

Jan. 6th, 2021

# Class 2: Data

Exploring AI and Neural Nets in Design

**Gia Jung**

Research Associate, Lab for Design Technologies, Harvard University  
Irving Innovation Fellow 2020 - 2021

**Claire Djang**

Lab for Design Technologies, Harvard University  
Currently at Certain Measures

## Housekeeping & Troubleshooting

1. Clarifying errors from the first workshop - could you install all packages?
2. Deciding your project and making your own Dataset:

*What's your progress?*

GO TO: <https://forms.gle/YAeVCmhUeHtA7e569>

1.1

## Final Project & Data

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Data - Model - Project

Workshop Visualization  
Project Preview

1.2

## Building Dataset

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Data

Collection  
Curation  
Processing

Focus Project

“Beaux-arts Latent Walk”

Breakout room:

What is your Dataset?

1.3

## Workshop

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Review: Toolset and Data Scraping

Data Processing and Augmentation

Making Custom Dataset: Office Hours

1.1

## Final Project & Data

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Workshop Visualization  
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## Data

1. Collection

2. Curation

3. Processing

## Model

1. Choosing a Model

2. Training a Model

## Project (Workshop)

Latent Space  
Exploration #1

**Interpolation  
Animation**

Latent Space  
Exploration #2

**Interpolated Grid**

Latent Space  
Exploration #3

**Vector Arithmetic**

## Data

1. Collection

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## Model

1. Choosing a Model

**DCGAN**

2. Training a Model

**Workshop**

## Project (Workshop)

Latent Space  
Exploration #1

**Interpolation  
Animation**

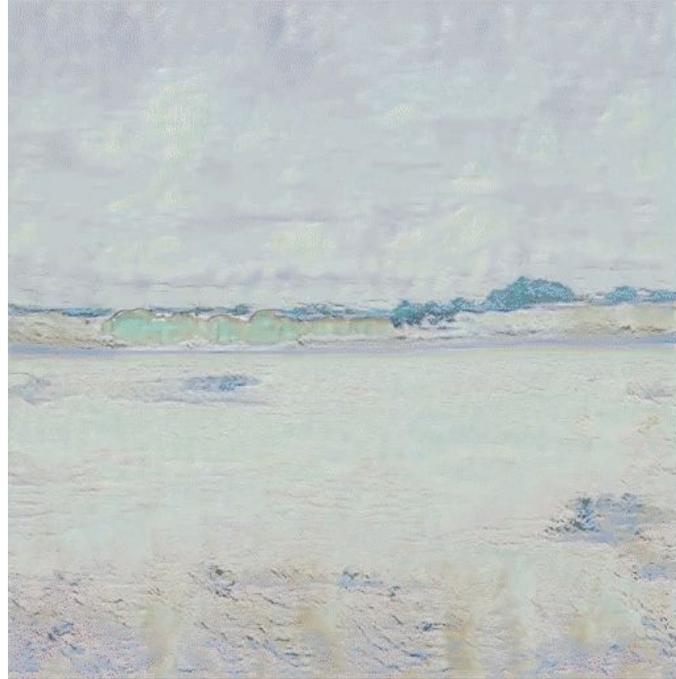
Latent Space  
Exploration #2

**Interpolated Grid**

Latent Space  
Exploration #3

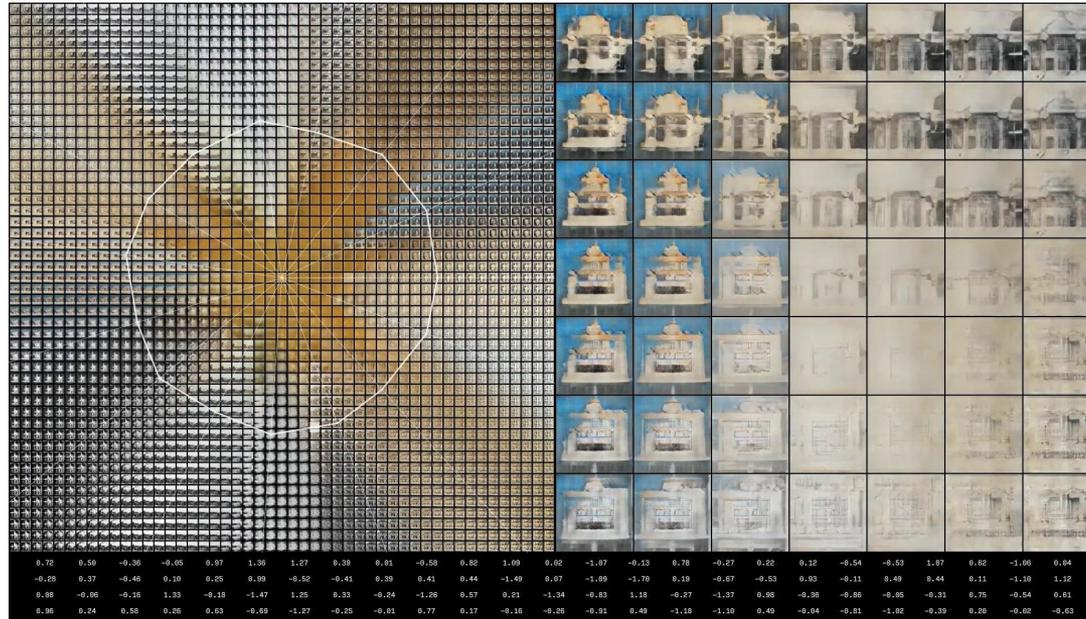
**Vector Arithmetic**

## Latent Space Exploration #1 Interpolation Animation



**The Landscape of Emotions** by Shiyi Peng MDes'20 (2020)

## Latent Space Exploration #2 Grid Animation



“Beaux-art Latent Walk” (2020)  
Lab for Design Technologies  
Prof. Andrew Witt, Gia Jung, Claire Djang

## Latent Space Exploration #3 Vector Arithmetic

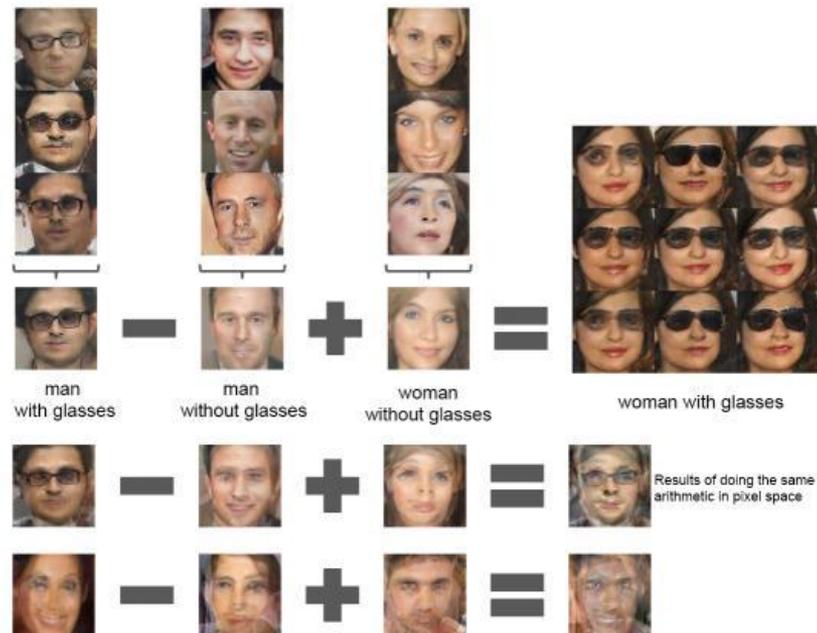
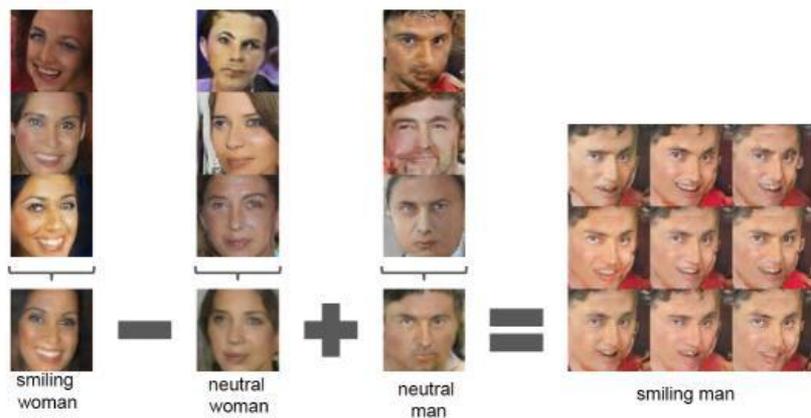


Figure 7: Vector arithmetic for visual concepts. For each column, the  $Z$  vectors of samples are averaged. Arithmetic was then performed on the mean vectors creating a new vector  $Y$ . The center sample on the right hand side is produced by feeding  $Y$  as input to the generator. To demonstrate the interpolation capabilities of the generator, uniform noise sampled with scale  $+0.25$  was added to  $Y$  to produce the 8 other samples. Applying arithmetic in the input space (bottom two examples) results in noisy overlap due to misalignment.

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## Example DCGAN Project (1) Balenciaga

08-22-18

# This AI designs Balenciaga better than Balenciaga

It's really into asymmetry and color-blocking.



[Image: [Robbie Barat](#)]



Robbie Barat, GAN-generated fashion design (left)  
Coat from ACNE Studios (right)

## Example DCGAN Project (2) Beaux-arts Drawings

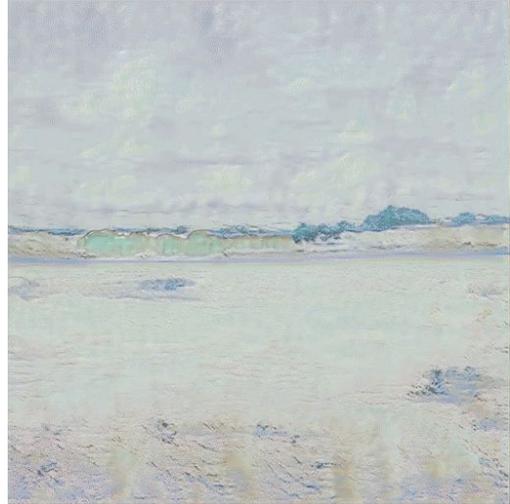
“Model is a generalization; form is a special case.” – Buckminster Fuller<sup>1</sup>



A matrix of architectural drawings generated from a neural network trained on thousands of Beaux-arts drawings. Project team: Andrew Witt, Gia Jung, Claire Djang, 2020.

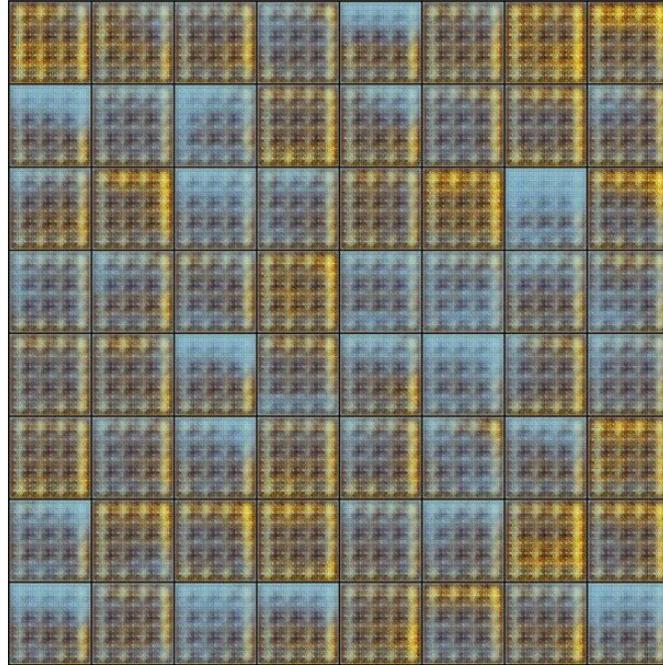
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Example DCGAN Project (3) Genre Paintings

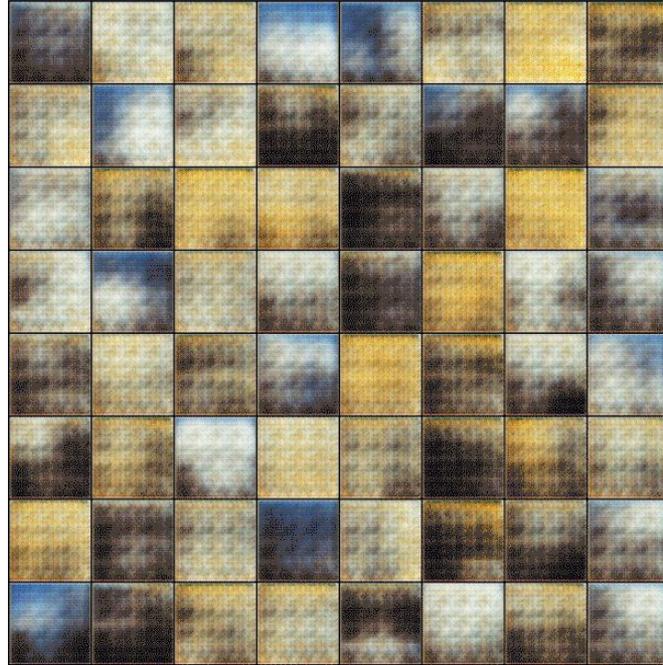


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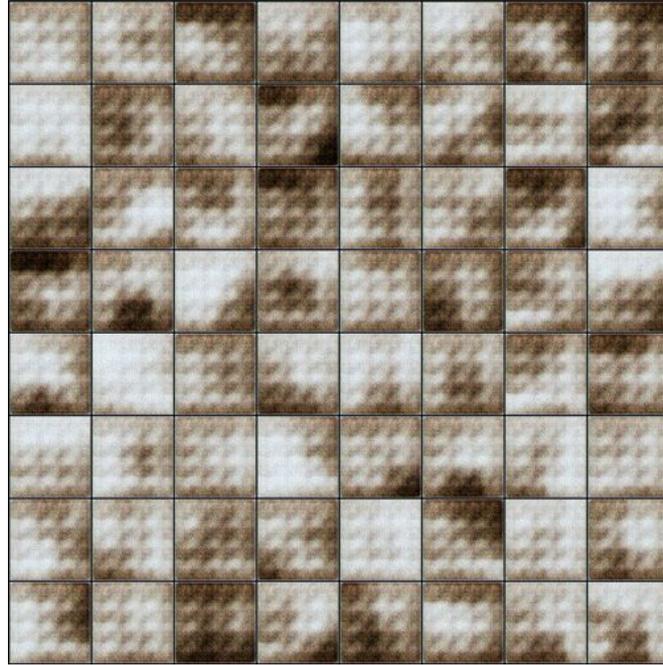
## Example DCGAN Project (3) Genre Paintings



Example DCGAN Project (3) Genre Paintings



Example DCGAN Project (4) Dwell



1.1

## Recap: Final Project

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Data - Model - Project

What is your Project?

1.2

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**Vector Arithmetic**

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**Vector Arithmetic**

## Data Collection (1) Building your own data



### FEATURED



**Bonji**  
Hakuin Ekaku • XVII-XVIII cent.



**Bonseki**  
Hakuin Ekaku • XVII-XVIII cent.



**Death**  
Hakuin Ekaku • XVII-XVIII cent.



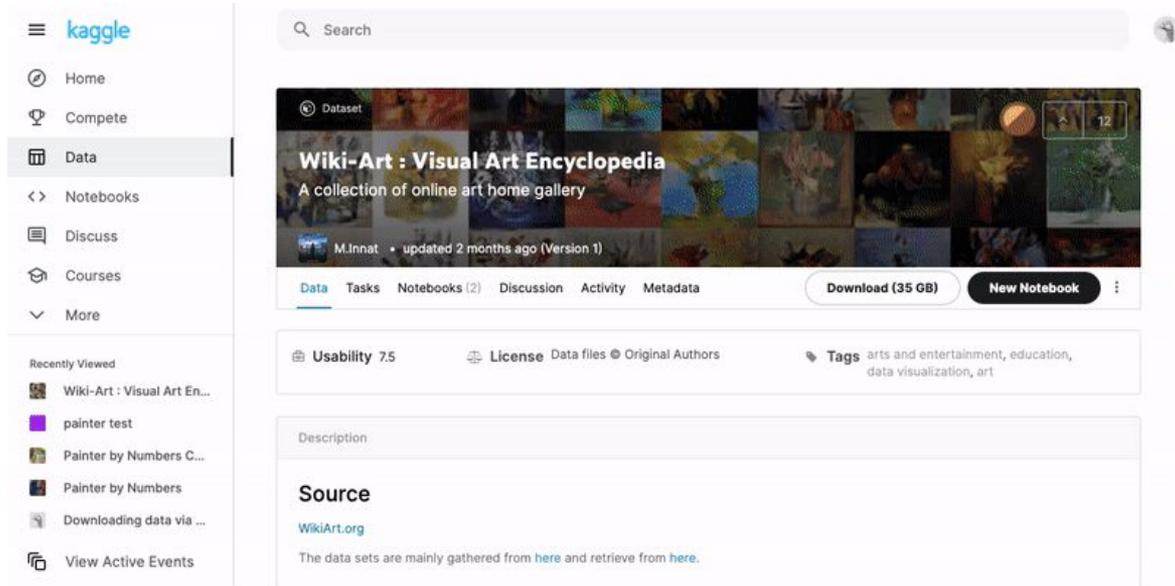
**Ensō**  
Hakuin Ekaku • XVII-XVIII cent.



**Ensō**  
Hakuin Ekaku • XVII-XVIII cent.



## Data Collection (2) Open Datasets



The image shows a screenshot of the Kaggle website interface. On the left is a navigation sidebar with the Kaggle logo and menu items: Home, Compete, Data (highlighted), Notebooks, Discuss, Courses, and More. Below these are 'Recently Viewed' items including 'Wiki-Art : Visual Art En...', 'painter test', 'Painter by Numbers C...', 'Painter by Numbers', and 'Downloading data via ...'. At the bottom of the sidebar is 'View Active Events'.

The main content area features a search bar at the top. Below it is a large banner for the dataset 'Wiki-Art : Visual Art Encyclopedia' with a grid of art images. The banner text reads 'A collection of online art home gallery' and 'M.Innat • updated 2 months ago (Version 1)'. Below the banner are tabs for 'Data', 'Tasks', 'Notebooks (2)', 'Discussion', 'Activity', and 'Metadata'. There are two buttons: 'Download (35 GB)' and 'New Notebook'.

Below the banner is a row of metadata: 'Usability 7.5', 'License Data files © Original Authors', and 'Tags arts and entertainment, education, data visualization, art'.

The 'Description' section is partially visible, showing a 'Source' heading and a link to 'WikiArt.org'. The text below the link states: 'The data sets are mainly gathered from here and retrieve from here.'

<https://www.kaggle.com/ipythonx/wikiart-gangogh-creating-art-gan>

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## Data Curation: (1) Analysis

**Data Explorer**  
84.29 GB

- all\_data\_info.csv
- replacements\_for\_corrupted...
- sampleSubmission.csv
- solutionPainter.csv
- submission\_info.csv
- test.zip
- train.zip
- train\_1.zip
- train\_2.zip
- train\_3.zip
- train\_4.zip
- train\_5.zip
- train\_6.zip
- train\_7.zip
- train\_8.zip
- train\_9.zip
- train\_info.csv

**Summary**

- 17 files
- 25 columns

[Download All](#)

**all\_data\_info.csv (12.75 MB)**

Detail Compact Column 10 of 12 columns

id	date	genre	# pixelsx	# pixelsy
2319 unique values	[null] 1913 Other (76308)	26% 1% 74% portrait landscape Other (71397)	16% 15% 69%	200 25.5k 162
tt Newman	1955.0	abstract	15530.0	6911.0
tt Newman	1950.0	abstract	14559.0	6866.0
nichol	2013.0		9003.0	9004.0
nichol	2013.0		9003.0	9004.0
nichol	2013.0		9003.0	9004.0
Mitsuoki		mythological painting	25528.0	3000.0
tt Newman		abstract	7345.0	8640.0
nige	1838	bird-and-flower painting	6483.0	9276.0
tt Newman	1963.0	abstract	6049.0	8206.0
Richard berger		cityscape	6238.0	7352.0
nige	1844	bird-and-flower painting	5492.0	8283.0
ang Paalen	1937.0	landscape	5331.0	8351.0

## Data Curation: (2) Segmentation

### Data Explorer

34.98 GB

- abstract
- animal-painting
- cityscape
- figurative
- flower-painting
- genre-painting
- landscape
- marina
- mythological-painting
- **nude-painting-nu**
  - 📄 000c0388d5a6f20e...
  - 📄 000cd538567395c7...
  - 📄 001638fc54ce78c0d...
  - 📄 0028bce344a81aa3...
  - 📄 003677a8d3939b35...
  - 📄 005170687fae6212...
  - 📄 0091818e1e9eeb94...
  - 📄 00bf766690e7853...
  - 📄 00e1156d96f204157...
  - 📄 00f07bd9d55ce1b5...
  - 📄 00fbd6bfe59136d30...
  - 📄 01055d6df693d18e...
  - 📄 011006f4526944eaa...
  - 📄 0116e0190edf3f39d...

### Summary

- 96.0k files

### < nude-painting-nu (3000 files)



0125a83a918cfccd88e...  
721.03 KB



01265fee4e88bcc6821...  
113.03 KB



013813503d05712be4...  
179.8 KB



015070582d202dcea6...  
24.33 KB



01530f3233091722b19...  
484.43 KB



015ae7ace3fd1b036af1...  
4.12 MB



01a3ba9bbf2c973d92f...  
160.67 KB



01aa9bc22a1a1bcc480...  
155.34 KB



01b93f2ea5daa6aee77...  
84.67 KB



01c9f3612f186947ff05...  
11.98 MB



01fd22cebd0f26a341...  
220.74 KB



02163af739750cbd2e5...  
7.83 MB



02201be28ba787dfd0e...  
320.24 KB



02463f0c848732bccb8...  
72.29 KB

This preview shows 30 out of 3000 items. [Load more](#)

## Data Curation: (2) Segmentation

The screenshot displays a data curation interface with three main components:

- Spreadsheet (Left):** A table with columns for artist, date, genre, pixelsx, and pixelsy. It lists various artists and their works, such as Konstantin Somov, Carlos Saenz de Tejada, and Ferdinand Hodler.
- Filter Panel (Middle):** A 'style' filter panel with a 'Sort' section (Ascending/Descending) and a 'Filter' section. The 'Filter' section includes a 'By color' dropdown and a 'Choose One' dropdown. A list of art styles is shown, with 'Art Nouveau (Modern)' selected.
- Data Preview (Right):** A table showing the result of the filter, with columns for artist, in\_train, new\_file, and file. It lists the filtered data points, such as 'rist\_grd', 'in\_train', 'new\_file', and 'file'.

artist	date	genre	pixelsx	pixelsy
77	Konstantin Somov	1934 interior	4374	5360
86	Carlos Saenz de Tejada	history paint	5360	5321
87	Carlos Saenz de Tejada	history paint	5321	5331
88	Carlos Saenz de Tejada	history paint	5331	5339
89	Carlos Saenz de Tejada	history paint	5339	5322
90	Carlos Saenz de Tejada	history paint	5322	5321
91	Carlos Saenz de Tejada	history paint	5321	5305
93	Carlos Saenz de Tejada	history paint	5305	5305
94	Carlos Saenz de Tejada	history paint	5305	5306
95	Carlos Saenz de Tejada	history paint	5306	5305
96	Carlos Saenz de Tejada	history paint	5305	5124
99	Ferdinand Hodler	1910 genre paint	5124	4410
109	Koloman Moser	c.1910 self-portrait	4410	4290
118	Koloman Moser	c.1896 illustration	4290	3738
119	Ferdinand Hodler	1915 portrait	3738	4194
128	Koloman Moser	1899 design	4194	4122
131	Koloman Moser	c.1895 illustration	4122	3278
143	Koloman Moser	1897 design	3278	4704
147	Koloman Moser	1898 portrait	4704	3894
152	Ferdinand Hodler	1916 portrait	3894	4758
154	Koloman Moser	c.1902 poster	4758	4800
156	Ferdinand Hodler	1901 symbolic portrait	4800	3690
157	Ferdinand Hodler	1911 portrait	3690	3816
161	Koloman Moser	c.1907 landscape	3816	4806
165	Ferdinand Hodler	1912 landscape	4806	4722
166	Koloman Moser	design	4722	4812
181	Ferdinand Hodler	c.1912 landscape	4812	4812
182	Ferdinand Hodler	1910 landscape	4812	4824
183	Ferdinand Hodler	1914 portrait	4824	3930
185	Ferdinand Hodler	1914 self-portrait	3930	3738
191	Ferdinand Hodler	c.1912 portrait	3738	4740
192	Koloman Moser	c.1914 sketch and design	4740	4746
193	Koloman Moser	c.1910 design	4746	3402
194	Koloman Moser	1905 design	3402	4746
197	Ferdinand Hodler	1890 portrait	4746	4734
199	Koloman Moser	1914 mythological	4746	4734
205	Koloman Moser	1914 self-portrait	4734	

Ready 4899 of 103250 records found

## Data Curation: (2) Segmentation



Flower



Cityscape



Nude

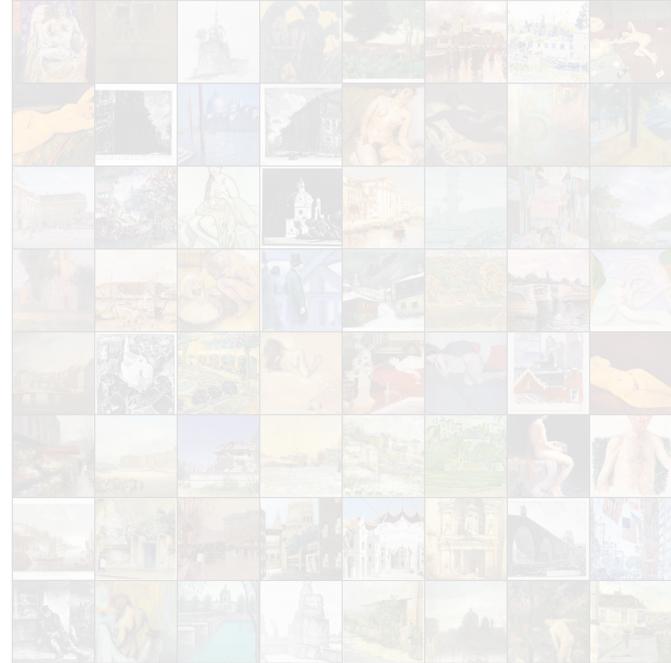
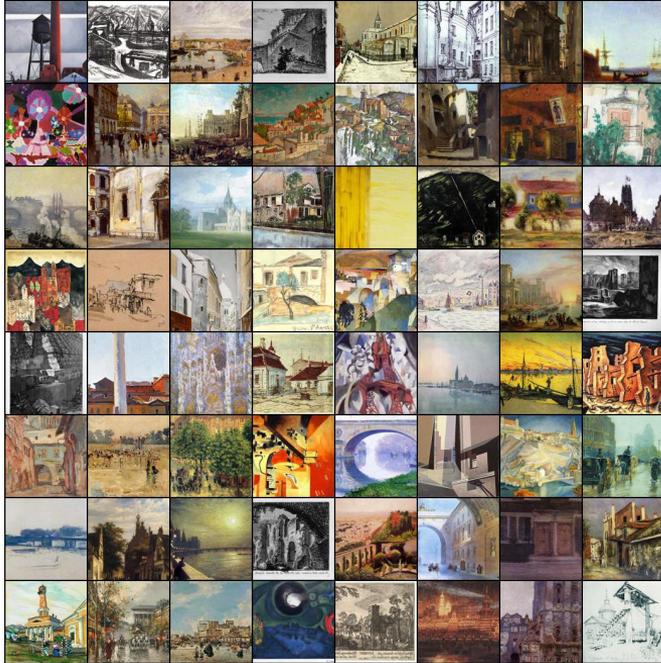


Landscape



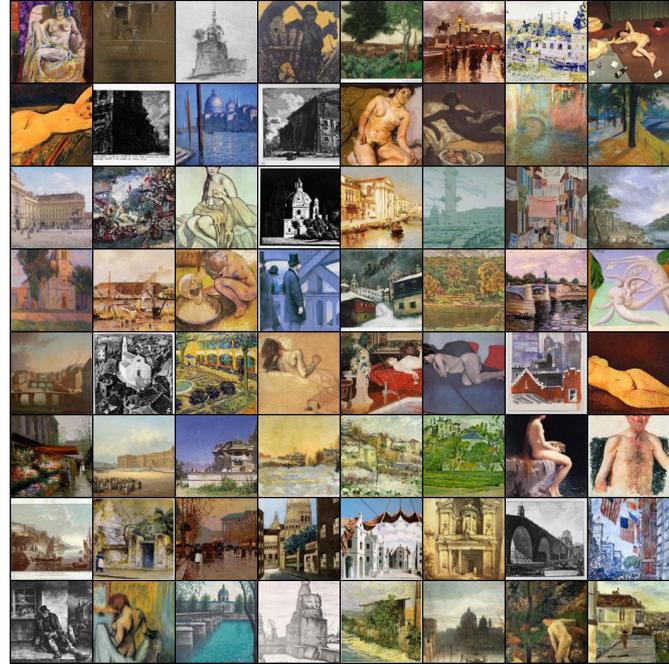
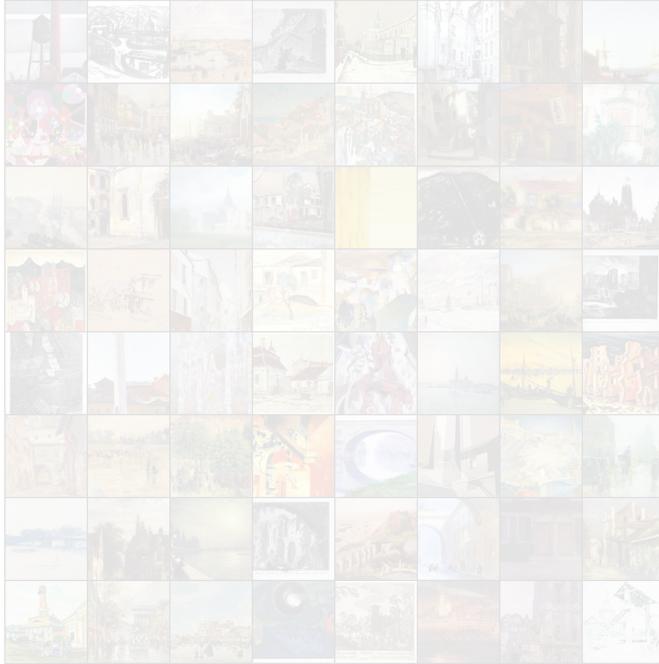
Marina

## Data Curation: (3) Hybridization



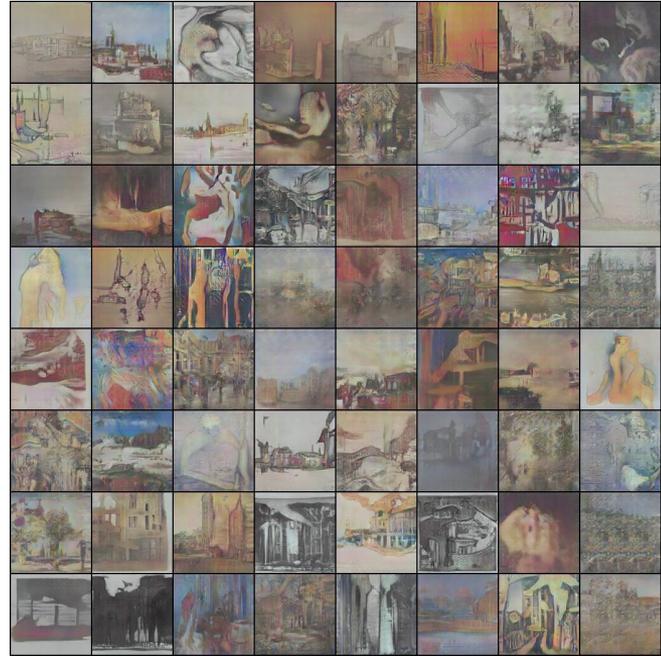
Training Data: Cityscape (Left), Cityscape and Nude (Right)

## Data Curation: (3) Hybridization



Training Data: Cityscape (Left), Cityscape and Nude (Right)

## Data Curation: (3) Hybridization



Generation: Cityscape (Left), Cityscape and Nude (Right)

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**Interpolated Grid**

Latent Space  
Exploration #3

**Vector Arithmetic**

Data Processing (1) Formatting: Squares



2232x2952

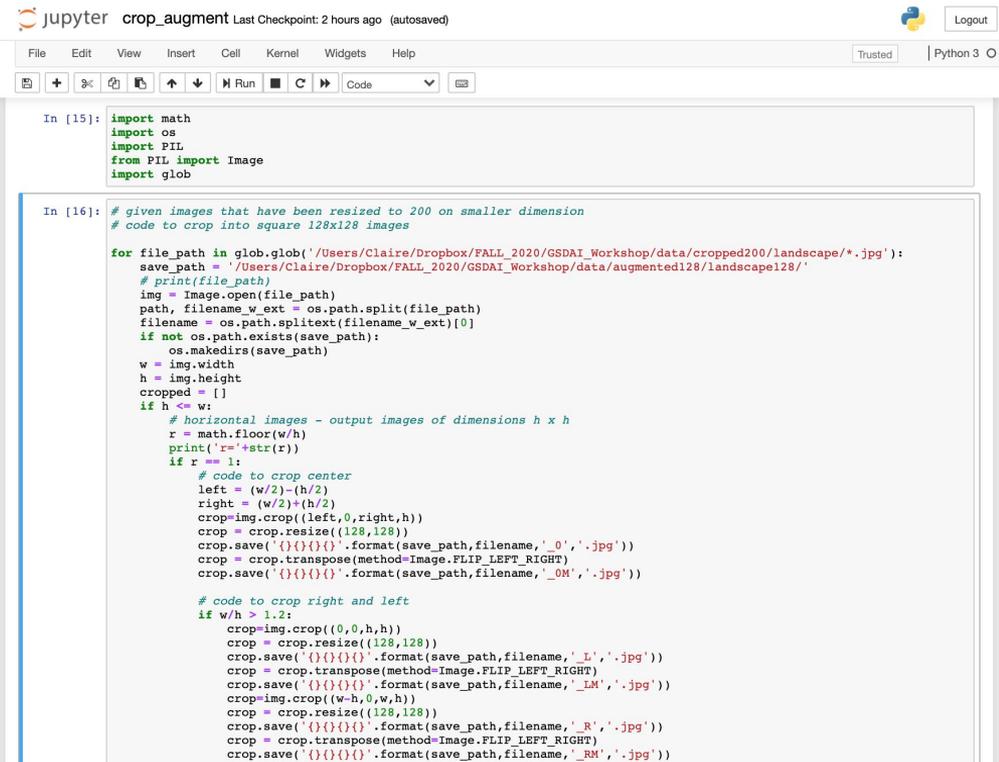


128x128

Data Processing (2) Augmentation: Cropping, Rotating, Flipping...



## Data Processing: (2) Augmentation



The image shows a Jupyter Notebook interface with the following elements:

- Header:** "jupyter crop\_augment Last Checkpoint: 2 hours ago (autosaved)" and a "Logout" button.
- Menu:** File, Edit, View, Insert, Cell, Kernel, Widgets, Help.
- Toolbar:** Includes icons for home, refresh, undo, redo, run, and code cell options.
- Code Cell 1 (In [15]):**

```
import math
import os
import PIL
from PIL import Image
import glob
```
- Code Cell 2 (In [16]):**

```
# given images that have been resized to 200 on smaller dimension
# code to crop into square 128x128 images

for file_path in glob.glob('/Users/Claire/Dropbox/FALL_2020/GSDAI_Workshop/data/cropped200/landscape/*.jpg'):
    save_path = '/Users/Claire/Dropbox/FALL_2020/GSDAI_Workshop/data/augmented128/landscape128/'
    # print(file_path)
    img = Image.open(file_path)
    path, filename_w_ext = os.path.split(file_path)
    filename = os.path.splitext(filename_w_ext)[0]
    if not os.path.exists(save_path):
        os.makedirs(save_path)
    w = img.width
    h = img.height
    cropped = []
    if h <= w:
        # horizontal images - output images of dimensions h x h
        r = math.floor(w/h)
        print('r'+str(r))
        if r == 1:
            # code to crop center
            left = (w/2)-(h/2)
            right = (w/2)+(h/2)
            crop=img.crop((left,0,right,h))
            crop = crop.resize((128,128))
            crop.save('{}{}{}'.format(save_path,filename,'_0',''.jpg'))
            crop = crop.transpose(method=Image.FLIP_LEFT_RIGHT)
            crop.save('{}{}{}'.format(save_path,filename,'_0M',''.jpg'))

        # code to crop right and left
        if w/h > 1.25:
            crop=img.crop((0,0,h,h))
            crop = crop.resize((128,128))
            crop.save('{}{}{}'.format(save_path,filename,'_L',''.jpg'))
            crop = crop.transpose(method=Image.FLIP_LEFT_RIGHT)
            crop.save('{}{}{}'.format(save_path,filename,'_LM',''.jpg'))
            crop=img.crop((w-h,0,w,h))
            crop = crop.resize((128,128))
            crop.save('{}{}{}'.format(save_path,filename,'_R',''.jpg'))
            crop = crop.transpose(method=Image.FLIP_LEFT_RIGHT)
            crop.save('{}{}{}'.format(save_path,filename,'_RM',''.jpg'))
```

## Data Processing (2) How machines see images



62	62	63	64	65	66	67	67	69	70	71	72	72	73	73	73	72	72	71	70	69	67	66	66	66	65	63	62	61	60	60			
61	62	63	64	66	66	67	68	68	69	70	71	71	72	72	73	72	72	71	71	70	69	68	66	66	65	65	63	62	61	60	60		
61	62	63	64	66	66	68	68	69	70	70	71	72	73	73	73	72	72	71	71	69	68	67	66	66	65	65	64	63	62	61	61		
61	63	64	64	66	67	68	68	68	69	70	71	71	73	73	74	73	73	71	70	69	68	66	66	65	64	63	62	61	61	60			
61	63	64	65	67	68	69	69	70	70	71	71	72	55	53	69	72	72	71	71	70	69	68	67	66	65	64	63	62	60	60			
63	64	65	66	67	68	69	69	70	70	71	72	42	4	5	11	48	72	71	71	69	69	68	67	66	65	64	62	62	60	59	59		
63	65	66	66	68	68	69	70	71	71	71	72	18	4	4	7	8	66	71	70	69	68	68	67	66	65	64	63	61	59	59	58		
63	65	67	67	68	69	69	70	71	71	72	64	4	27	24	54	33	29	52	64	68	68	67	66	65	64	63	62	61	59	58	58		
64	65	66	66	68	69	70	71	71	71	72	24	24	12	17	24	48	60	37	43	38	52	66	68	67	66	65	64	63	61	60	59	58	57
65	66	67	67	68	69	71	49	6	6	6	5	34	36	12	47	34	17	29	54	43	63	67	66	65	64	63	62	60	59	58	57		
64	65	66	66	68	69	38	6	6	5	5	7	16	19	4	47	44	27	24	40	67	66	66	65	65	64	63	61	60	59	58	57		
63	64	65	65	67	30	6	6	5	5	5	6	8	9	20	27	51	78	41	44	66	65	65	65	65	64	63	62	60	59	58	57		
63	64	65	65	34	5	5	5	5	5	5	4	19	6	7	54	64	20	59	65	65	64	64	64	63	62	61	60	59	57	56			
63	64	64	65	14	5	6	5	4	5	4	18	7	5	4	19	10	11	65	64	64	64	63	61	66	62	61	60	59	58	56			
63	64	64	65	53	7	4	5	6	6	7	10	6	5	5	4	21	24	18	64	64	64	63	62	64	65	62	62	60	59	58	57		
64	64	64	64	65	50	4	4	4	5	11	16	6	6	4	6	35	16	26	66	64	64	63	61	72	67	63	62	61	59	58	57		
64	64	64	64	65	46	4	4	4	5	6	9	8	5	29	10	43	56	29	57	64	64	63	61	70	67	62	64	65	59	59	57		
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Data Processing (2) Augmentation: Cropping, Rotating, Flipping...



1.1

## Recap: Final Project

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Data - Model - Project

What is your Project?

1.2

## Data

---

Data

Collection

Curation

Processing

Focus Project

“Beaux-arts Latent Walk”

Breakout room:

What is your Dataset?

1.3

## Workshop

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Review: Toolset and Data Scraping

Data Processing and Augmentation

Making Custom Dataset: Office Hours



Focus Project "Beaux-arts Latent Walk"

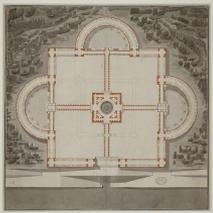
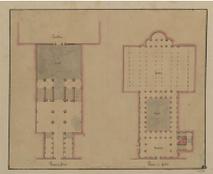
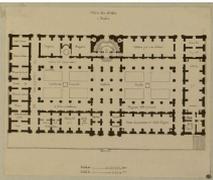
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Focus Project: “Beaux-arts Latent Walk”

Go To:

<http://www.ensba.fr/ow2/catzarts/index.xsp>

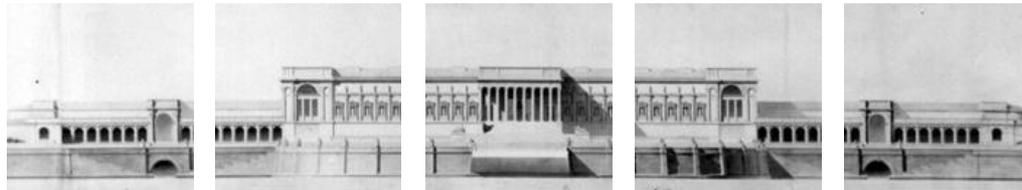
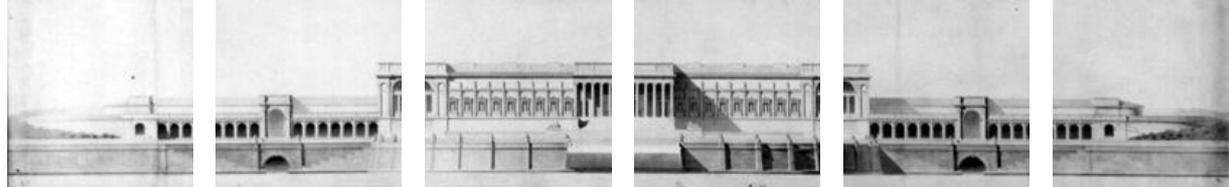
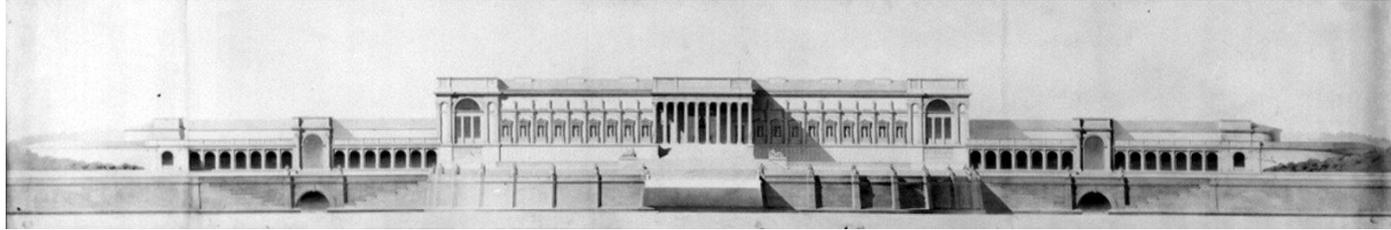
## Total Scraped Images - Plan Images

Total	Number of Images	Example	Search terms
<b>Plan:</b>  <b>1813</b>	864		"Dessin d'architecture et ornement" ET plan
	667		"Dessin scolaire d'architecture" ET plan
	282		estampe ET plan SAUF elevation SAUF coupe

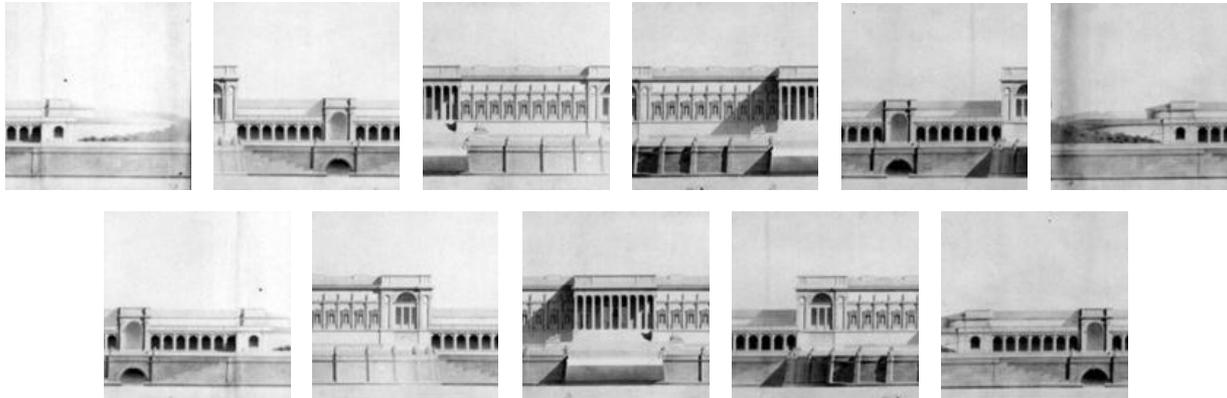
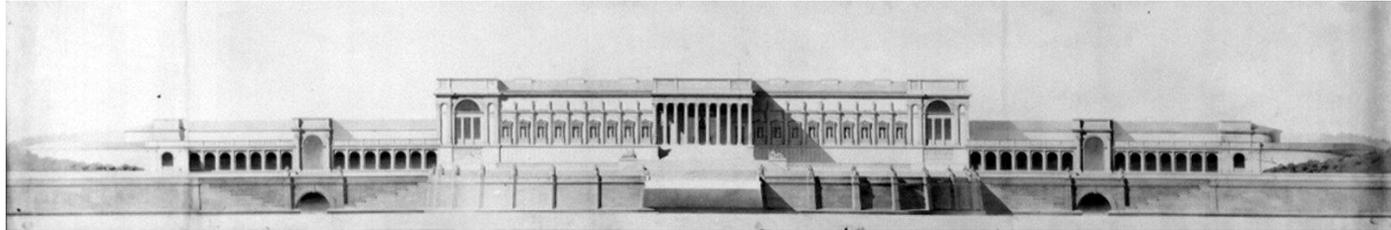
Total Scraped Images - Section/Elevation Images

<b>Section &amp; Elevation:  2027</b>	1127		"Dessin scolaire d'architecture" ET elevation; "Dessin scolaire d'architecture" ET coupe
	500		"Dessin d'architecture et ornement" ET elevation
	290		"Dessin d'architecture et ornement" ET coupe SAUF elevation
	110		"Dessin d'architecture et ornement" ET façade SAUF coupe SAUF elevation SAUF plan

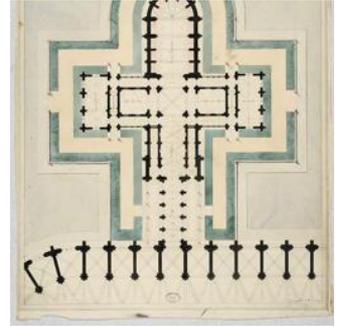
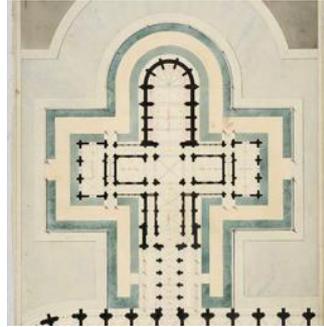
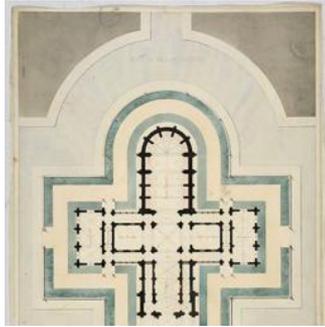
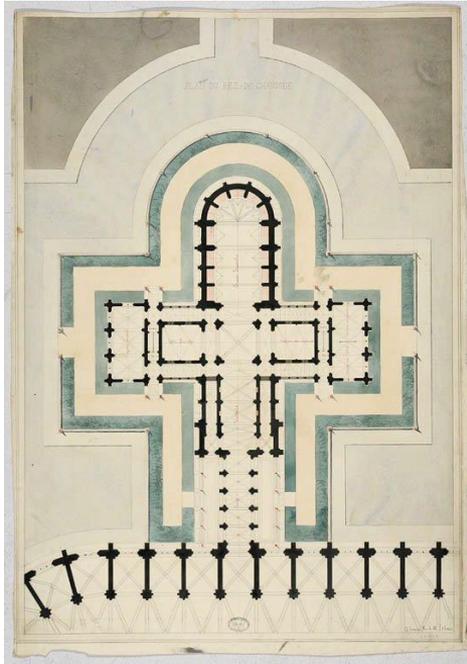
Data Augmentation: Horizontal Elevation with Many Square Crops



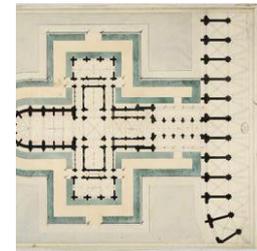
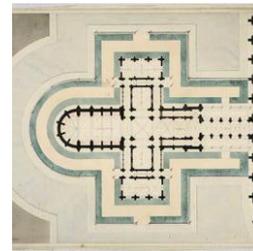
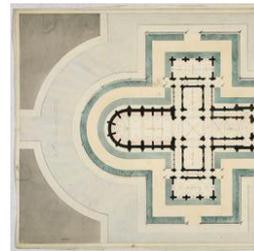
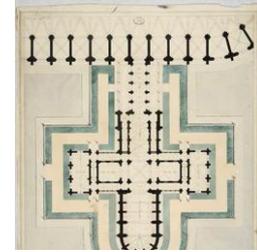
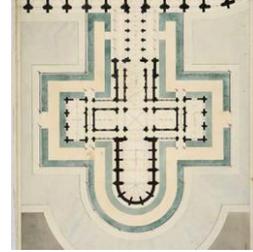
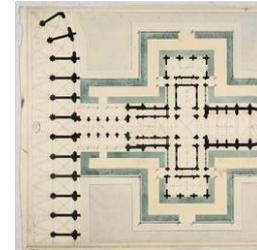
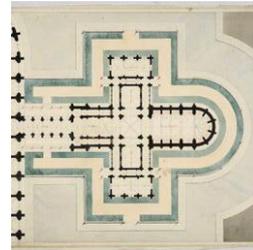
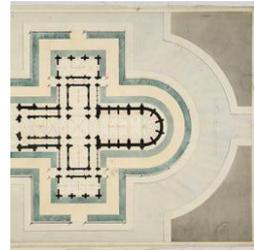
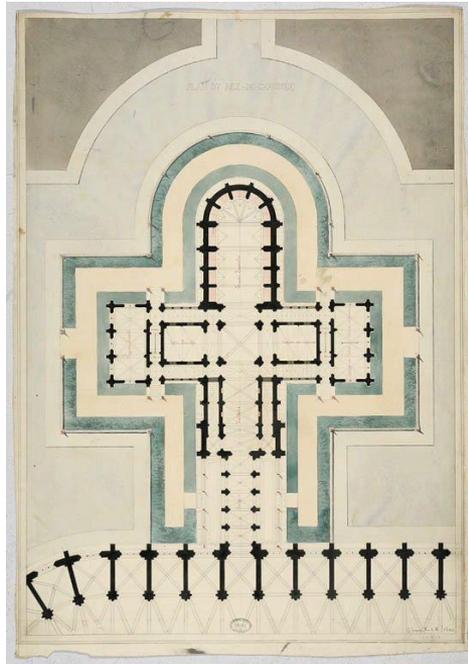
Data Augmentation: Horizontal Elevation with Many Square Crops - Flipped



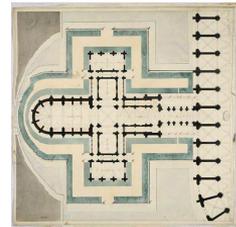
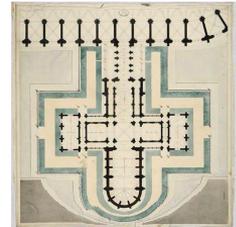
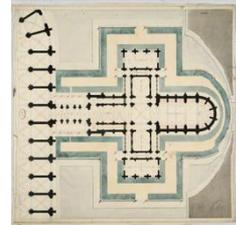
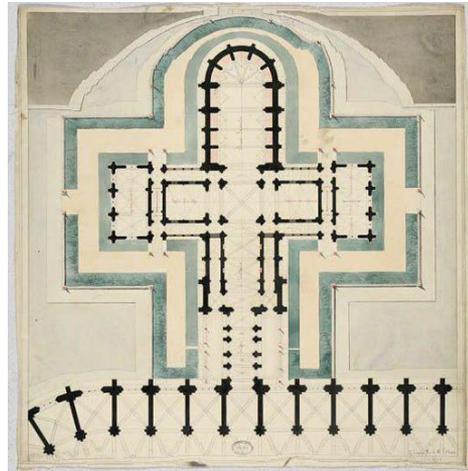
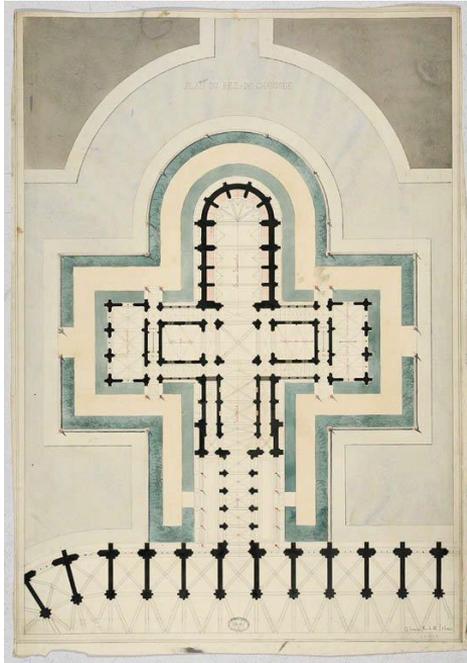
Data Augmentation: Plan Image with Top, Middle, Bottom Crops



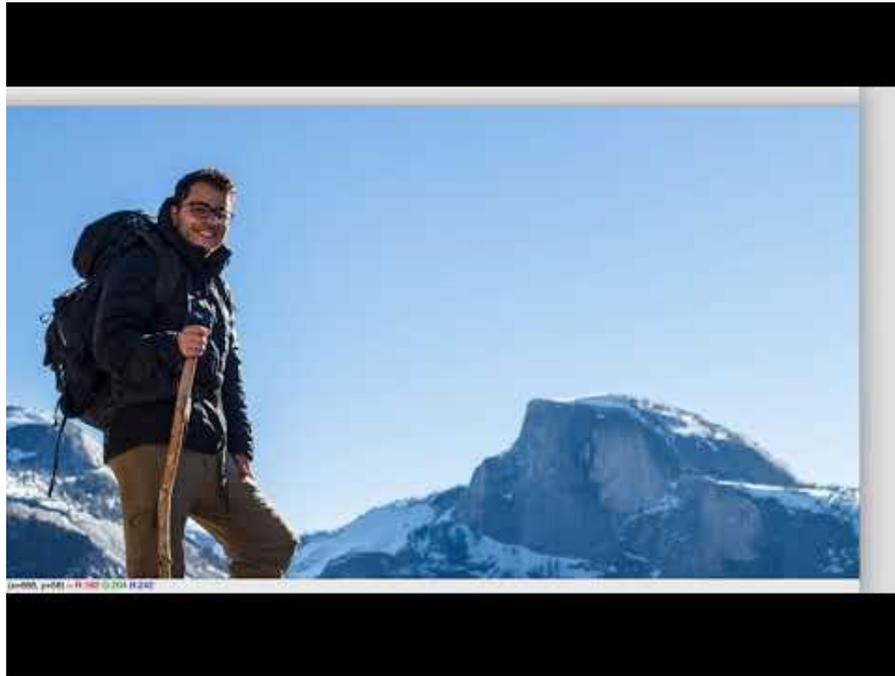
Data Augmentation: Plan Image with Top, Middle, Bottom Crops - Rotate x4



Data Augmentation: Plan Image with Seam-Carving (Content-Aware Resizing) + Rotate

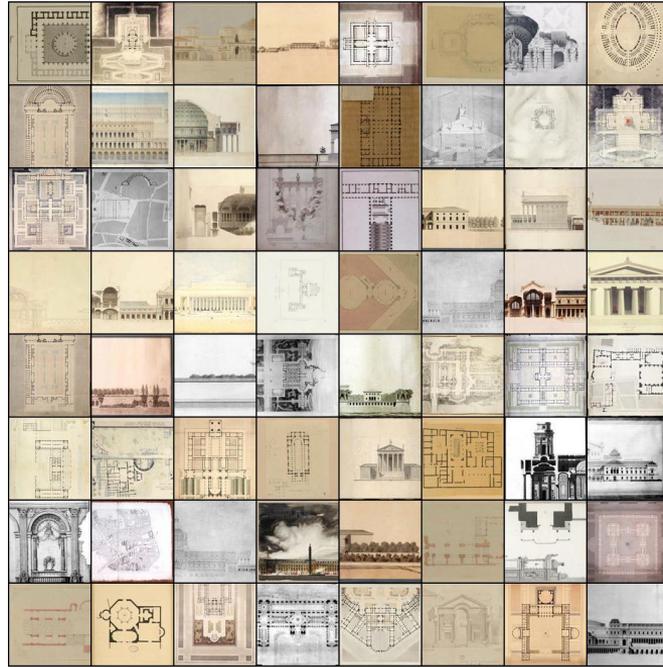


Algorithm: Seam-Carving for Content-Aware Resizing



<https://www.youtube.com/watch?v=wR3HMyMi2dw>  
[http://graphics.cs.cmu.edu/courses/15-463/2007\\_fall/hw/proj2/imret.pdf](http://graphics.cs.cmu.edu/courses/15-463/2007_fall/hw/proj2/imret.pdf)

## Final Training Set



1.1

## Recap: Final Project

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Data - Model - Project

What is your Project?

1.2

## Data

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Data

Collection

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Processing

Focus Project

“Beaux-arts Latent Walk”

**Breakout room:**

What is your Dataset?

1.3

## Workshop

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Review: Toolset and Data Scraping

Data Processing and Augmentation

Making Custom Dataset: Office Hours

# What's your project?

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Go To: <http://bit.ly/contact-gsdai>

Austin Lu (MLA II)	Ana Gabriela Loayza (MArch II)
Kehe Gao (MDes Tech)	Connie Chang (MDes Tech)
Peltong Chen (MDes)	Yunzi Shi (MArch I)
George Guida (MArch II)	Audrey Watkins (MArch I)
Benjamin V. B.	Phoebe Jiang (MDes)
Yuxin Yang (MLA I)	Chen Wang (MDes)
Tsz Kit Justin Ng (MArch I)	Kritika Kharbanda (MDes EE)
Elisa Ngan (MDE)	Jessica Chen (MDes EE)
Siqi Joyce Zhu (MLA II)	Tiangang Lyu (MLA I)
Dongyun Kim (MDes Tech)	

1.1

## Recap: Final Project

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Data - Model - Project

What is your Project?

1.2

## Data

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Data Scraping

Data Curation

Data Processing

Focus Project  
“Beaux-arts Latent Walk”

1.3

## Workshop

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Review: Toolset and Data Scraping

Data Processing and Augmentation

Making Custom Dataset: Office Hours

