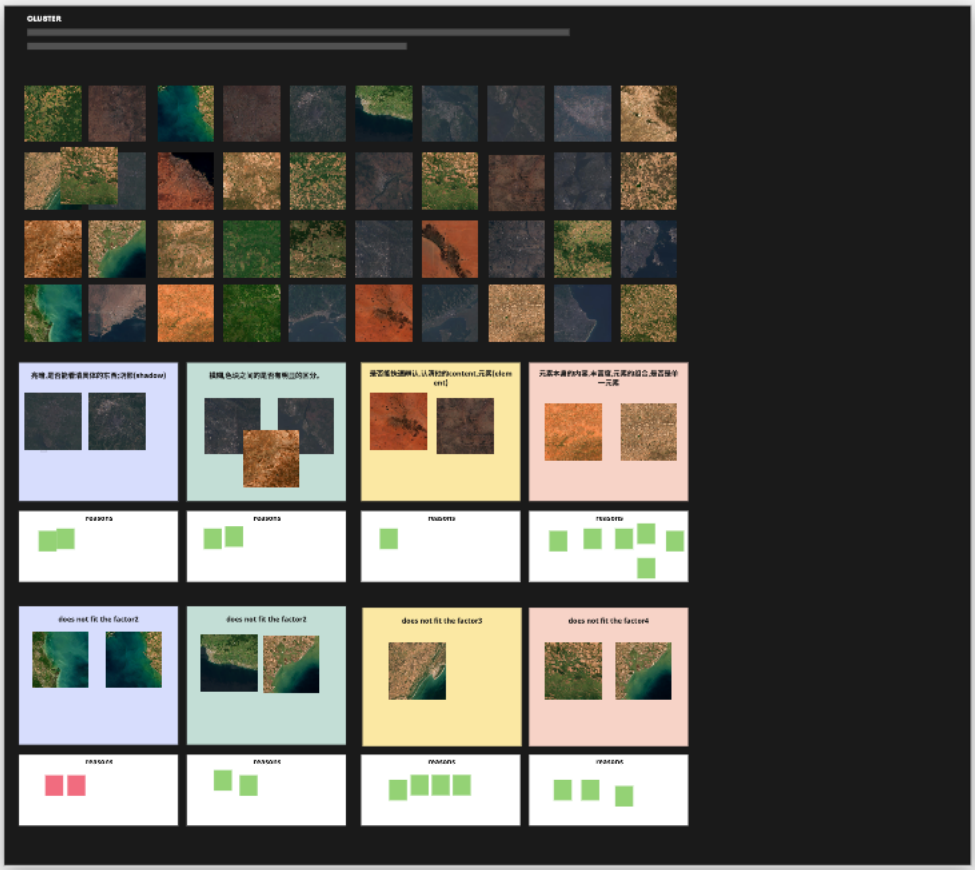
Rui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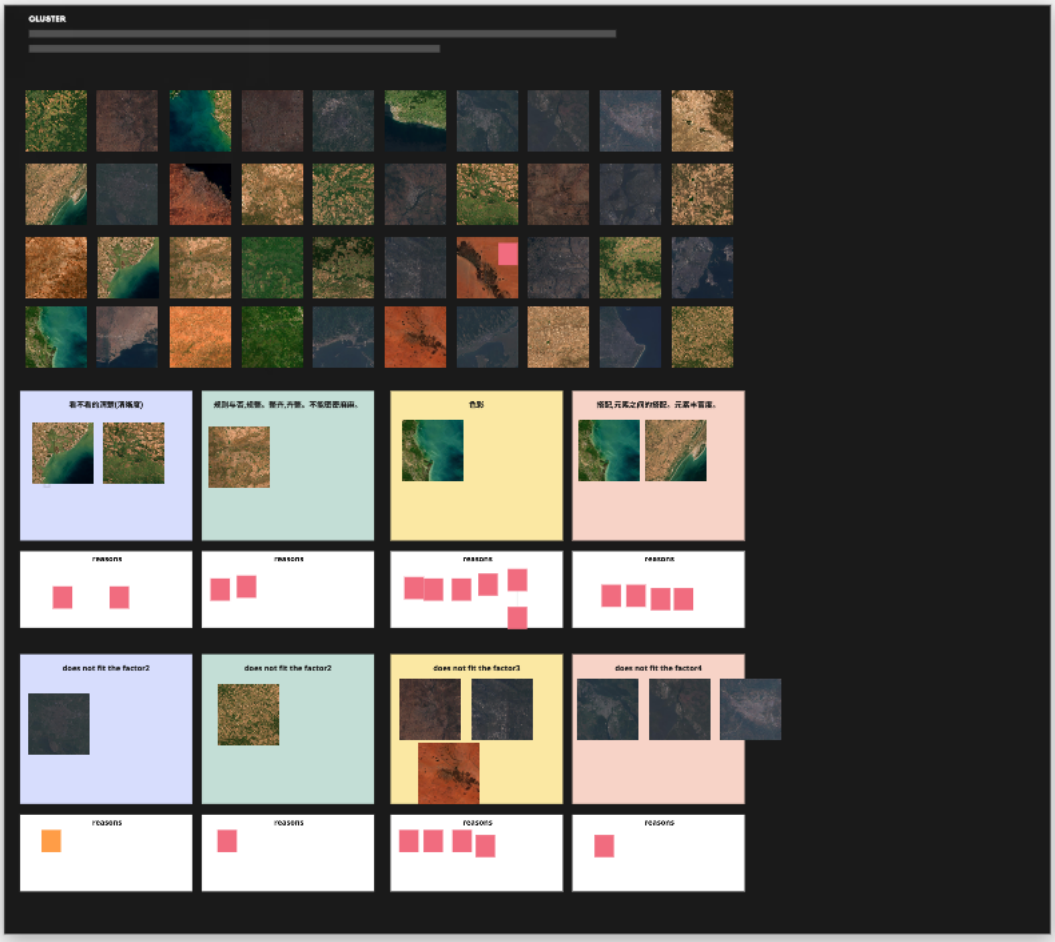
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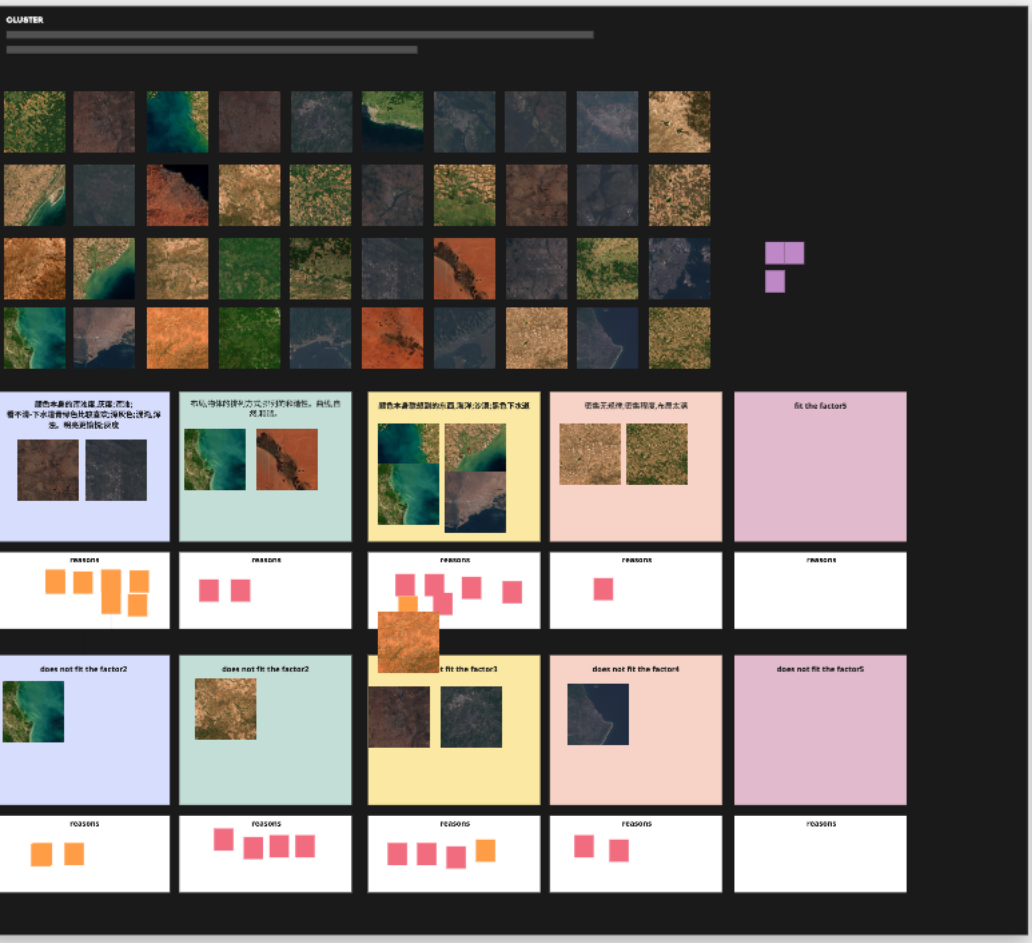
Melody


CLUSTER
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does not fit the factor2
does not fit the factor2
does not fit the factor4
does not fit the factor5
reasons
reasons
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reasons
reasons

06.Video's research data

Clip	Mean	Max	Min				
Clip1	1.90909090909091	3	1	2	3	1	
Clip2	5.90909090909091	7	4	6	5	7	
Clip3	4.72727272727273	7	3	5	5	6	
Clip4	2.90909090909091	5	1	4	3	2	
Clip5	4.27272727272727	5	3	4	4	3	
Clip6	1.63636363636364	3	1	1	2	1	
Clip7	4.63636363636364	7	3	5	4	5	
Clip8	2.18181818181818	3	1	3	3	2	

2	2	1	3	1	1	3	2
6	7	5	4	7	4	7	7
5	6	3	3	6	3	7	3
4	1	3	1	4	2	3	5
5	4	3	5	5	4	5	5
1	2	3	2	1	2	2	1
7	5	4	3	5	4	5	4
1	2	3	2	1	2	3	2