Friedrich-Alexander-Universität
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Scene Classification on Fine Arts with Style Transfer

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Agenda

01 Background

02 Methodology

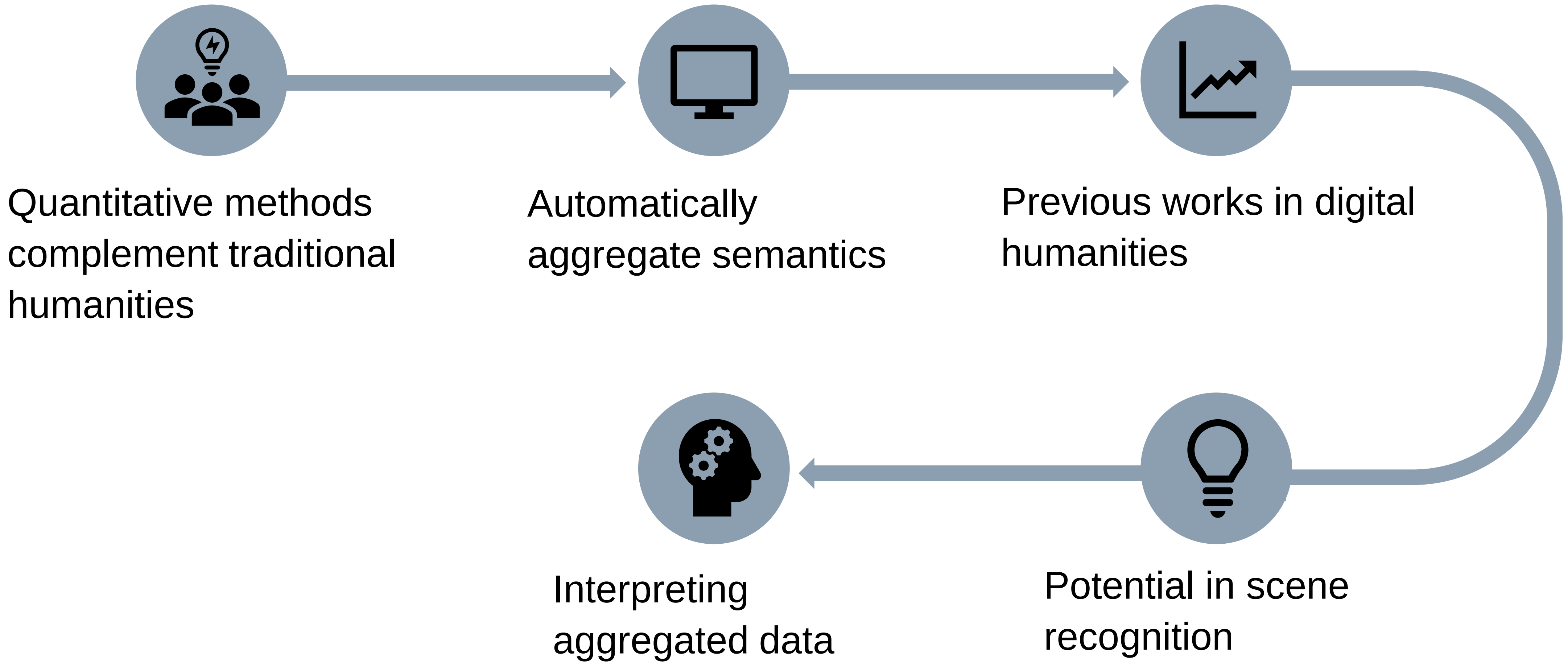
03 Results

04 Conclusion

Sample images: Artistic stylized Places365 (left); Artwork: *Landscape with river* [7] (right)

Background

Background


Quantitative methods complement traditional humanities
Automatically aggregate semantics
Previous works in digital humanities
Potential in scene recognition
Interpreting aggregated data

Methodology

Methodology

Training and Evaluation Pipeline

- **Pretraining**:

  SWAG [1] and Hiera [2]

- **Task adaptation**:

  Places365-standard [3] for scene labels

- **Style transfer adaptation**:

  Artistic style transfer to provide artistic content

- **Fine-Tuning**:

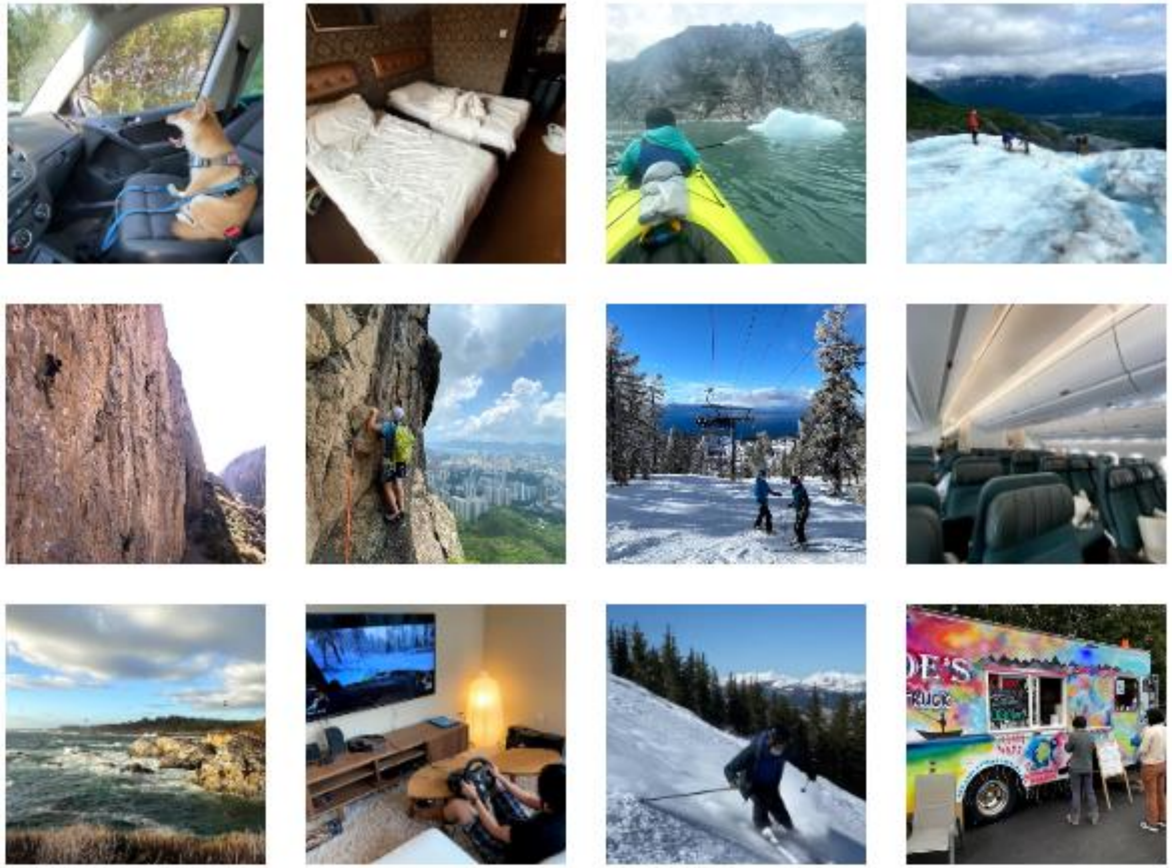
  Task-specific fine-tuning for scene classification

- **Evaluation**:

  Evaluation on unseen artworks

Methodology

Task Adaptation



Overview of the *Places365* [3] dataset. Places365-standard consists of 1.8 million images, 365 categories.

Places365-standard [3] for scene labels

ImageNet recognizes objects and classifies them to object labels (e.g. mountain tent)

Places365 provides entry-level of an environment (e.g. mountain)

Challenges:

- Mismatch between historical and modern scenes
- Similar categories

Methodology

Applying Artistic Style Transfer

Artistic Style Transfer to provide artistic content

- ImageNet and Places365 are photographs
- Domain gap to artistic representation
- Adaptation via style transfer

Stylized Places365 data sample with reasonable artistic style transfer.

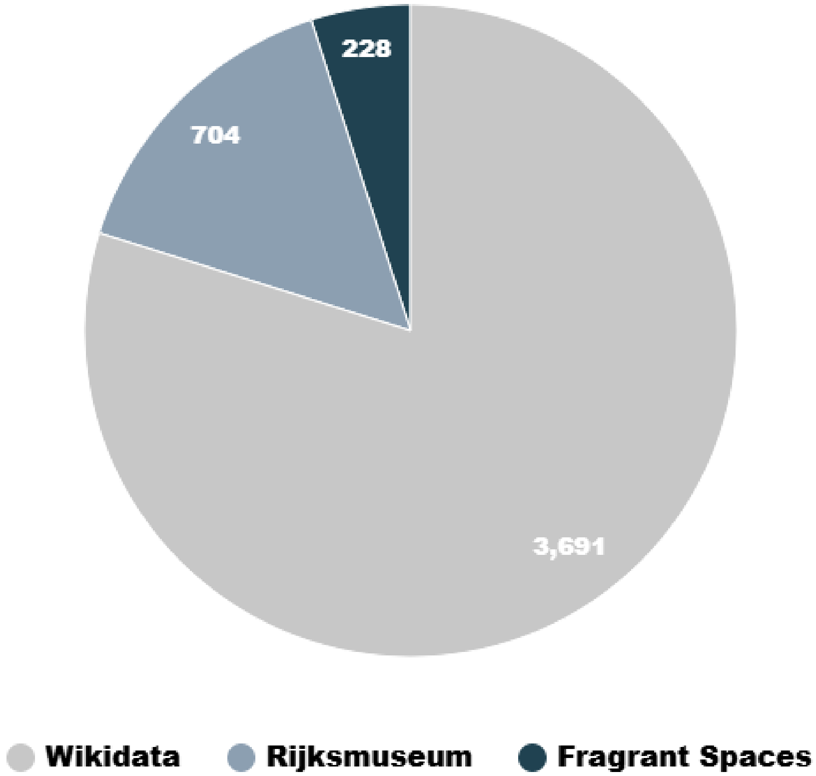
Stylized Places365 data sample with unnatural style transfer

Methodology

Fine-tuning with Artworks: data collection

Artworks Source Distribution

- Artworks from Wikidata [5]
- Artworks from Rijksmuseum [6]
- Fragrant Spaces from ODOR [8] dataset



Number of artworks from different resources

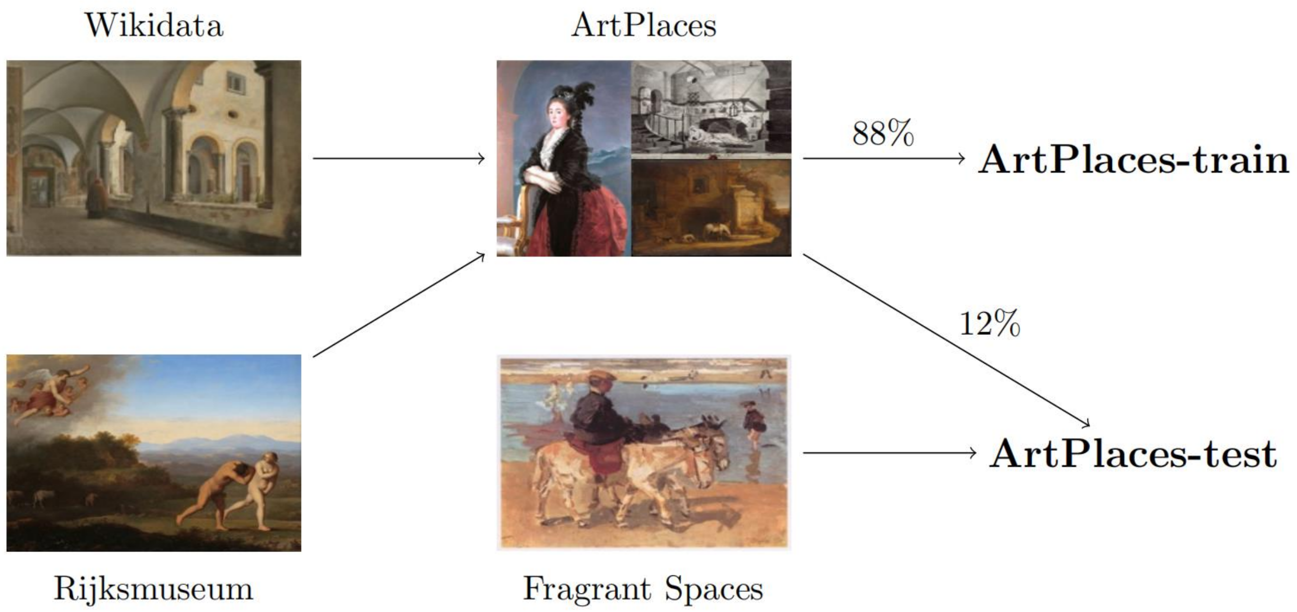
[5] https://wikidata.org

[6] https://rijskmuseum.nl

[8] Zinnen M: Smelly, dense, and spreaded: The Object Detection for Olfactory References (ODOR) dataset

Methodology

Fine-tuning with Artworks: data reallocation



Separation of artworks to form training and test sets.

Dataset Assembly

- Combine Wikidata and Rijksmuseum
- ArtPlaces split into two sets
- ArtPlaces-train for fine-tuning
- Rest of Artplaces: labels are manually corrected
- ArtPlaces-test: corrected artworks and Fragrant Spaces for evaluation

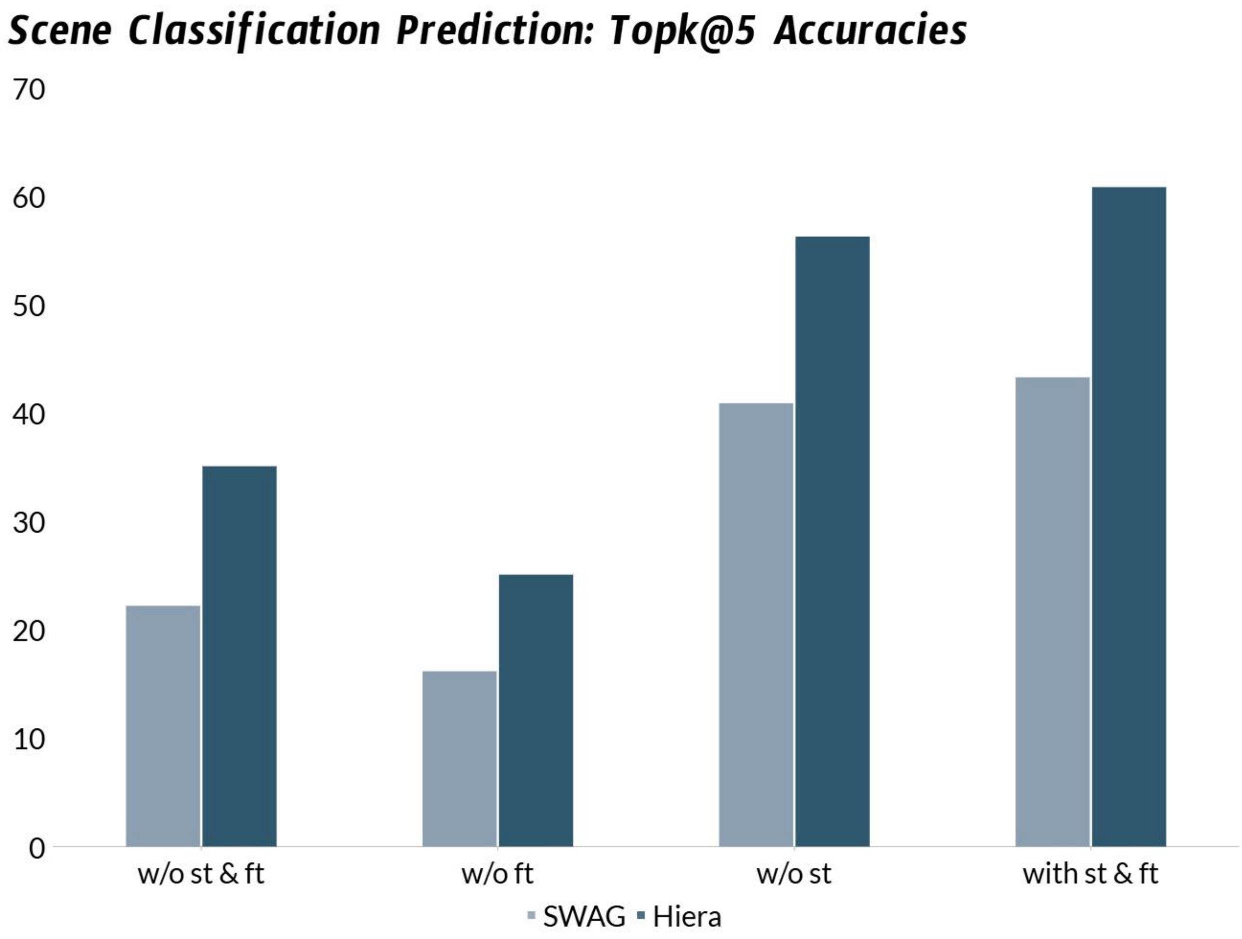
Challenge:

- Non-scenery artworks

Results

Results

Quantitative Analysis



Prediction results: the suffix “st” refers to stylization, and the suffix “ft” is the abbreviation for fine-tuning.

Evaluation on Artworks

- Hiera-ViT/B surpasses SWAG-ViT/B in all the conditions.
- The fine-tuning dominates the contribution in increasing performance.
- Combining stylization and fine-tuning leads to best results.

Results

Qualitative Analysis

Predictions over different settings with the following exemplar images

Example images for evaluating the networks. *Glacier in Magdalena Bay, Spitsbergen* Friedrich Kallmorgen (left); *The Water Lily Pond* by Claude Monet (right)

Conclusion

Conclusion

01 **Benchmark in artistic scene recognition**

Applying a multi-stage domain adaptation training strategy.

02 **Combined training**

Combination of stylization and fine-tuning

03 **Challenges**

Intra-class variation and semantic ambiguity across categories

04 **Data cleaning**

Non-scenery paintings with unclear scene categories

05 **Scene categories**

Historical artwork specific categories

06 **Varying styles of artworks**

Asserting a prior style classification network

References and Image Credits

[1] Singh M, Gustafson L, Adcock A, et al. Revisiting weakly supervised pre-training of visual perception models

[2] Ryali C, Hu Y T, Bolya D, et al. Hiera: A hierarchical vision transformer without the bells-and-whistles

[3] Zhou B, Lapedriza A, Khosla A, et al. Places: A 10 million image database for scene recognition

[4] *King Candaules* by Jean-Léon Gérôme © Museo de Arte de Ponce; *Rivierlandschap met koeien* by Aelbert Cuyp © Rijksmuseum (Accession No. SK-A-3957); *Portrait of Cornelis Pietersz. Hooft* by Cornelis van der Voort © Amsterdam Museum (Accession No. SB5824)

[5] *Landscape with river* by Jan Griffier © National Gallery of Armenia (Accession No. 749)

Thank you for your listening!