

# Capturing aesthetic complexity in art using compression ensembles

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- **Goal:** Quantification of visual aesthetics and artistic expression.<sup>[cf. 1-4]</sup>
- **Previous research:** Complexity approximated via compression (gif, png).
- **Here** we propose a novel method, *compression ensembles*, using multiple compression ratios of the image, its various transformations<sup>[5]</sup>, embedded in a latent vector space (using PCA). Simultaneous comparison of multiple artworks in multiple dimensions of complexity captures polymorphic family resemblance.<sup>[6]</sup>

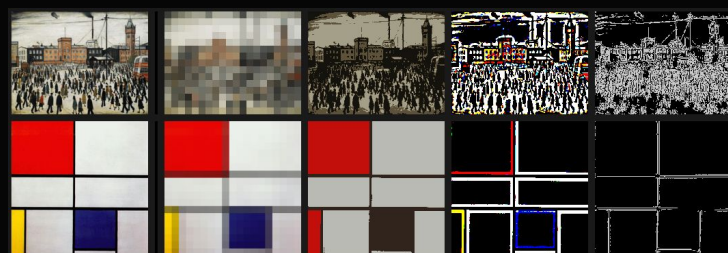
## → Pipeline:

- import as bitmaps;
- 79 transformations;
- compress all;
- record size ratios;
- run PCA.

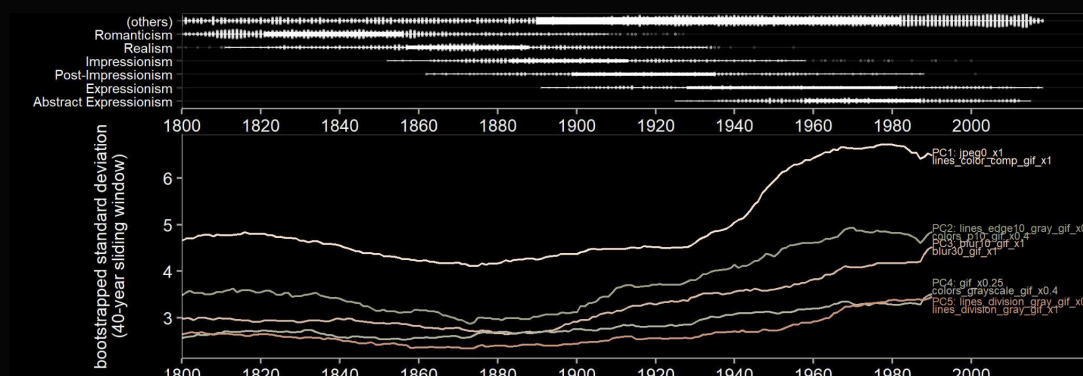


## → Example:

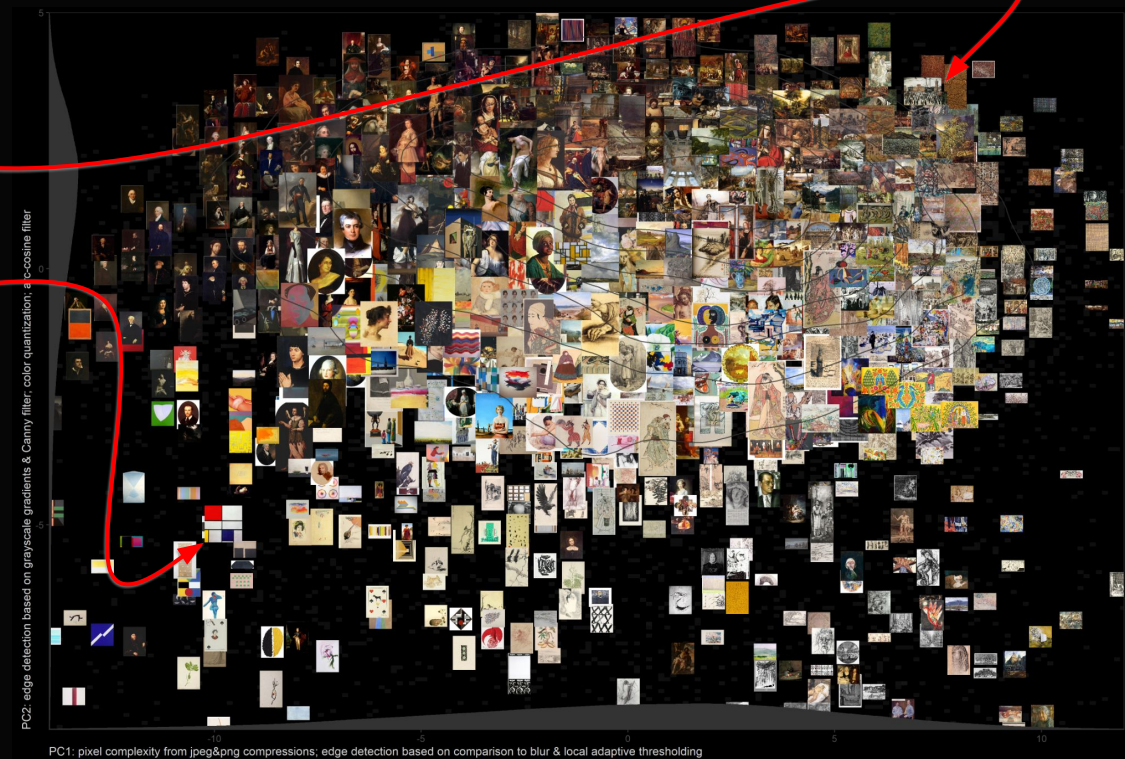
- Same 4 transforms of 2 different artworks;
- Arrows show position within the PCA model on the right: 23k images from art500k/Wikiart.



- **Preliminary results:** The possibility space of aesthetic complexity has expanded over time. Below: time series of bootstrapped stdev of PCA components 1-5, based on the 23k image sample, balanced by year, 1400-2018. The upper panel shows the distribution of 6 most frequent (style) categories plus other. Both plots 1800 onwards (zoom in for detail).



- **Evaluation (1):** MultiPic human visual complexity judgements in 6 languages. Regression predicting human ratings (scale of 1-5). Out-of-sample absolute prediction error  $\leq 0.24$  (less than differences between languages).  $R^2=0.71$  (full), 0.61 (top 5 PCs), 0.37 (just gif).
- **Evaluation (2):** Artist and genre retrieval (PCA trained on 23k artworks, LDA+KNN classifier). Test set of 23 artists with  $100 \pm 20$  artworks each, model correctly predicts artist  $\sim 65\%$  of the time (cross-validated out-of-sample kappa; i.e. accounting for the random baseline accuracy of 4%). Similar for genre, art movement, and artist's nationality. Dating prediction error within  $\sim 50$  years.
- **Our method** outperforms previous human judgement correlations, is cognitively plausible, and captures differences between artists' styles.



- **Future work:** Trace artists' trajectories in the complexity space. And the general ensemble approach should also be applicable in other domains beyond visual art, in particular, cf. the complexity-expressivity trade-off literature in linguistics.<sup>[7,8]</sup>