

Creating Blue and White Porcelain with AI

AI for Art 2022

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Project Narrative

This project questions and reflects the process of the global production of blue and white porcelain through the use of Artificial Intelligence. Throughout history, the visual appearance of blue and white porcelain have varied in style, pattern and material through oversea trading. The way that foreign workshops produced these ceramic works often skipped an understanding of the cultural motifs present on the plates and vases, but instead rushed to a result. This process could be comparable to how AI operates, generating outputs without fully understanding the meanings of the inputs. The subject is chosen because ceramic patterns are often more abstract and flexible, have fewer color variations, and are mostly symmetrical, which results in higher error-tolerance for the final product.

This project uses **OpenCV** to preprocess the images and then use **Canny Edge detection** to extract outlines from images of selected ceramic art works. I was able to gather a total of 118 **images from Wikimedia Commons** (categories: 17th_century_ceramics_artwork, Delftware, Faience, Jingdezhen_ware) to serve as inputs and ground truths for training. The networks used for this project is **Pix2Pix**. The work can be accessed at: <https://colab.research.google.com/drive/1WEuxpIQ0LDeI3G9U1gAlpAumphIkKTJ?usp=sharing>

Database

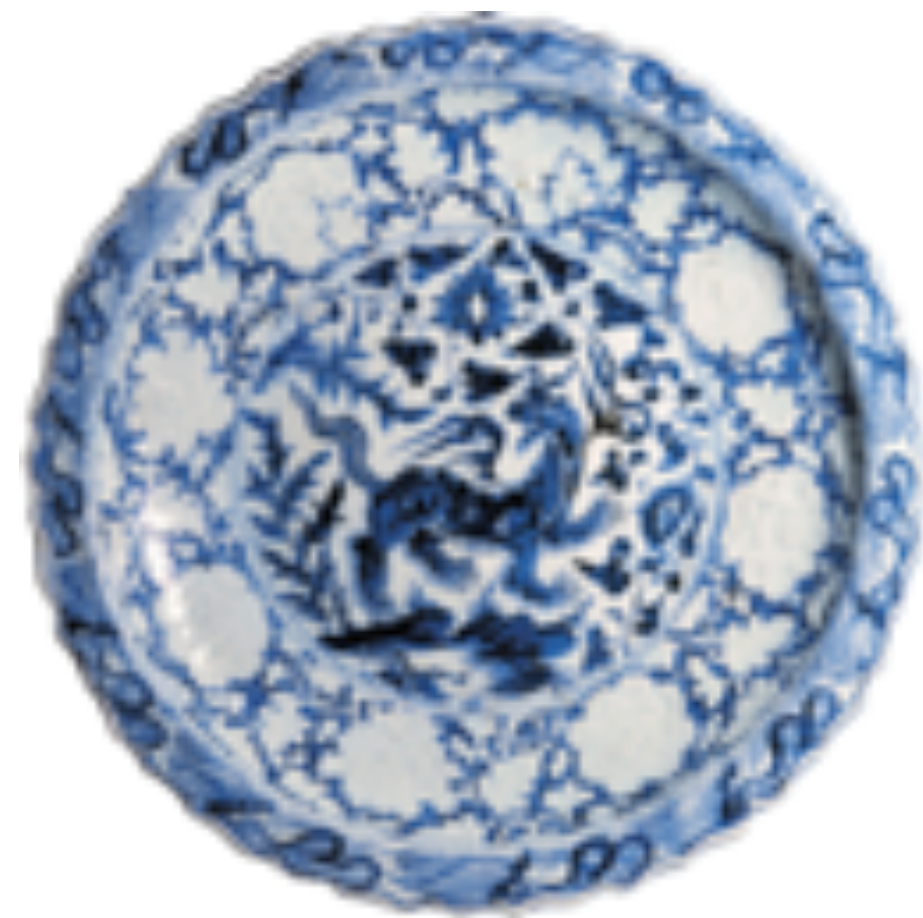
- As a by-product of this project, I created an Airtable database with 125 entries of porcelain plates.
- Each entry has
 - Filename
 - Image
 - Start year (earliest estimated year of production)
 - End year (latest estimated year of production)
 - Production Site

ID	Filename	Start Year	End Year	Origin
11	Wing_Ingleschen_dragon_dish.jpg	1620-01-01	1688-01-01	Ingleschen ware (China)
12	Wing_Ingleschen_dish_with_dragon.JPG	1620-01-01	1688-01-01	Ingleschen ware (China)
13	Bowl_in_bronze_collector_Restonok_1811-1812-1-4...	1660-01-01	1660-01-01	Denia (Italy)
14	Dish_with_dragons_chasing_farming_scene.jpg	1667-01-01	1672-01-01	Ingleschen ware (China)
15	Bowl_with_dragon_andPhoenix_design_Ingleschen...	1670-01-01	1620-01-01	Ingleschen ware (China)
16	Lotus-Shaped_Dish_Mark_Reign_Period.JPG	1670-01-01	1620-01-01	Ingleschen ware (China)
17	Wing_Ingleschen_Porcelain_Mark_Reign_20.jpg	1670-01-01	1620-01-01	Ingleschen ware (China)
18	Wing_Ingleschen_Porcelain_Mark_Reign_21.jpg	1670-01-01	1620-01-01	Ingleschen ware (China)
19	Soft_change_in_the_style_of_the_Chinese_Mark_Per...	1688-01-01	1700-01-01	Soft (Spain)
20	Plate_ferretto_Laura_161660-83.jpg	1688-01-01	1616-01-01	Soft (France)
21	Plate_with_deer_software_Netherlands_17th-18th_c...	1688-01-01	1688-01-01	Soft (Spain)
22	Early_17th_century_bronze_1683.jpg	1688-01-01	1688-01-01	Ravenna (Italy)
23	Knick_dish_depicting_two_Persian_figures.jpg	1688-01-01	1688-01-01	Ingleschen ware (China)
24	Dish_of_soft_software_Ingleschen_plate_in_porcela...	1688-01-01	1700-01-01	Ingleschen ware (China)
25	Wing_Ingleschen_Porcelain_s_1688.jpg	1688-01-01	1688-01-01	Ingleschen ware (China)
26	Porcelain_vase_1687.jpg	1687-01-01	1688-01-01	Yamamoto (Czech Rep...)
27	Wife_1686.jpg	1686-01-01	1610-01-01	Brachet (Czech Rep...)
28	Wing_Ingleschen_Porcelain_Tang_Reign_22.jpg	1627-01-01	1627-01-01	Ingleschen ware (China)
29	Wing_Ingleschen_Porcelain_Zhangchen_Reign_23.jpg	1628-01-01	1688-01-01	Ingleschen ware (China)
30	Dish_please_note_refines.jpg			
31	Ingleschen_Dish_Fujian_BronzeWare_20101			
32	Dish_and_bowl_with_on-the-shoulder_dish			

Data Summary

From 1271 to 1939



Jingdezhen, China
1271-1795
59 entries



Delftware, the Netherlands
1600-1939
32 entries



Faience, Frankfurt, Germany
1650-1700
6 entries

Other origins:

Spain (1)

Italy (2)

France (3)

Slovakia (2)

Japan (1)

Czech Republic (2)

Denmark (2)

Unknown (12)

Workflow



Workflow

Blurred for background removal



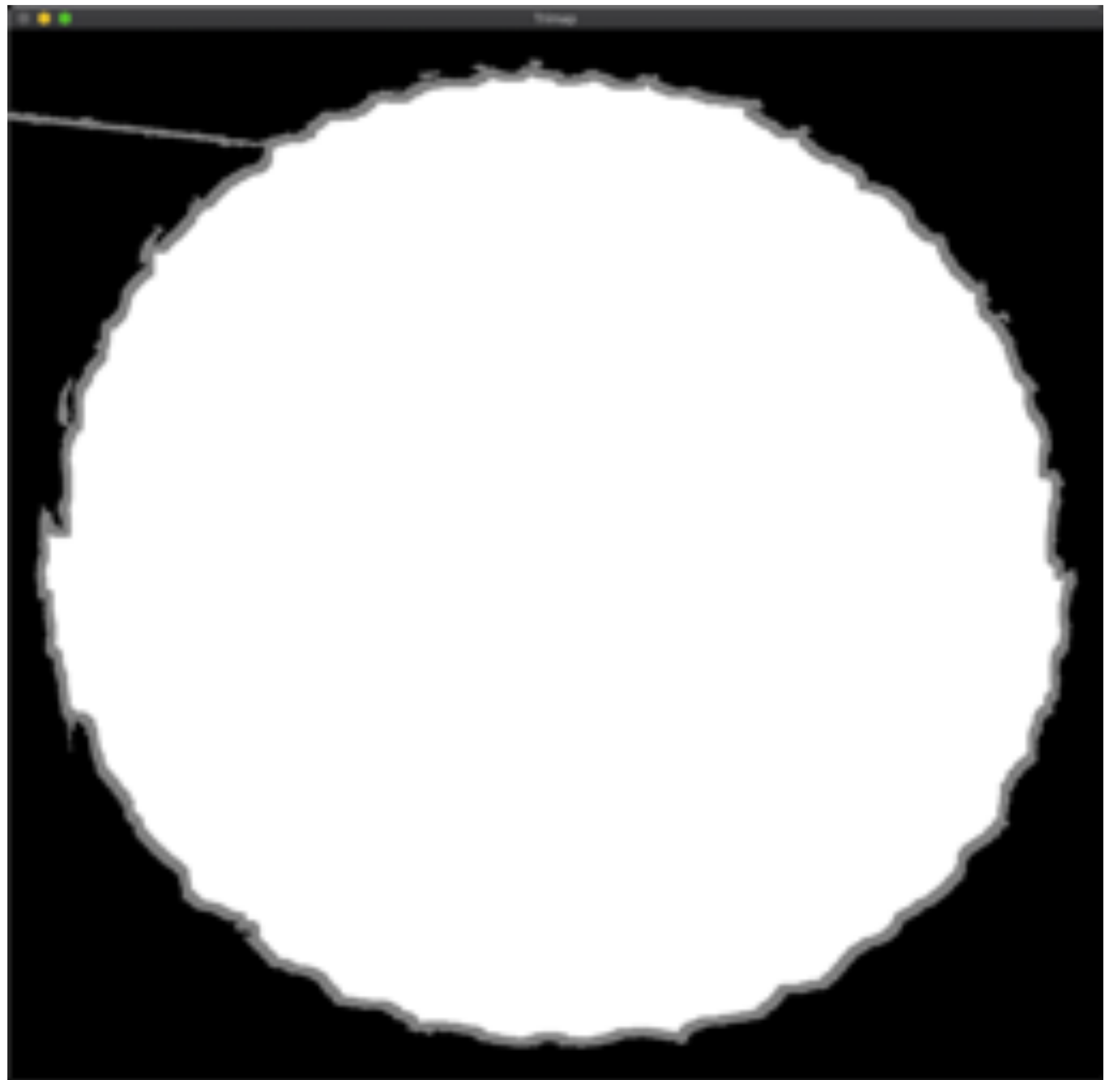
Workflow

**Draw Contour of Object
of Interest**



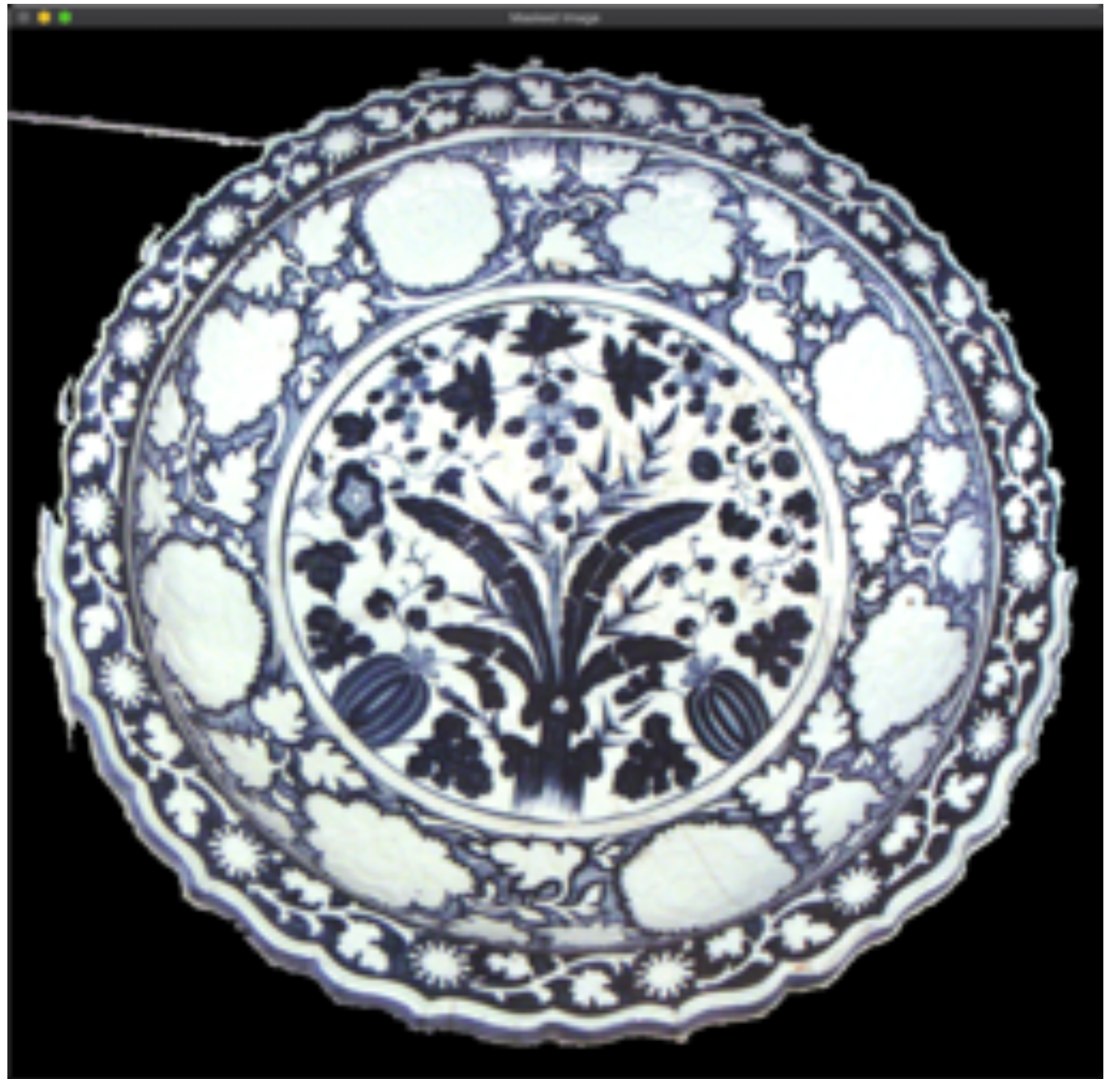
Workflow

Shape of mask



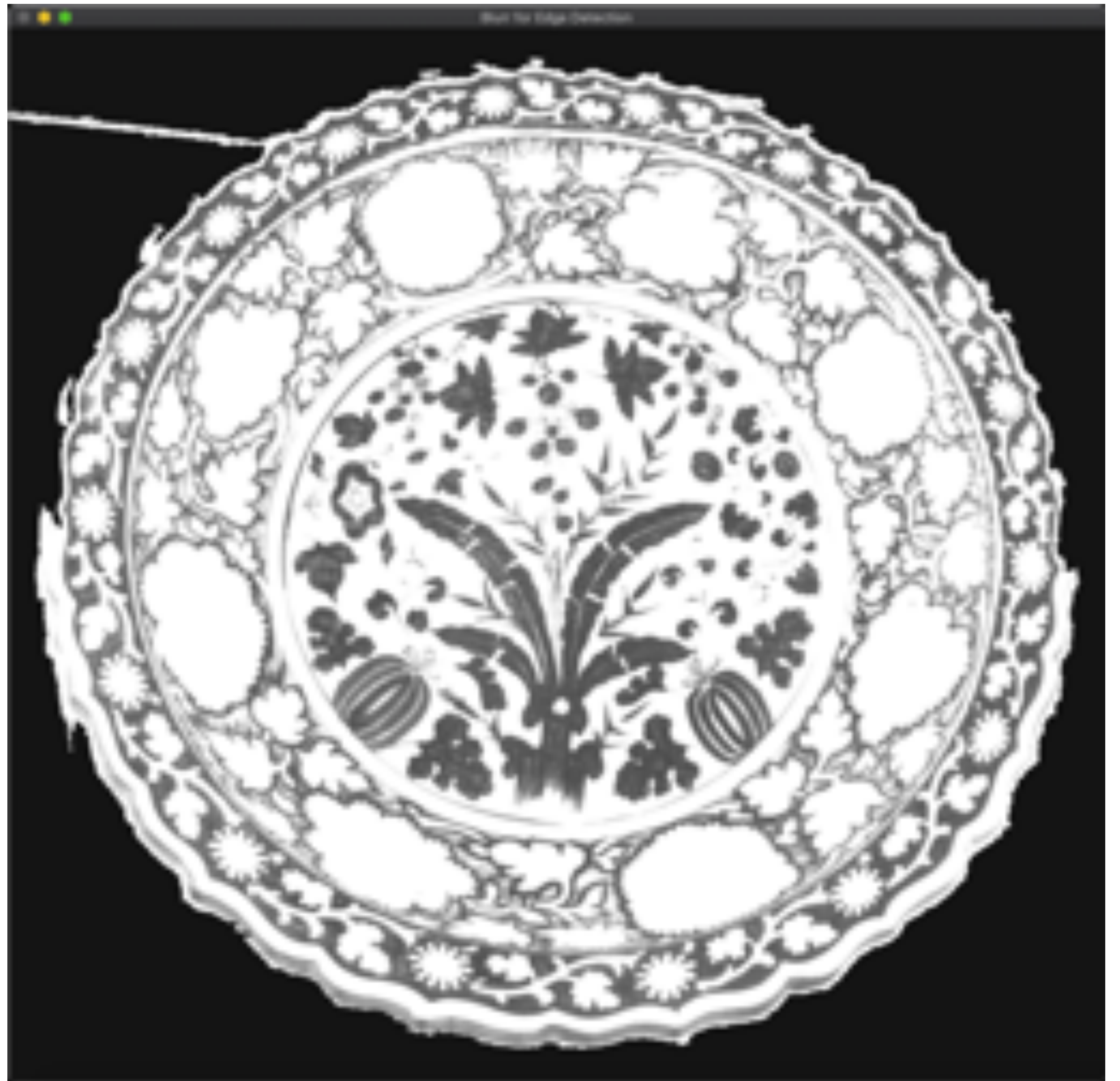
Workflow

Masked image



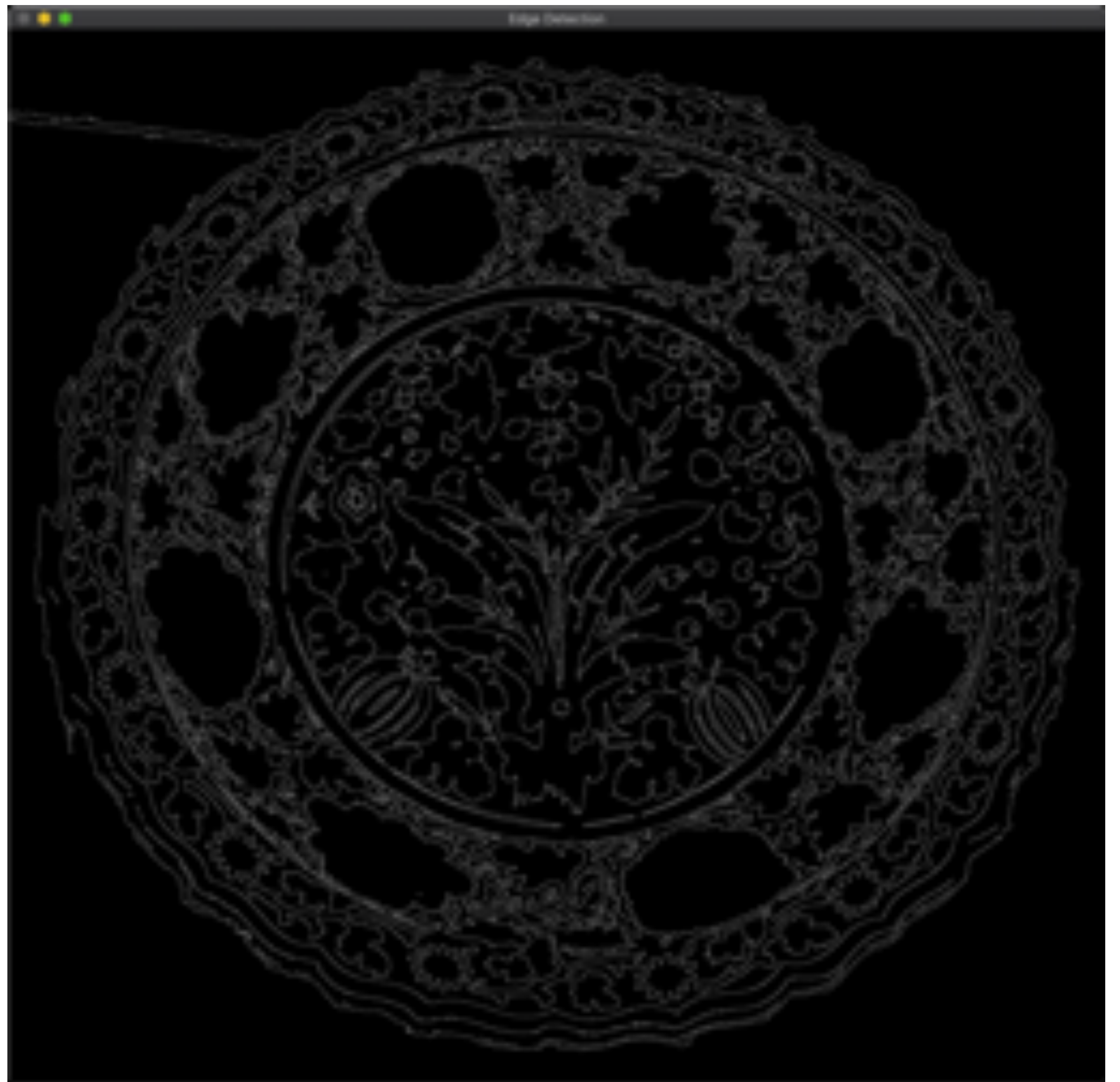
Workflow

Blurred and gray-scaled for Canny Edge Detection



Workflow

Canny Edge Detection



Workflow

Resized to 1024x1024 and concatenated to feed into Pix2Pix



Preprocessing Results and Challenges

A very perfect example



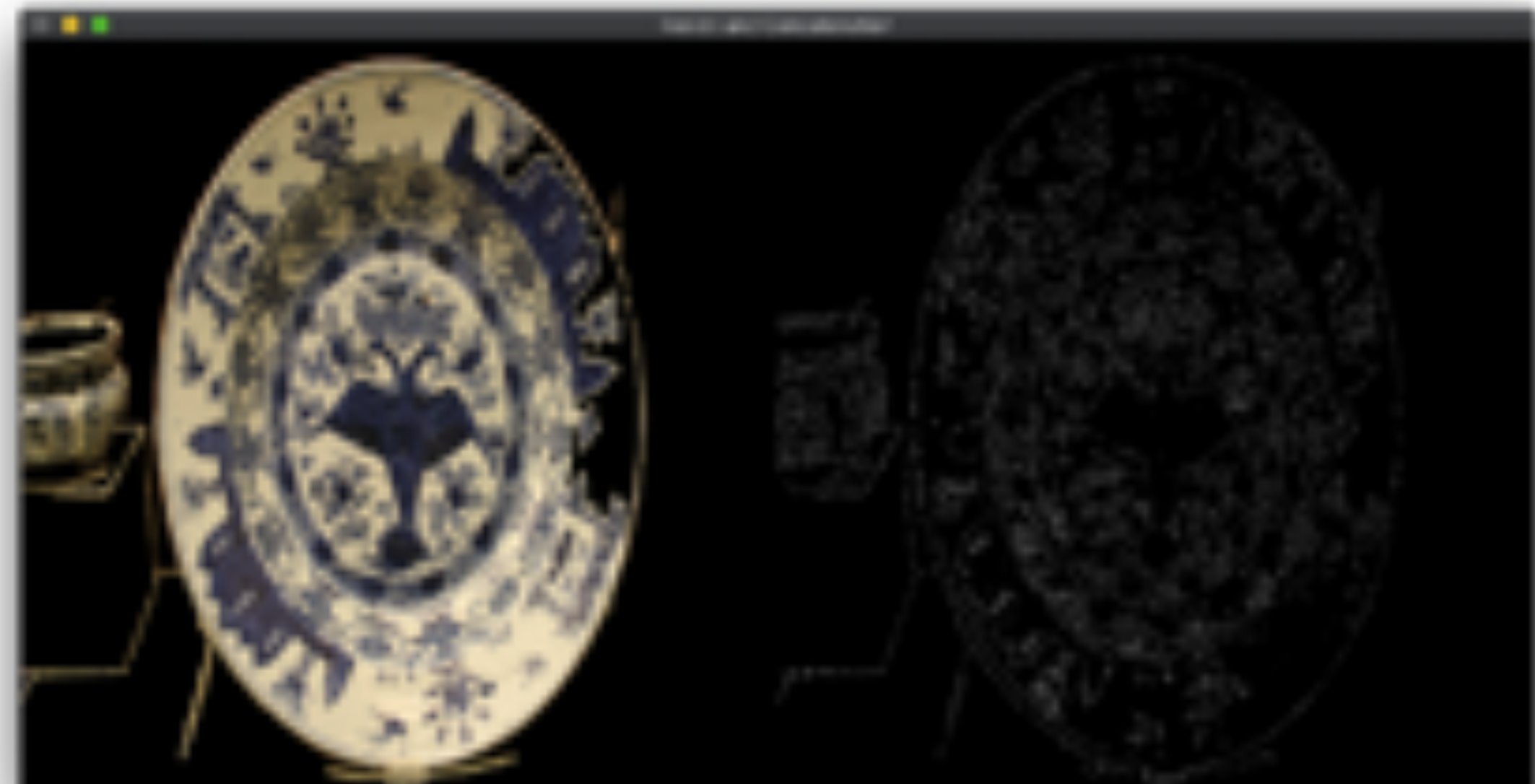
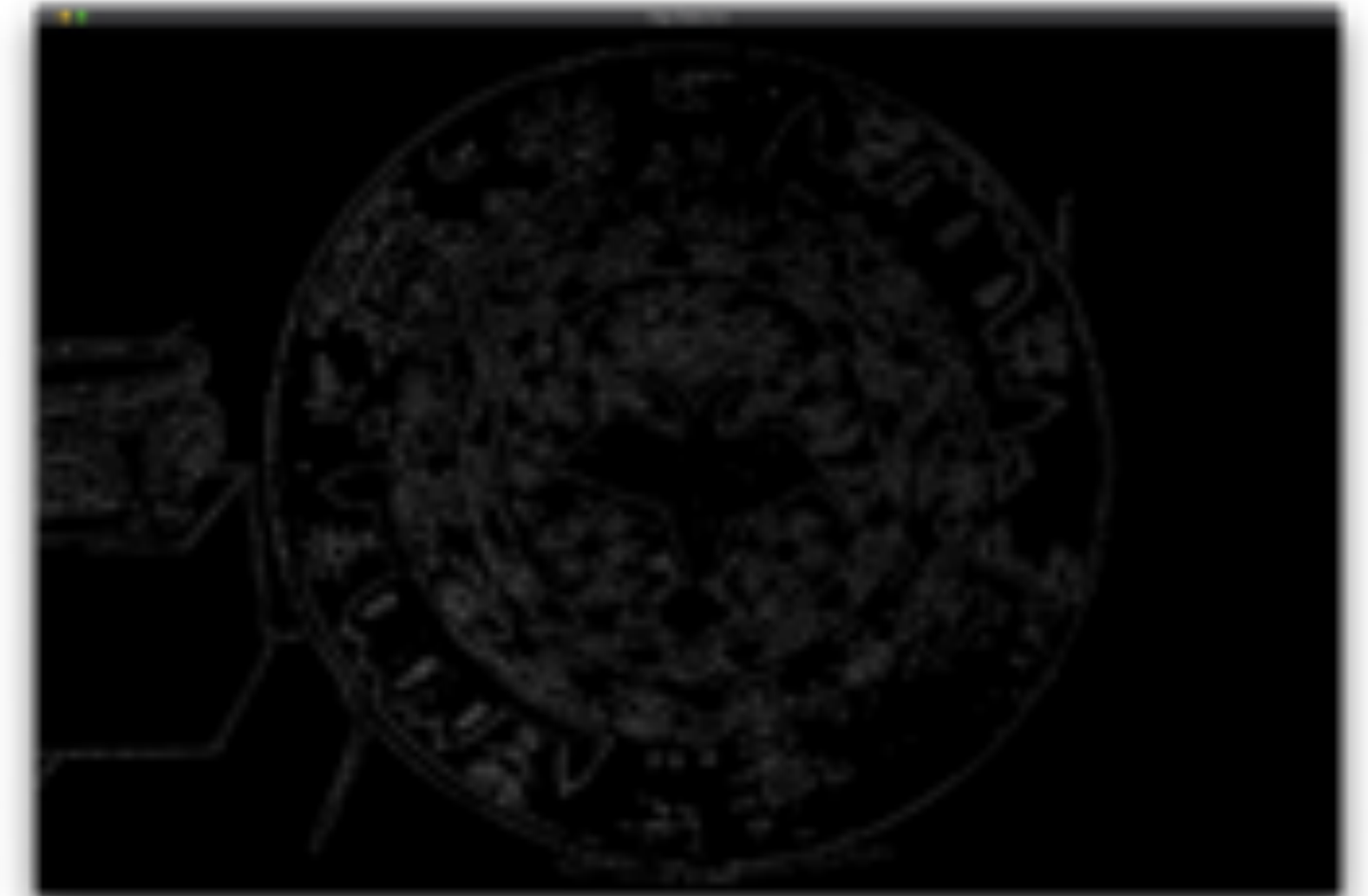
Preprocessing Results and Challenges

Messy background, shadows, low contrast, etc.



Preprocessing Results and Challenges

**Messy background,
light reflection,
shadows, low
contrast, irregular
size, etc.**



Pix2Pix Results

Result after 50k iterations

```
1. fit(train_dataset, test_dataset, steps=50000)
```

time taken for 5000 steps: 1344.14 sec

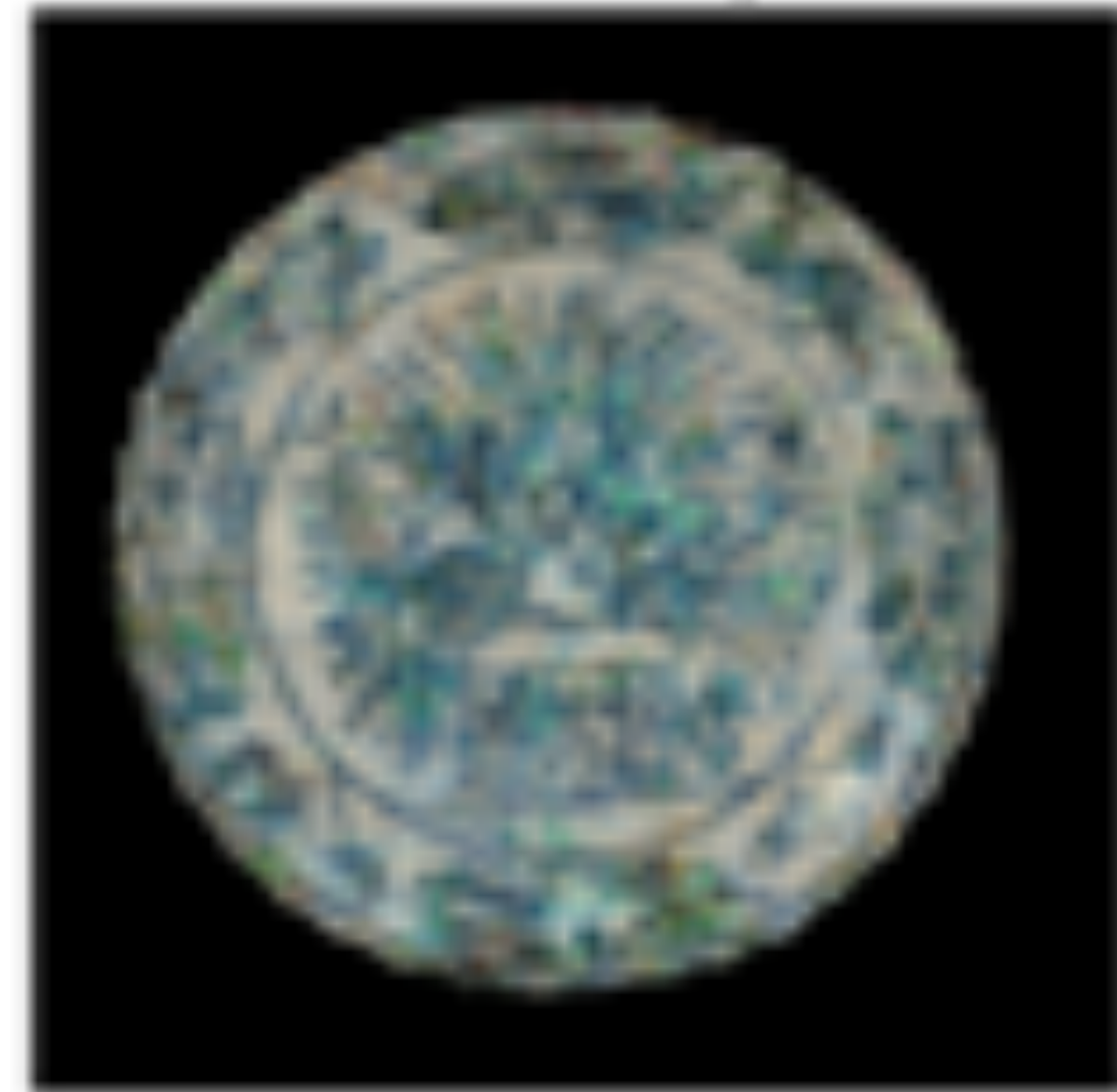
Input Image



Ground Truth

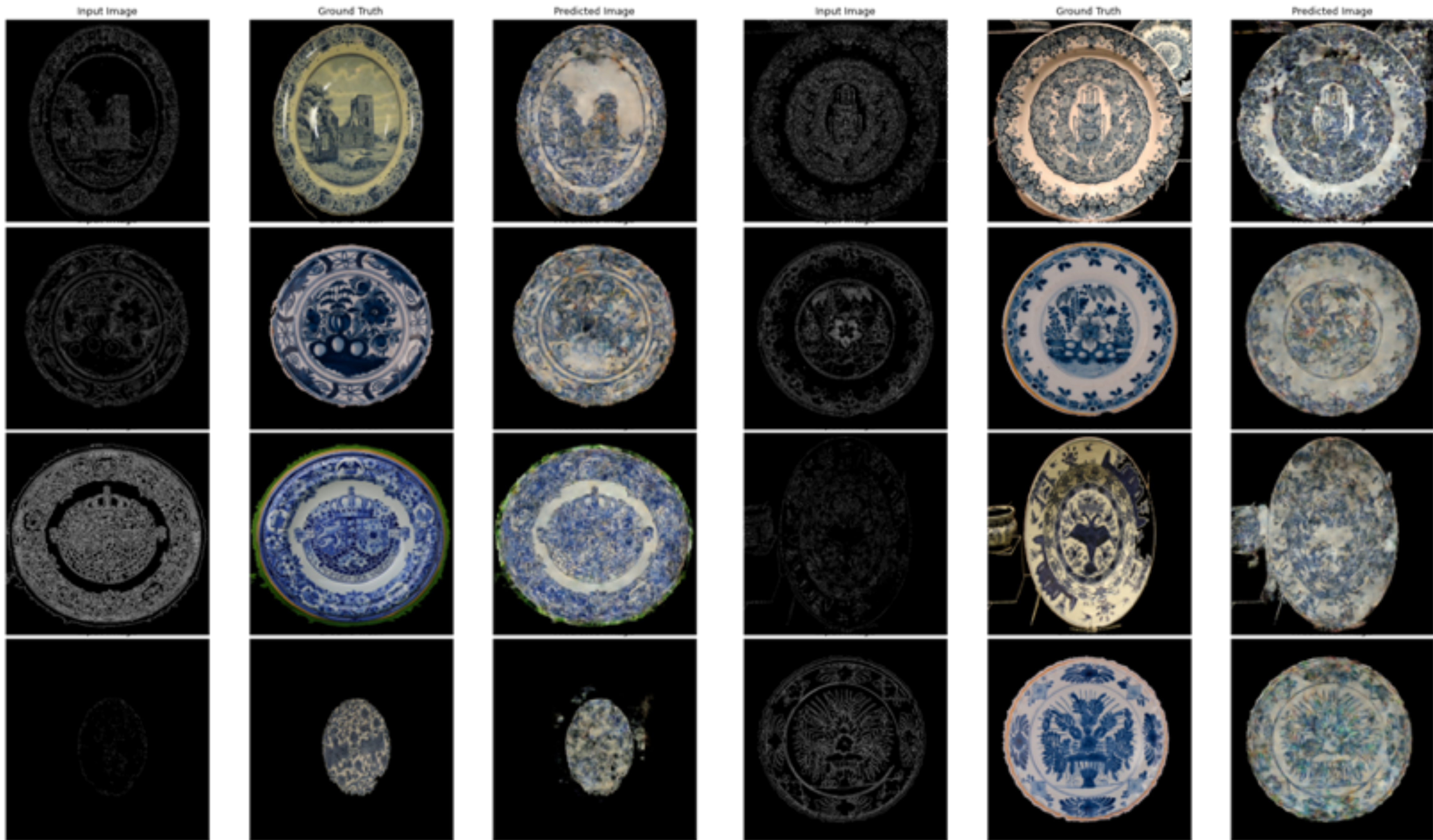


Predicted Image

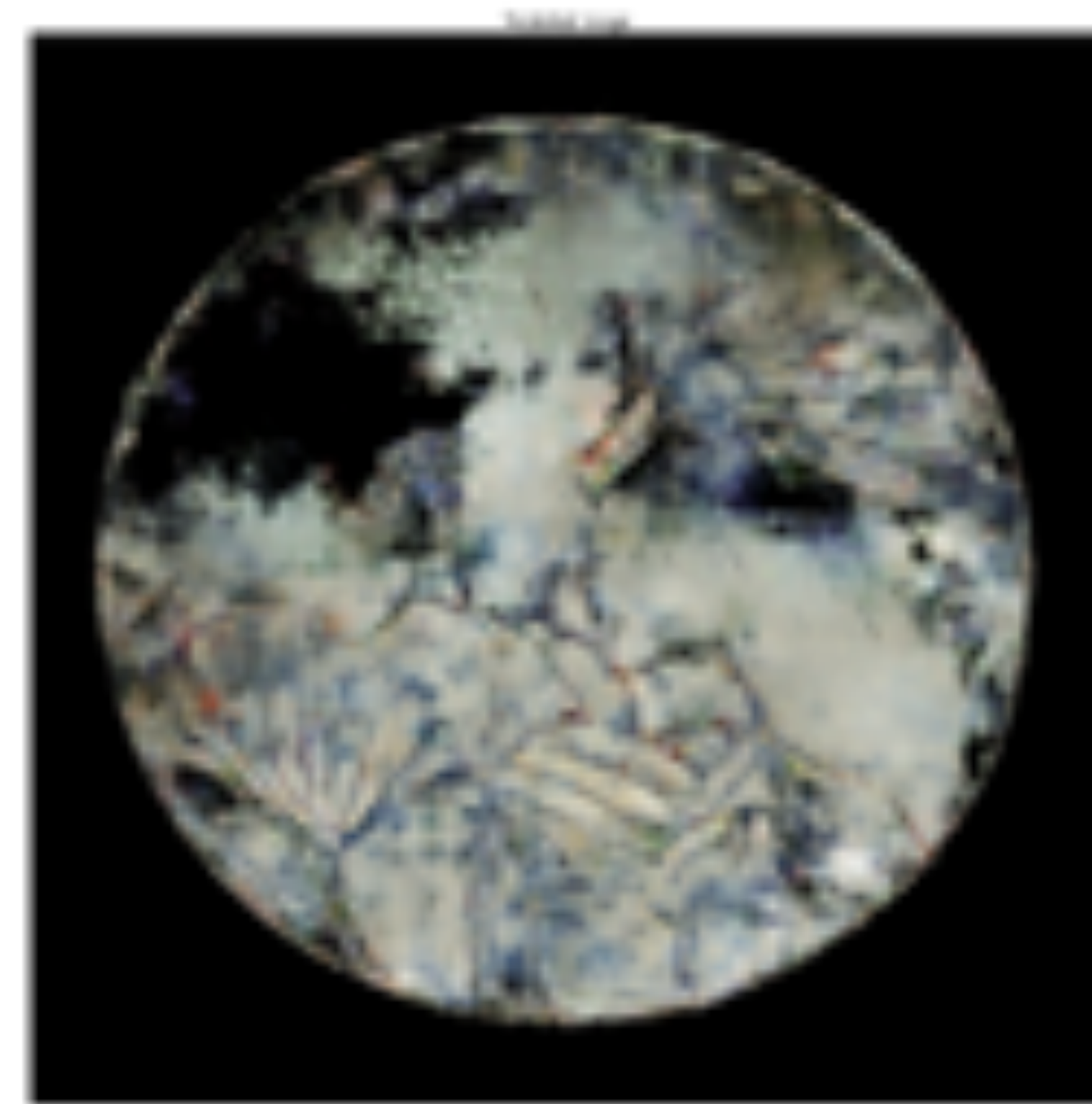


Steps: 49%





Custom Made Plate



References

E. (2014). Chinese And Japanese Porcelain For The Dutch Golden Age. Uitgeverij De Kunst.

Gerritsen, A., & Riello, G. (2015). The Global Lives of Things: The Material Culture of Connections in the Early Modern World (1st ed.). Routledge.

Richardson, T. K. J. B. E. M. (2011). The Transformation of Vernacular Expression in Early Modern Arts (Intersections). BRILL.

S. S. -C. Chen, H. Cui, P. Tan, X. Sun, Y. Ji and H. Duh, "Cantonese Porcelain Image Generation Using User-Guided Generative Adversarial Networks," in *IEEE Computer Graphics and Applications*, vol. 40, no. 5, pp. 100-107, 1 Sept.-Oct. 2020, doi: 10.1109/MCG.2020.3012079.

Philipau, Derek. This vessel does not exist. Accessed November 16, 2021. <https://thisvesseldoesnotexist.com/>.

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Airtable Database: <https://airtable.com/appX9USR7tZt9UsIp/tblJcLdQHBpts8ExO/viw6VPahk8W2jqNdJ?blocks=hide>

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Tensorflow tutorial on Pix2Pix: <https://www.tensorflow.org/tutorials/generative/pix2pix>

DCGAN Tutorial: from Nathan Inkawhich <<https://github.com/inkawhich>>