



LAKE FOREST
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Paintings-100:

A DIVERSE PAINTING DATASET
FOR LARGE SCALE CLASSIFICATION

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Who Are We?

- I'm an Associate Professor in the department of Computing and Information Sciences at Edgewood College, Madison, Wisconsin, and do research in the field of Computer Vision.
- My co-author, Dr. Sugata Banerji is an Associate Professor of Computer Science at Lake Forest College, Lake Forest, Illinois. He shares the same research interests. He is also the corresponding author of this paper.
- Erica and Brian are former and current undergraduate students respectively of Lake Forest College.



Atreyee Sinha

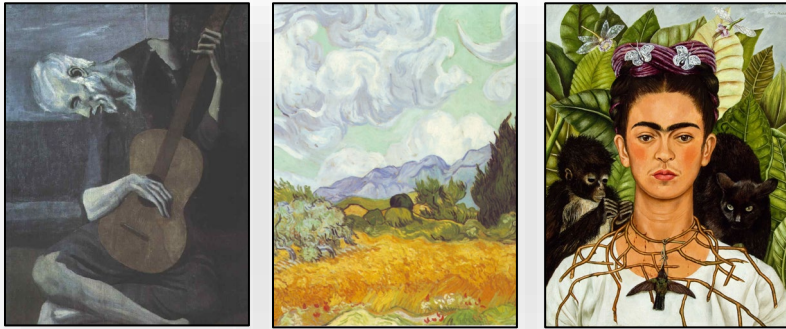
Edgewood College



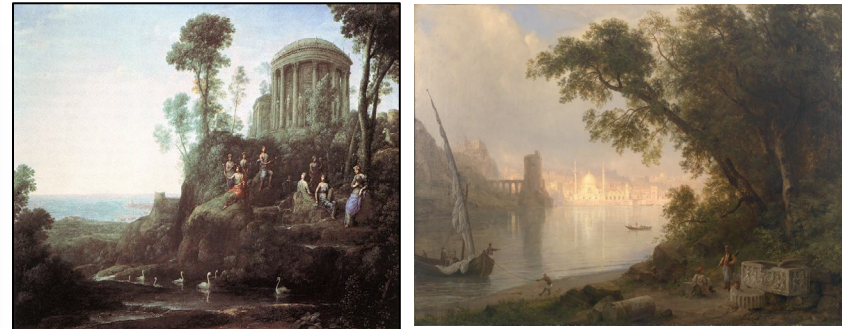
Sugata Banerji

Lake Forest College

Painting Classification/ Artist Recognition



Do you know who painted these?



Can you tell if these were painted by the same artist?

Artist/ style recognition is a challenging problem

- Too few training images
- Variance in data
- Emphasis is not on the subject, but something else

Potential applications:

- museum work,
- painting theft investigation,
- forgery detection,
- art education,
- other applications

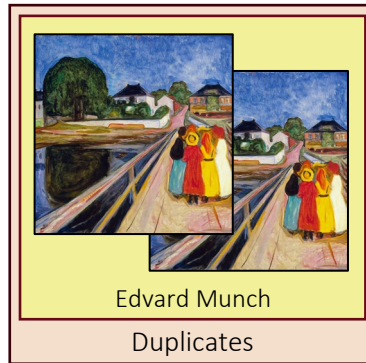
The Data

- We started with a dataset of 91 painters in the Painting-91 dataset [\[1\]](#)
 - The dataset consisted of 4266 paintings from 91 different artists
 - The number of images per artist varied ranging from 31 (Frida Kahlo) to 56 (Sandro Botticelli)
 - The images were all collected from the Internet

[1] Khan, F.S., Beigpour, S., de Weijer, J.V., Felsberg, M.: Painting-91: A large scale database for computational painting categorization. MVAP(2014)

The Dataset Problems

- The images were very low resolution
- It had
 - Tiny images (~260px)
 - Misattributions
 - Partial paintings
 - Duplicates (with variations)



- ✓ We removed these errors
- ✓ Increased resolution (~1500px)



Misattributions



Crops



Color variations

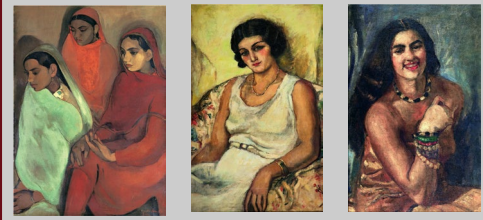


Enhancing the Dataset

- We used Google reverse image search to find high resolution version of each image, manually
 - Wasn't always available easily, especially for newer artists
- Made sure duplicates are recorded, and slightly cropped and color-changed versions are replaced by exact copies
- Read the description to make sure the images are correct
- Read up about the painter to discover different versions etc.
- Increased the number of classes/images per class (where needed)

Time consuming work!

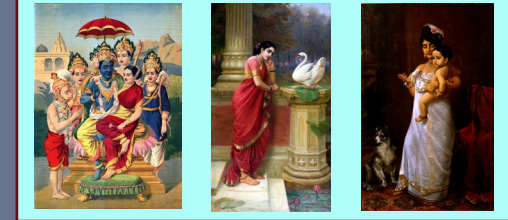
We Added More Painters



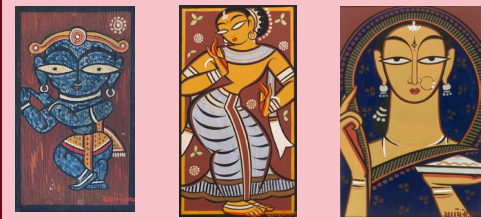
Amrita Sher-Gil



Katsushika Hokusai



Raja Ravi Varma



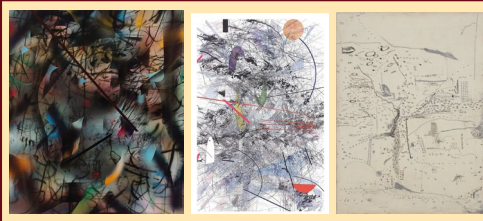
Jamini Roy



Kitagawa Utamaro



Utagawa Hiroshige



Julie Mehretu



Rafiy Okefolahan



Zhang Xiaogang



We Added More Painters

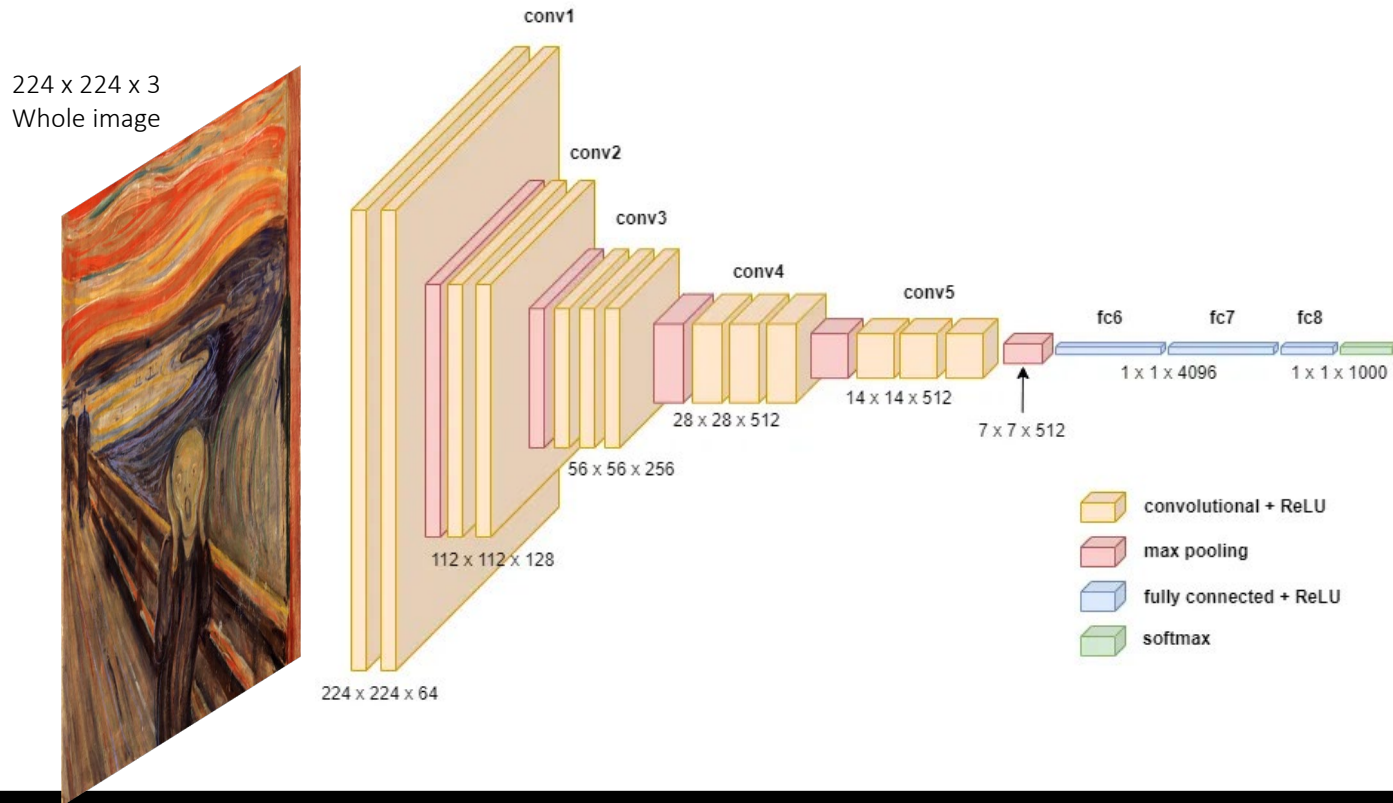
The Ukiyo-e style class was added to the existing 13

Artist	Nationality	Style
Amrita Sher-Gil	Hungarian-Indian	Several
Jamini Roy	Indian	Indian folk art
Julie Mehretu	Ethiopian American	Several
Katsushika Hokusai	Japanese	Ukiyo-e
Kitagawa Utamaro	Japanese	Ukiyo-e
Rafiy Okefolahan	Cape Verdean	Contemporary multimedia
Raja Ravi Varma	Indian	Indian realism
Utagawa Hiroshige	Japanese	Ukiyo-e
Zhang Xiaogang	Chinese	Surrealism

Methodology

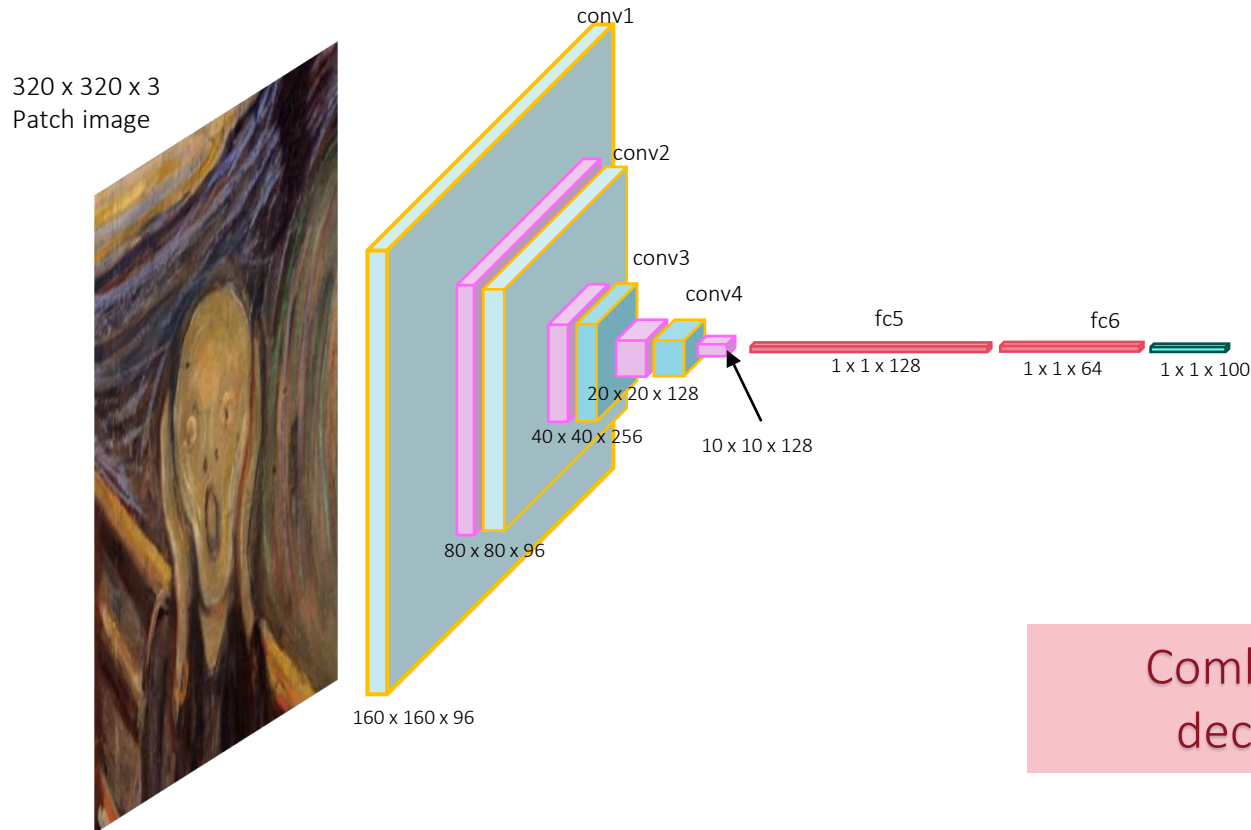
Train a CNN on the whole images

- **Challenge:** too few images for training CNN
- **Tool used:** CNN (VGG-16) pretrained on ImageNet, fine-tuned on whole images



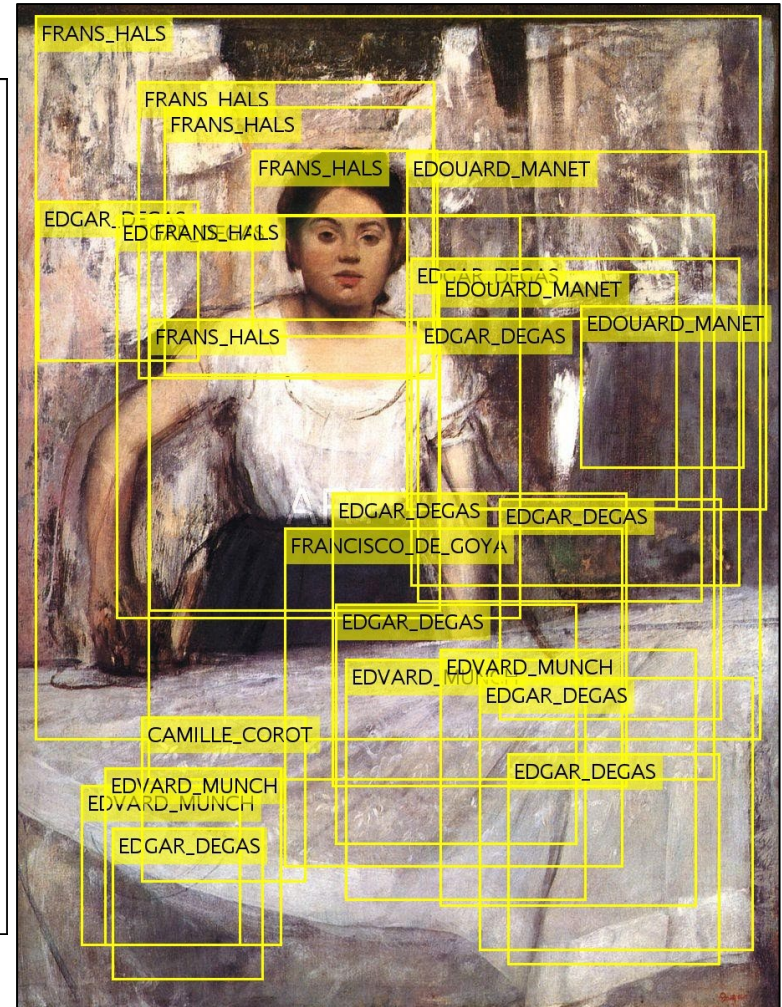
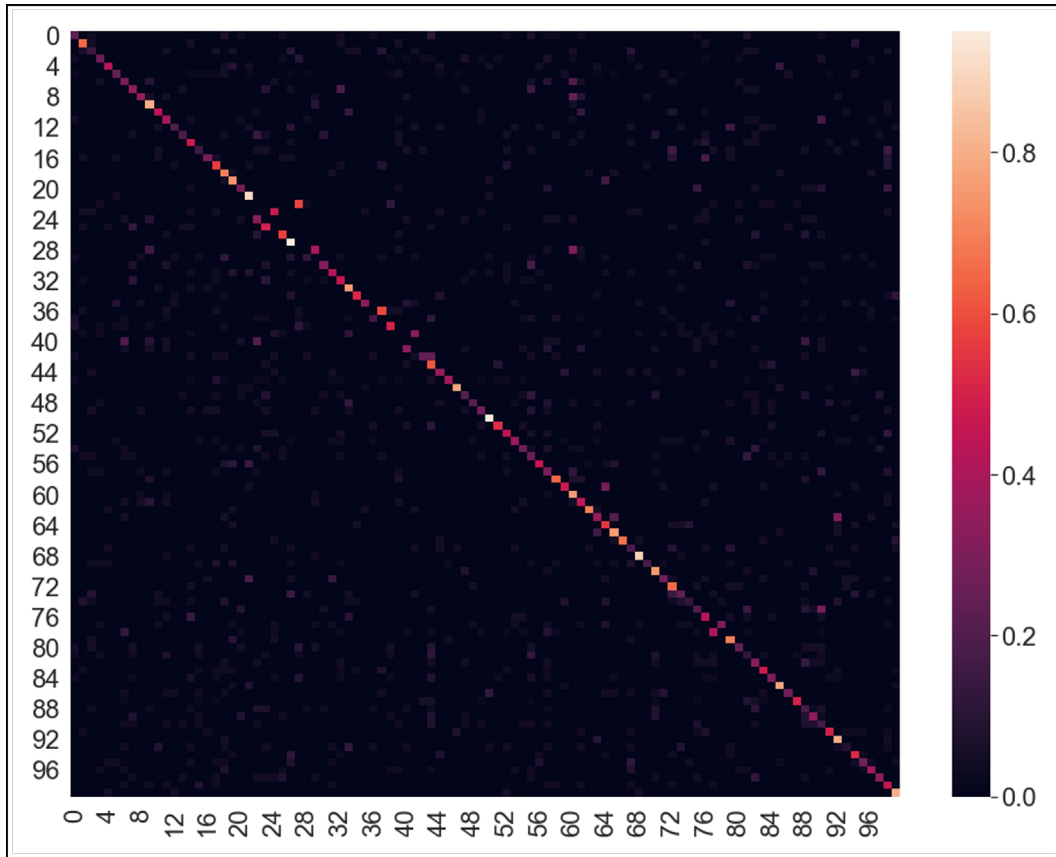
Methodology

- Cut each image into multiple small patches randomly
- Train another CNN (designed from scratch) on the patches



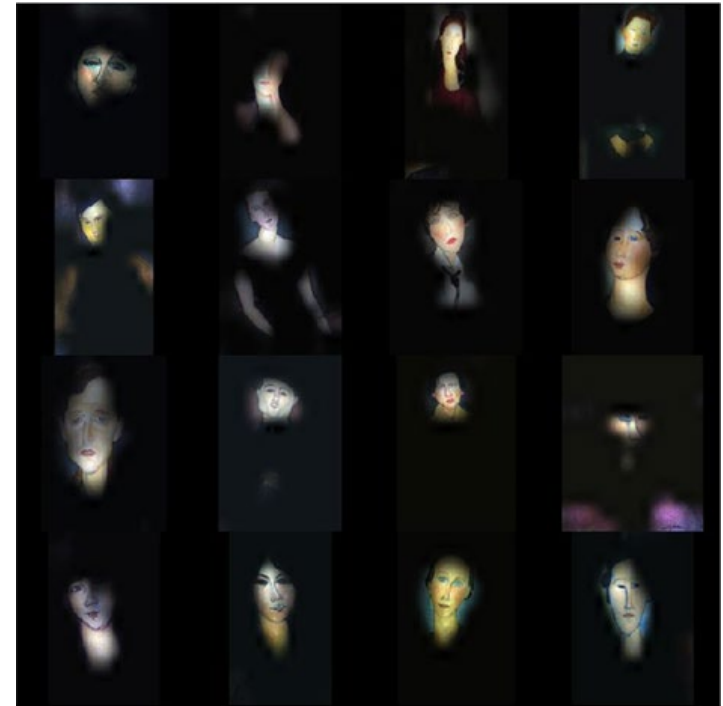
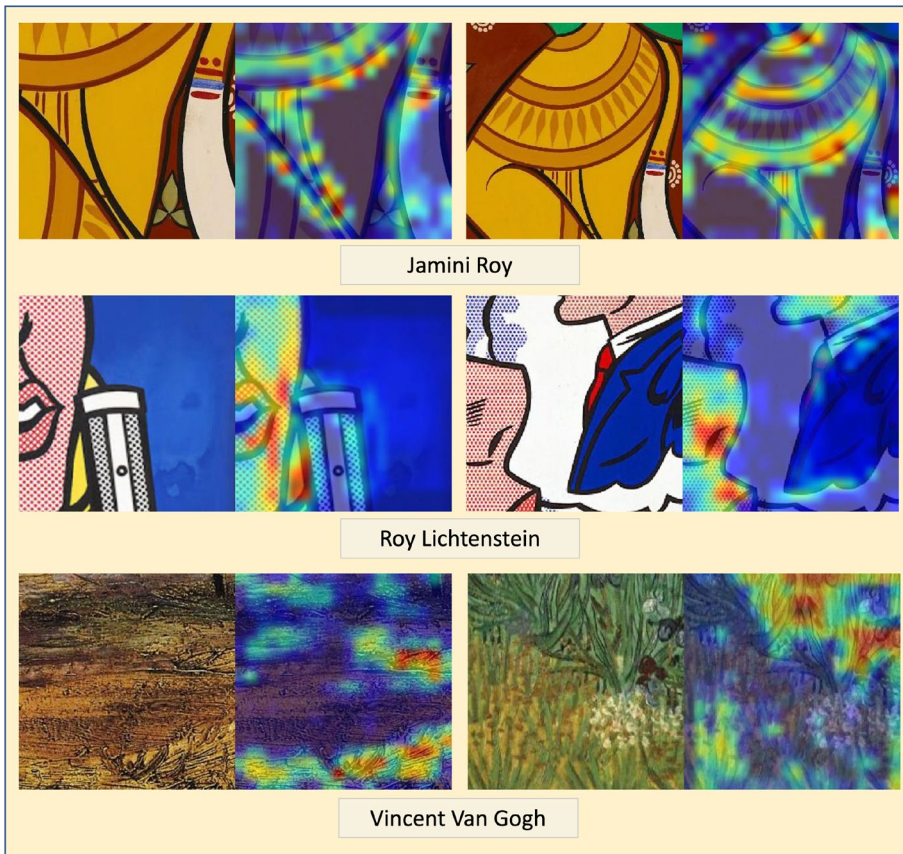
Combine the
decisions!

Results



Heatmap Analysis

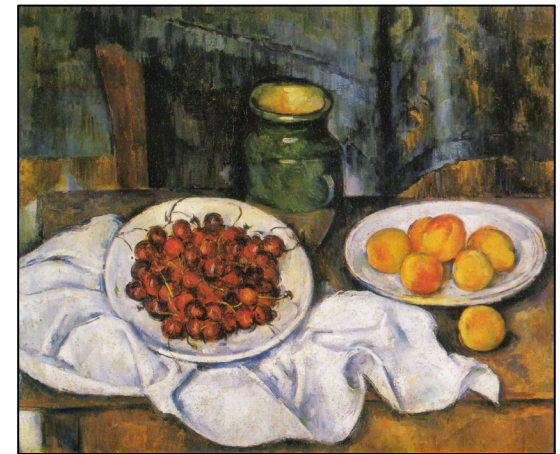
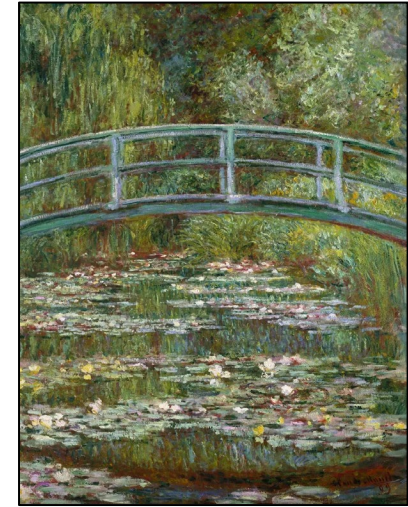
What makes a Picasso look like a Picasso?



Amedeo Modigliani

Future Research

- Style Classification
- More heatmap analysis
- Interpretable results
- Try other techniques for generating boxes



Questions?

For further questions:

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