VISUALIZING A WORLD OF ART

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PROBLEM: Accessibility

Big Open Source Digitized Art Collections: The Met, The Chicago Museum of Art, WikiArt...

- How to sort through them all?
- Access multiple collections?
- Gain new and interesting insights?

APPROACH

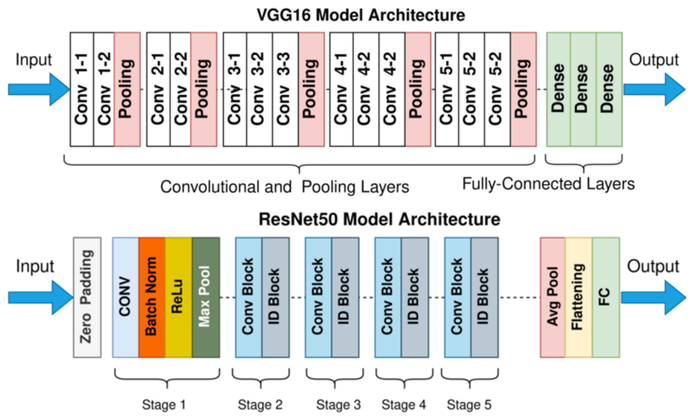
Using Machine Learning our team built a web application that takes a user uploaded image and returns similar artwork, as well as information, from multiple digitized museum collections.

- Feature Extraction with CNN(VGG16)
- Similarity using Euclidean distance.
- Hosted on Streamlit

DATASET

The Metropolitan Museum (New York)
Taipei's National Palace Museum of Art

- API: Over 200,000 images
- Final Dataset: 2300+
- Stored on GCP



Compare Feature Vectors

EXTRACT FEATURES

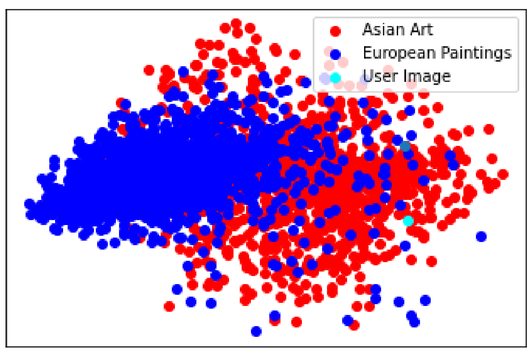
Convolutional Neural Network to extract and create new dateset. Example: VGG16, 13 Convolutional layers, 3 dense layers, 5 MaxPool layers.

- Input to CNN: original dataset (resized)
- Output extracted feature vectors from each image.
- New dataset of extracted features for each image
- Smaller!
- Can compare features between images

COMPARE SIMILARITIES

Using feature extracted dataset created with CNN, can compare dissimilarity of features between images in the dataset (or new images).

- Distance Metrics: Traditional method
- Euclidean distance:
  - distance between two flattened image vectors.
- Cosine Similarity:
  - dot product divided it by the magnitudes of each vector.



Extracted Features	Distance Metrics	Avg. RMSE	Testing Time (sec)
Original	Euclidean	48.82	1554
ResNet50	Euclidean	101.66	20.64
ResNet50	Cosine	103.7	10.65
VGG16	Euclidean	57.88	25.15
VGG16	Cosine	111.52	12.4
Customized	Euclidean	66.96	62.9
Customized	Cosine	119.47	12.75

EXPERIMENTS

- **Best CNN method?** ResNet50, VGG16, Custom, (none?)
- **Best distance metric?** Euclidean, Cosine
- **Most computationally efficient?**
- **How to evaluate each method?**

Many options: Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Multi-scale Structural Similarity Index (MS-SSIM), Spatial Correlation Coefficient (SCC),

Take a test image and compare evaluation metrics for each model and metric against the dataset.

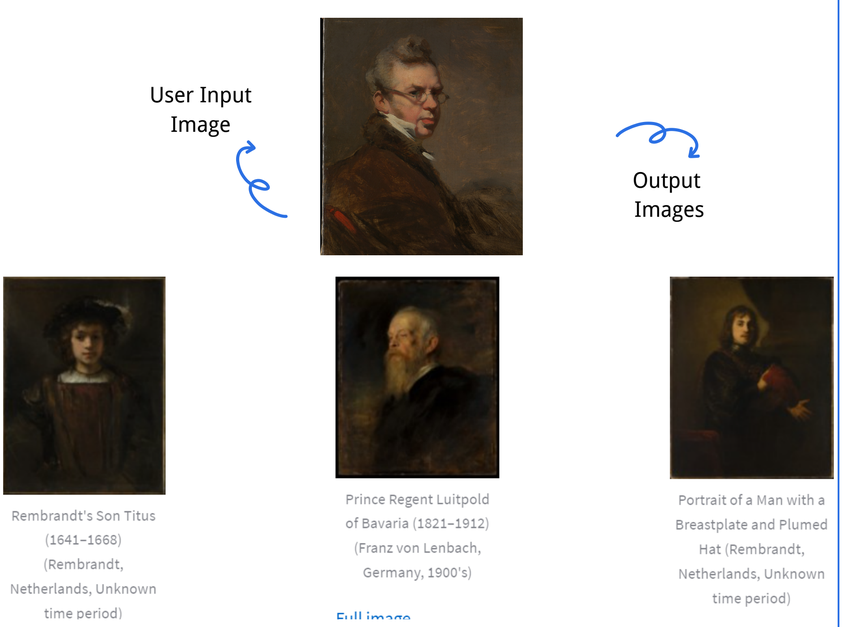
- **Finding 1:** Comparison between Original pictures take too long to run.
- **Finding 2:** VGG16 layers have an average better performance ResNet50
- **Finding 3:** Euclidean distance metrics generate better performance visually.
- **Finding 4**: Metrics alligned in results, chose RMSE

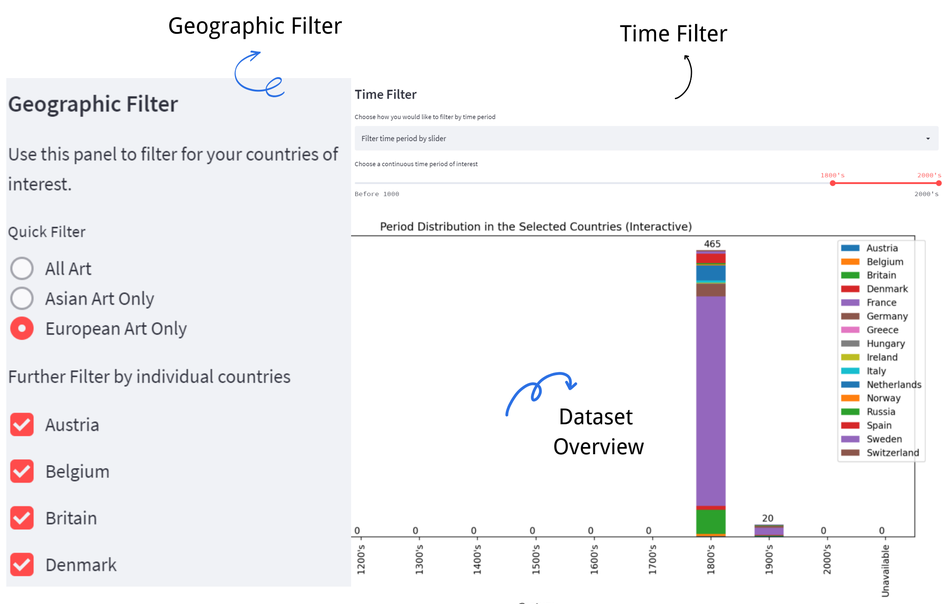
RESULTS

Based on experiments:

- VGG16 was best performing CNN Algorithm
  - visually and by RMSE evaluation
  - Relatively quick
- Euclidean Distance outperformed Cosine

In the future, the algorithm can be improved (Advanced/New Model: ResNet152, RNN). For now choose VGG16 and Euclidean Distance





INTERACTIVE VISUALIZATIONS

Our Goal is not just similarity, but insight.

- Filtering by region, by country, by time period
- Choose the number of pictures you want to consider

Returned information includes:

- Geographic and time information about individual works
- Distributive information, as a stacked barchart
- An interactive Choroppleth map

Our final approach is outlined below:
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