Palette

By Isaiah Westphalen

About me

- Boston Based Data Scientist
- BA in Mathematics & Minor in Physics from Boston University

Problem Statement

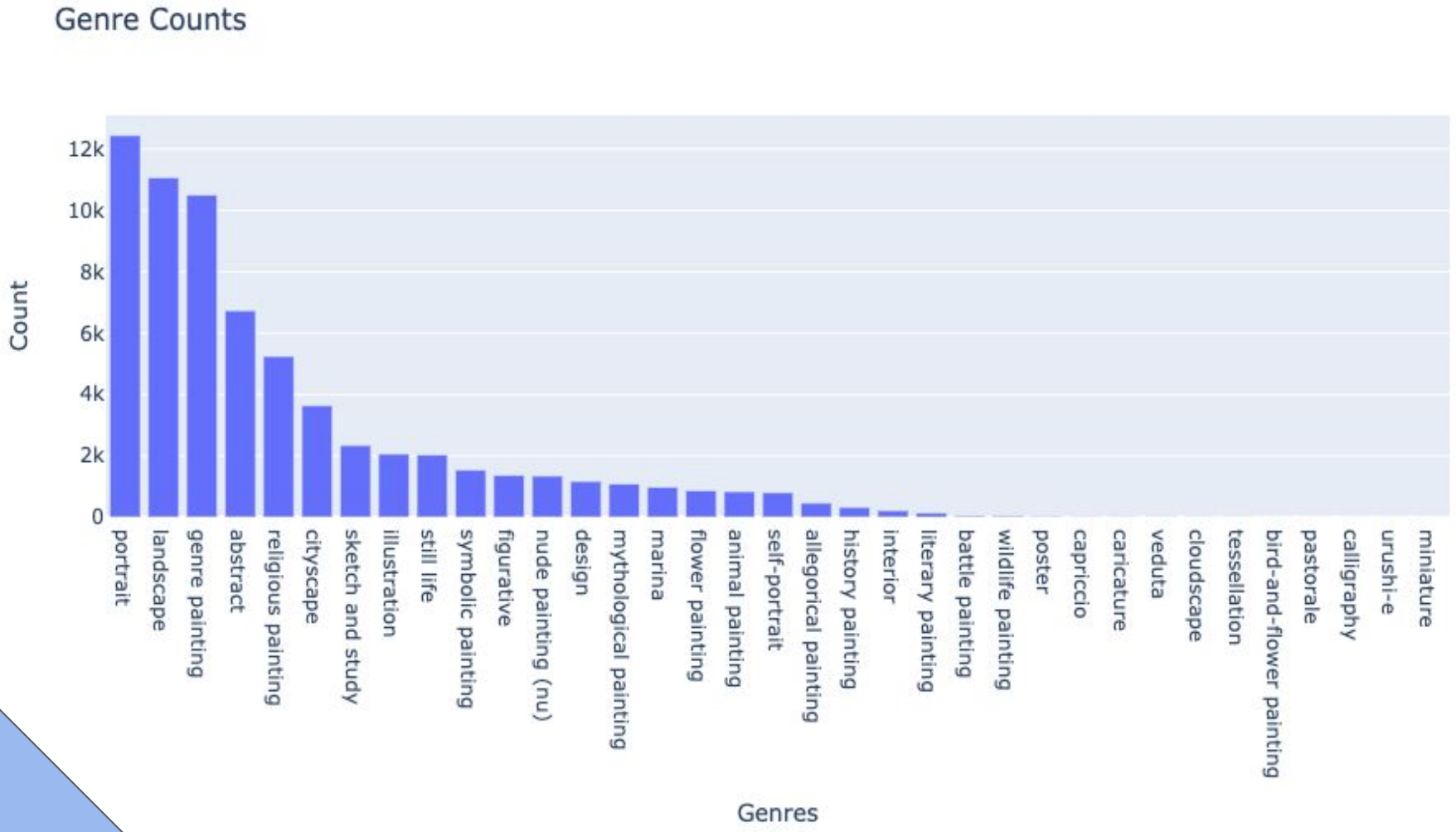
- Different genres of art incorporate the use of different mediums, subject matter, and color palettes to produce unique and meaningful pieces
- Art Museums want to increase interest and accessibility of art
- Using multi-class image classification that optimizes for accuracy we can develop a model that will be able to determine which genre an art piece belongs to

Contents

The Data

WIKIART
VISUAL ART ENCYCLOPEDIA

- Painter by Numbers Dataset from Kaggle.com
- 79,433 images from WikiArt ~ 80 GB
- 35 genres
- .jpg images, non-uniform sizes


Genre Counts
Count
12k
10k
8k
6k
4k
2k
0
portrait
landscape
genre painting
abstract
religious painting
cityscape
sketch and study
illustration
still life
symbolic painting
figurative
nude painting (nu)
design
mythological painting
marina
flower painting
animal painting
self-portrait
allegorical painting
history painting
interior
literary painting
battle painting
wildlife painting
poster
capriccio
caricature
veduta
cloudscape
tessellation
bird-and-flower painting
pastorale
calligraphy
urushi-e
miniature
Genres

Genres

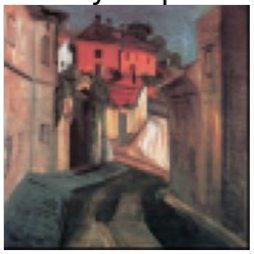
landscape

portrait

abstract

self-portrait

cityscape



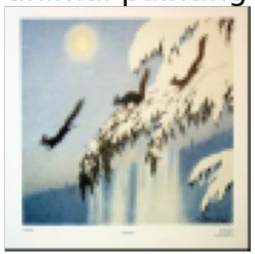
genre painting

symbolic painting

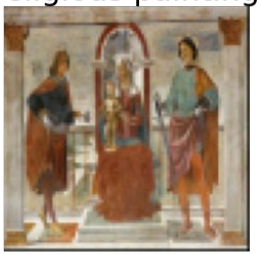
still life

illustration

animal painting



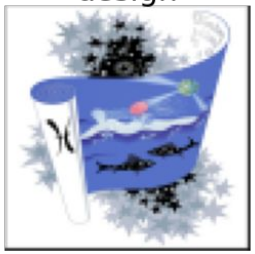
religious painting



flower painting

sketch and study

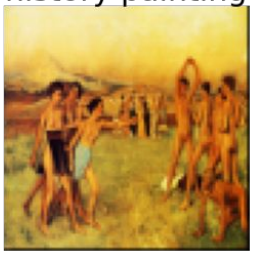
design



mythological painting

marina

history painting



Genres

figurative

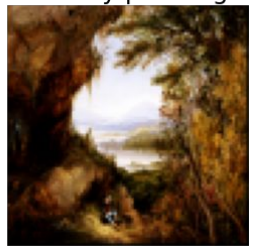
nude painting (nu)

allegorical painting

interior

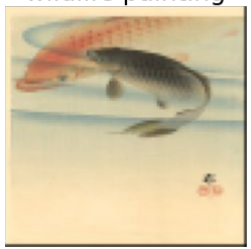
battle painting

literary painting



caricature

wildlife painting



bird-and-flower painting

poster

miniature

calligraphy

pastorale

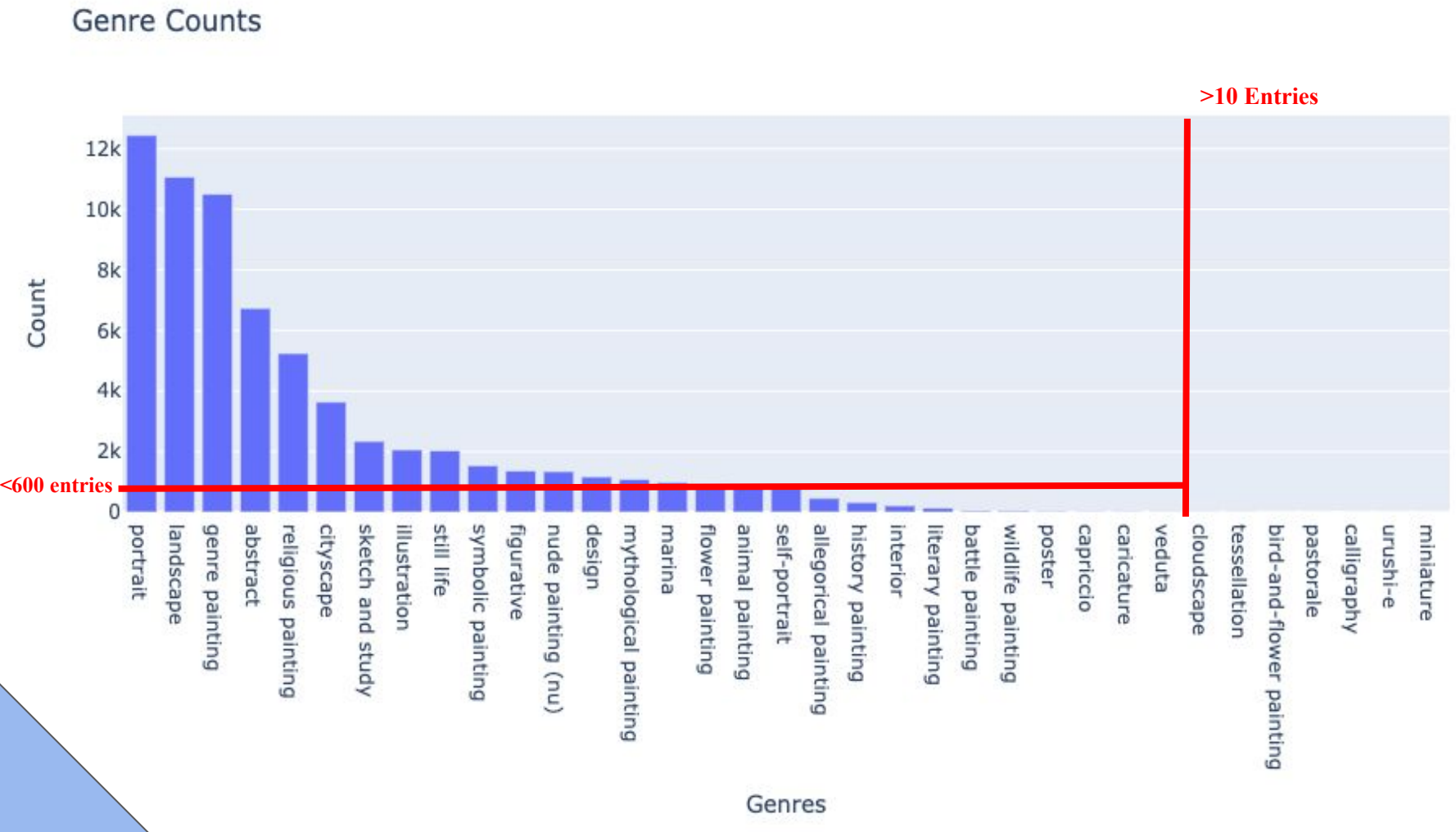
capriccio

cloudscape

tessellation

veduta

urushi-e

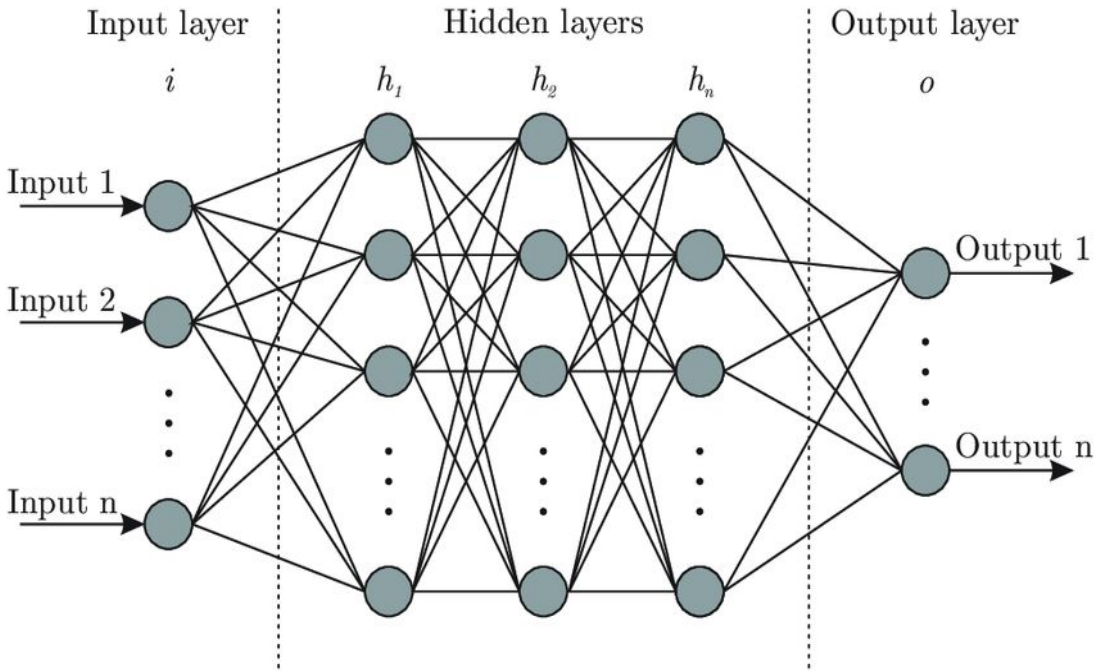

Genre Counts
>10 Entries
<600 entries
Count
12k
10k
8k
6k
4k
2k
0
portrait
landscape
genre painting
abstract
religious painting
cityscape
sketch and study
illustration
still life
symbolic painting
figurative
nude painting (nu)
design
mythological painting
marina
flower painting
animal painting
self-portrait
allegorical painting
history painting
interior
literary painting
battle painting
wildlife painting
poster
capriccio
caricature
veduta
cloudscape
tessellation
bird-and-flower painting
pastorale
calligraphy
urushi-e
miniature
Genres

The Modeling:

- Establishing a baseline:
  - Portrait - 18%
- Convolutional Neural Network (CNN)

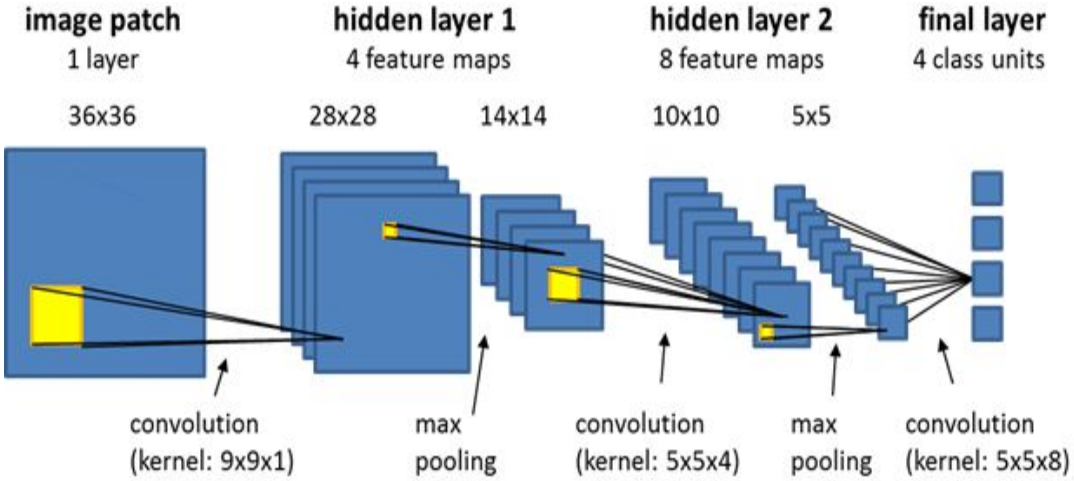
The Modeling - Neural Networks:

- Deep learning
- Loosely based on how the brain works and learns
- Made up of hidden layers, neurons, and weights

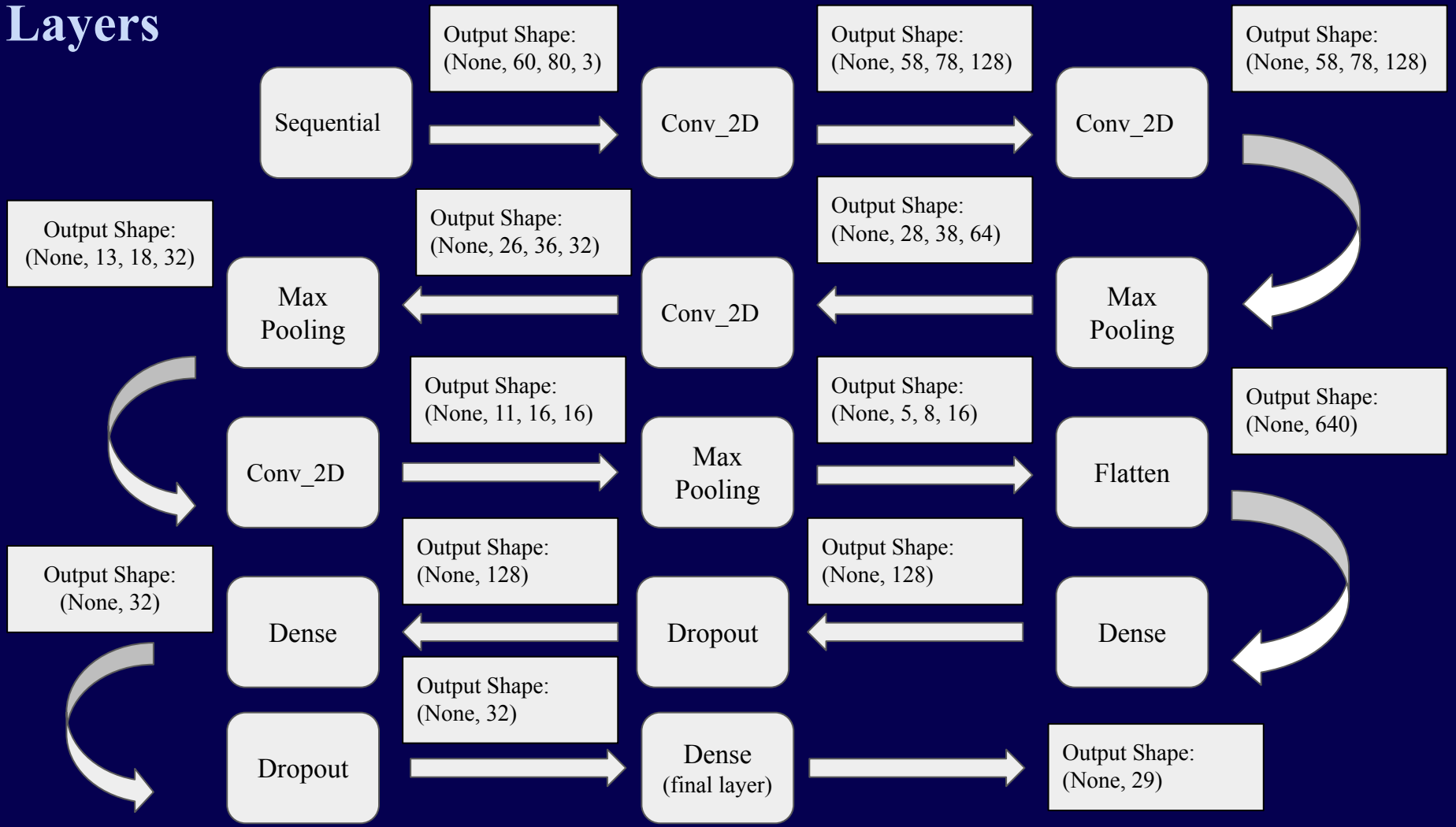


The Modeling - CNNs:

- Generally used for visual analysis
- Convolutional layers
- Pooling layers
- Flattening
- Dense layers
- Drop out layers
- Final outputs



Layers


Sequential
Output Shape: (None, 60, 80, 3)
Conv_2D
Output Shape: (None, 58, 78, 128)
Conv_2D
Output Shape: (None, 58, 78, 128)
Max Pooling
Output Shape: (None, 28, 38, 64)
Conv_2D
Output Shape: (None, 26, 36, 32)
Max Pooling
Output Shape: (None, 13, 18, 32)
Conv_2D
Output Shape: (None, 11, 16, 16)
Max Pooling
Output Shape: (None, 5, 8, 16)
Flatten
Output Shape: (None, 640)
Dense
Output Shape: (None, 128)
Dropout
Output Shape: (None, 128)
Dense
Output Shape: (None, 32)
Dropout
Output Shape: (None, 32)
Dense (final layer)
Output Shape: (None, 29)

First Model Results - Loss

First Model Results - Accuracy

Final Model - Class Imbalance:

- How to fix?
  - Bootstrapping
- A new data set: 21,000 images, 35 classes

Genre Counts
Count
0
100
200
300
400
500
600
marina
animal painting
cityscape
caricature
veduta
allegorical painting
capriccio
flower painting
design
pastorale
symbolic painting
urushi-e
cloudscape
history painting
religious painting
literary painting
nude painting (nu)
calligraphy
tessellation
self-portrait
genre painting
mythological painting
bird-and-flower painting
interior
still life
portrait
sketch and study
wildlife painting
illustration
poster
figurative
battle painting
abstract
landscape
miniature
Genres

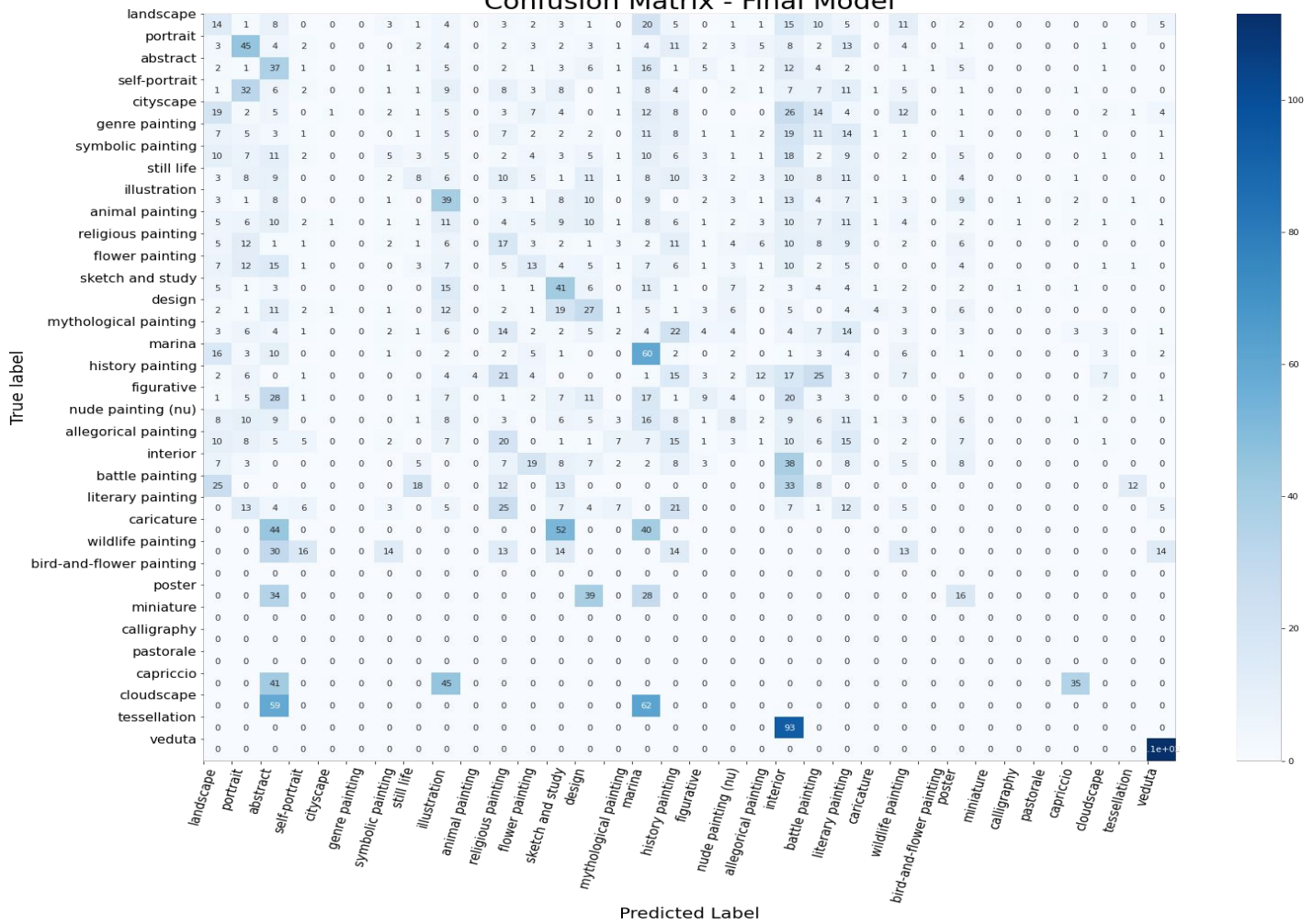
Final Modeling:

- Establishing a baseline:
  - Since each class has 600 entries, the baseline for this model will be 1 / 35 (or ~ 3%)
- Convolutional Neural Network

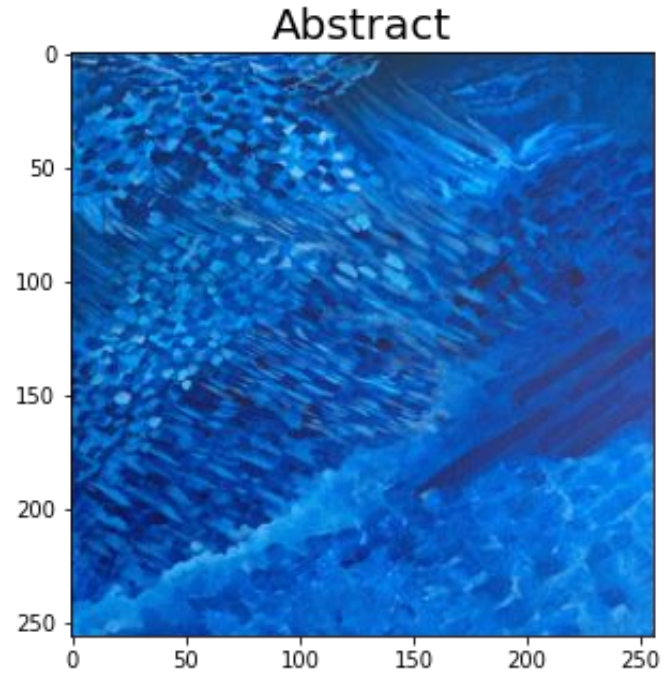
Final Model Results - Loss

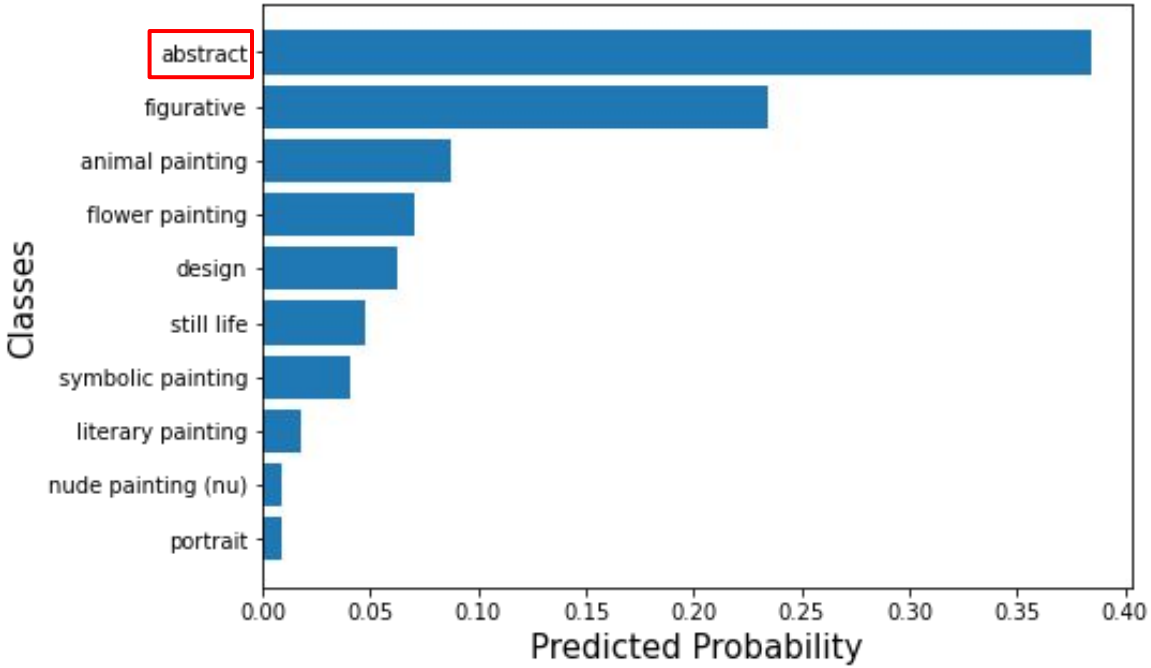
Final Model Results - Accuracy

48% Validation Accuracy

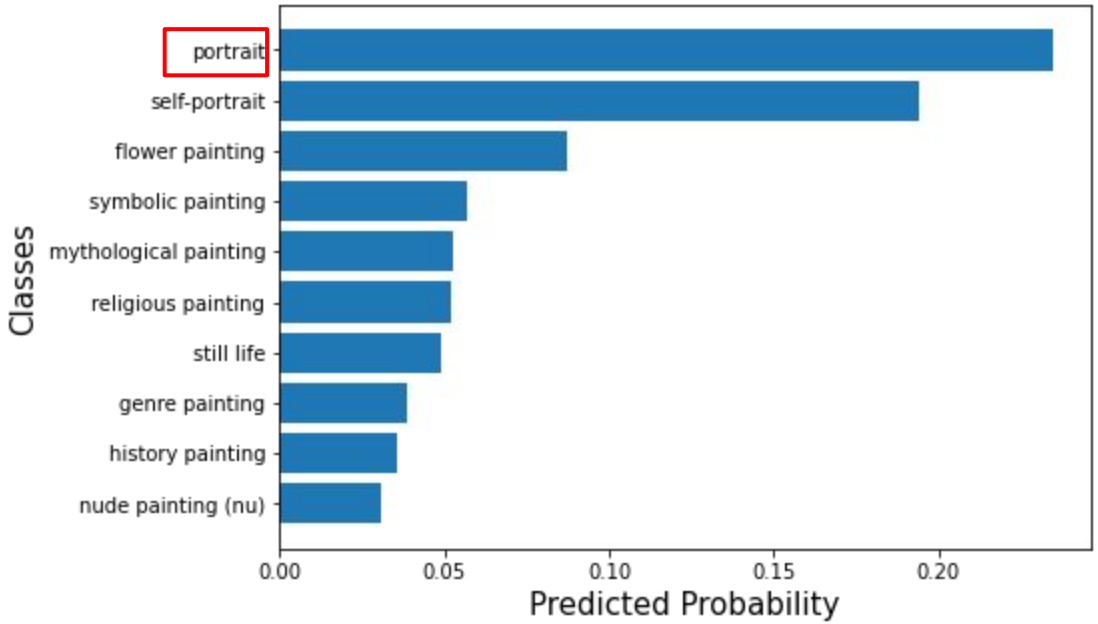

Confusion Matrix - Final Model
True label
Predicted Label
landscape
portrait
abstract
self-portrait
cityscape
genre painting
symbolic painting
still life
illustration
animal painting
religious painting
flower painting
sketch and study
design
mythological painting
marina
history painting
figurative
nude painting (nu)
allegorical painting
interior
battle painting
literary painting
caricature
wildlife painting
bird-and-flower painting
poster
miniature
calligraphy
pastorale
capriccio
cloudscape
tessellation
veduta
100
80
60
40
20
0

Visual Application

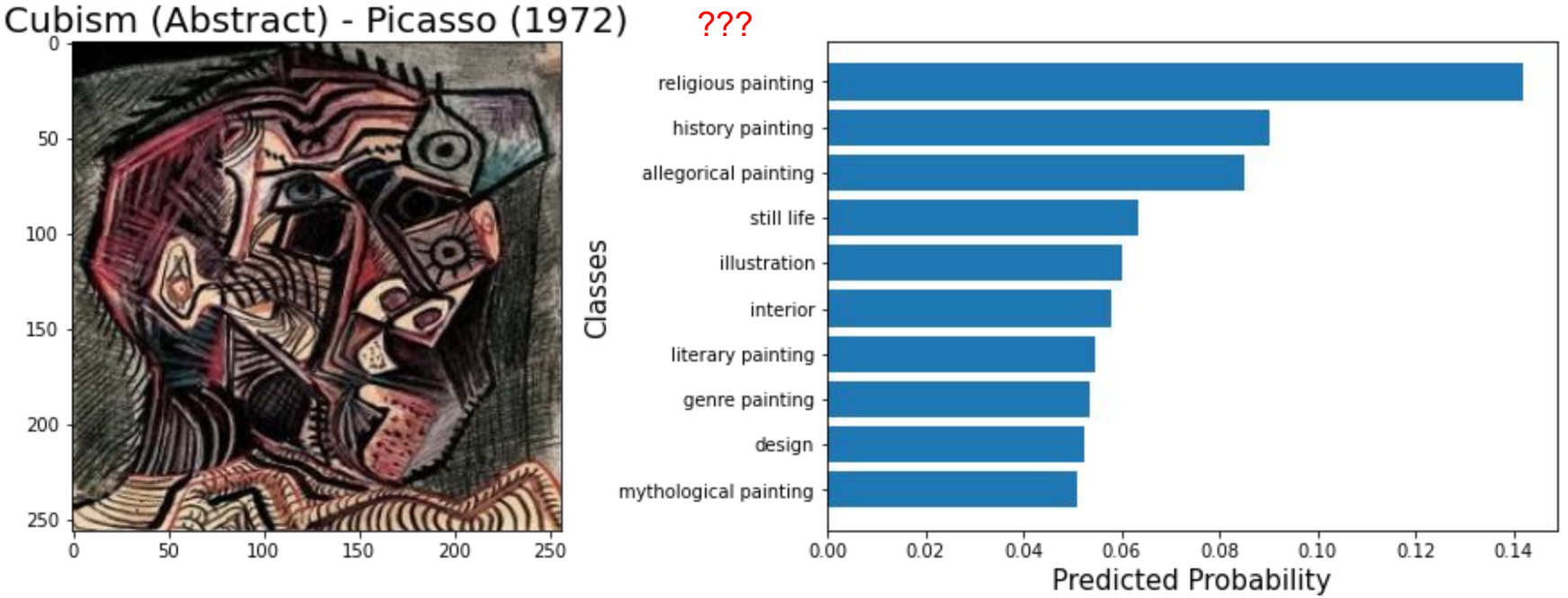




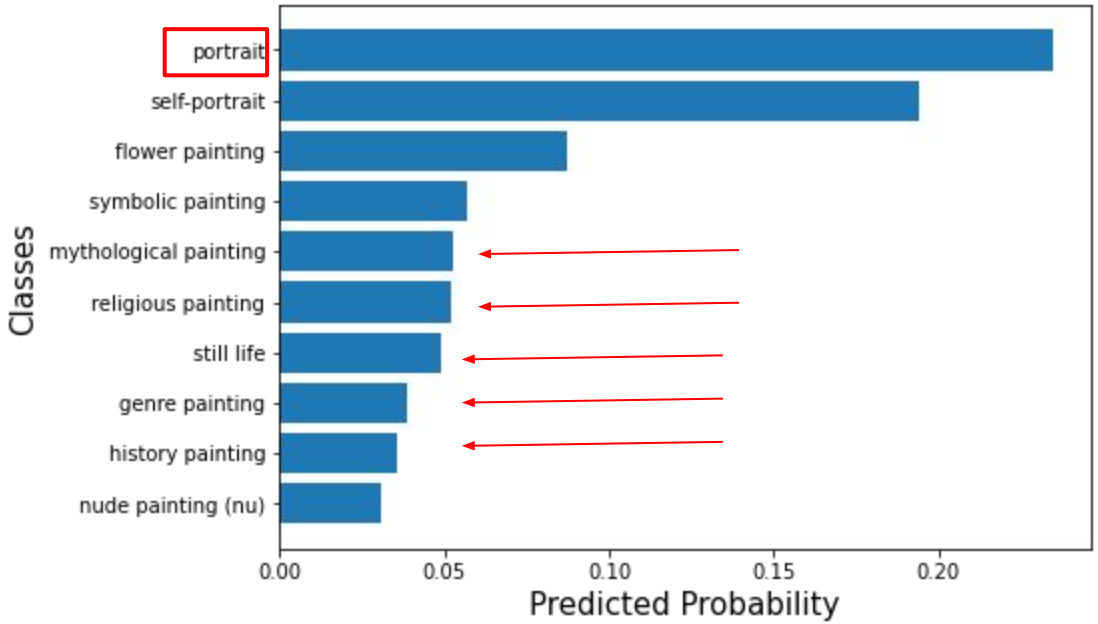
Visual Application



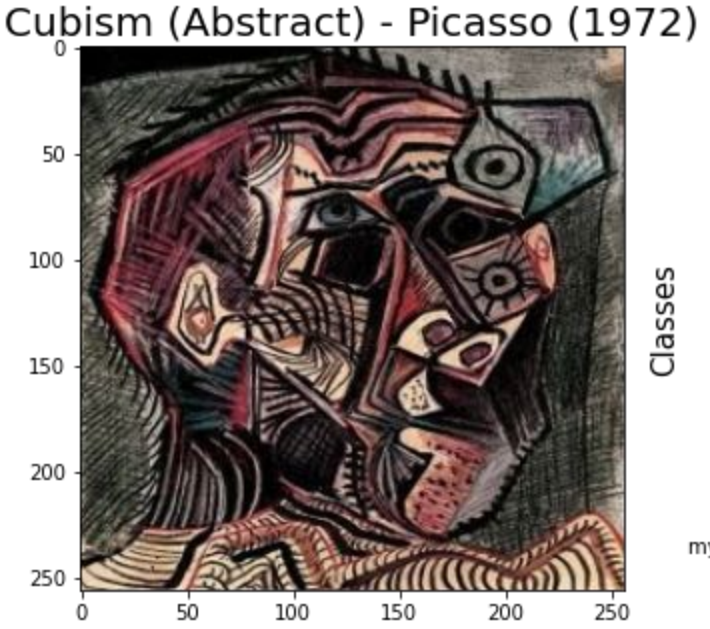
Visual Application



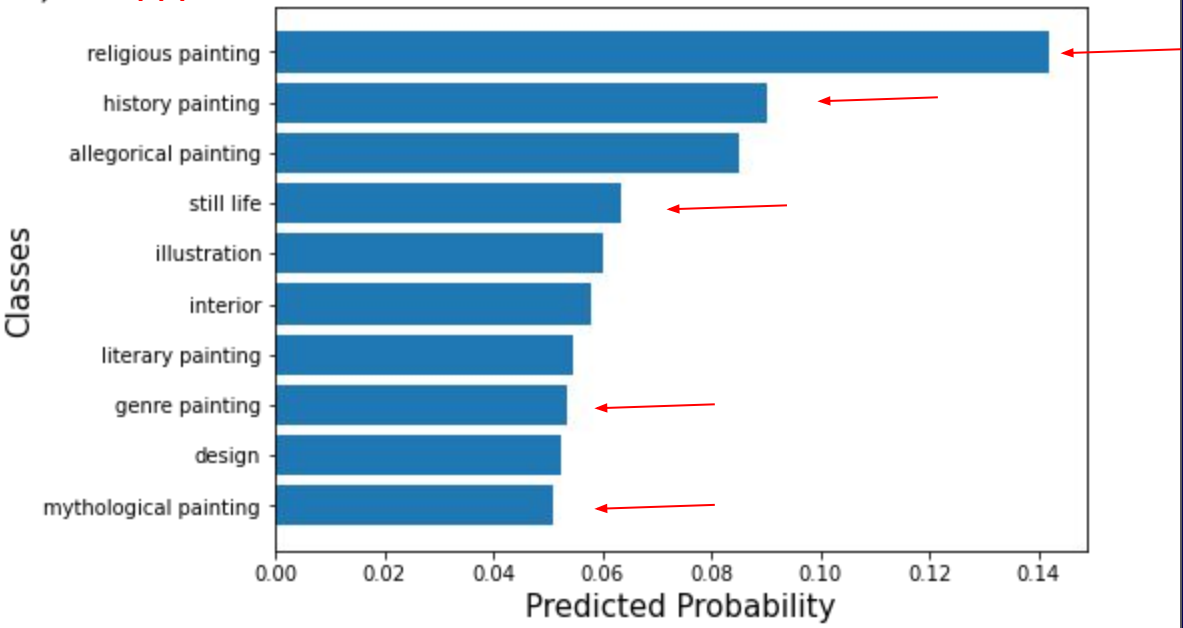
Visual Application



Visual Application



???



Religious Paintings - Google Search

Religious art - Wikipedia
en.wikipedia.org

Religious Oil Paintings - Religious ...
ipaintings.com

Immaculate Conception Reli...
ebay.com · In stock

contemporary religious pai...
osnatfineart.com

Do we need faith to see religious art ...
theguardian.com

Famous Religious Image P...
ranker.com

Painting the Life of Chris...
metmuseum.org

The importance of religious art - Art ...
gallerytoday.com

Religious Oil Paintings - Religio...
ipaintings.com

Amazon.com: Artist Signed Jesus Christ ...
amazon.com

Religious Paintings | Fi...
fineartamerica.com

12 Inspiring Religious ...
catholiccompany.com

12 Inspiring Religious Paintings ...
catholiccompany.com

Roya Art-Hand Painted ...
amazon.com

Sacred Art & Religious ...
kurtwenner.com

Religious Art Wallpapers - Top Free ...
wallpaperaccess.com

History Paintings - Google Search

History painting - Wikipedia
en.wikipedia.org

What is History Painting? – A Scholarly ...
ascholarlyskater.com

History painting – Art Term | Tate
tate.org.uk

History painting – Art Term | Tate
tate.org.uk

History Painting | Artsy
artsy.net

History Painting: Definition ...
visual-arts-cork.com

History painting - Wikipedia
en.wikipedia.org

Contemporary History Painting – ...
brooklynrail.org

Most Famous Paintings in Art History Of ...
timeout.com

American History Paintings of the 17...
nga.gov

War Is Hell Store
fineartamerica.com

Art History Timeline: Western Art ...
invaluable.com

History painting - Wikipedia
en.wikipedia.org

History painting – Art T...
tate.org.uk

Most Famous Paintings in Art History Of ...
timeout.com

Conclusion :

- Best result: 48% Validation Accuracy vs 3% Baseline
- Predictions improved drastically after accounting for class imbalances
- Predicts well based off of similar color palettes
- Improvements:
  - combining genres
  - AWS or other cloud computing services that could be used to process more data
  - supplementing classes with outside data

Recommendations and Next Steps :

- Museums can use this to model to learn more about pieces on hand and their similarities, as well as classify different artistic phases of particular artists' lives
- Add to a web/phone app to make art more accessible to museum patrons and give them an idea of what art they might be interested in learning more about