Aligning Non-exact Copies of Artwork

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1. Research Topic

The viability of using a geometric matching network for the purpose of aligning non-exact copies of artworks with their originals.

2. Background

- Alignment is essential for making meaningful comparisons between copies of artworks and the originals from which they are inspired/derived.
- No scholarly research exists about techniques extending into the application of registering artwork.
- Trained descriptors and geometric models are the current state of the art for image alignment.

3. Contribution

- A review of geometric matching networks as a mechanism to cope with the types of variations that often exist between originals and copies of artworks.

4. Data

- Mauritshuis collection: high-resolution captures of a variety of art pieces in their collection.
- DALL·E 2: artificially generated images that take inspiration from *Girl with a Pearl Earring.*

References

- [1] . Rocco, R. Arandjelovic, and J. Sivic, “Convolutional neural network architecture for geometric matching,” 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017
- [2] I. Rocco, R. Arandjelovic, and J. Sivic, “End-to-end weakly-supervised semantic alignment,” 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2018.

5. Methodology

- Using slightly altered *CNNGeo*[1] and *WeakAlign*[2] implementations to conduct experiments.
- Using pretrained networks with object classes similar to those commonly found in artworks e.g., person for portraits.
- Evaluation Metrics:

Metric	Description
PCK (Percentage of Correct Keypoints)	Count of keypoint transfers below some threshold
DIST (Distance from Ground Truth)	Euclidian pixel distance from expected location
IoU (Intersection over Union)	Foreground overlap between target and warped image

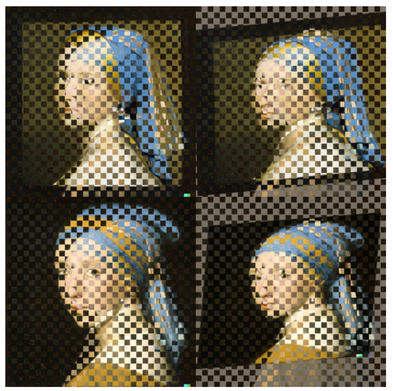
- Figure 1: Key-point annotation example

- Figure 2: Foreground segmentation example

6. Results

		Affine	TPS	Affine + TPS
VGG	PCK@0.1	78.18	82.73	No model
	PCK@0.05	60.91	56.36	No model
	DIST	5.93	6.07	No model
	IoU	74.57	78.85	No model
Resnet	PCK@0.1	82.73	82.73	80.91
	PCK@0.05	57.27	63.64	62.73
	DIST	6.53	5.65	5.82
	IoU	69.85	75.39	78.74

- Figure 3: Tabulated evaluation results over the DALL·E 2 variations of *Girl with a Pearl Earring*



- Figure 4: Examples of interlaced alignment results

- Figure 5: Image patch alignment result

7. Limitations

- Complex scenes pose a challenge just as in other applications of image registration.
- Lack of training data. Synthetically generated data is an option but public access to systems like DALL·E 2 is currently limited.

8. Conclusions

- Qualitative results indicate that models trained using real-world data from outside the domain of artwork generalise well for this application.
- Quantitative results will require further research in order to have other bases for comparison.
- Availability of more data could open up the possibility of creating natively trained networks for semantic artwork alignment.