

AI in Digital Painting Analysis and Conservation

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Version 2.0.1

Digital Painting Analysis and Conservation



- **SfM in 3D monument and painting reconstruction**
- Fragmented Artefact re-assembly
- IR reflectography and mosaicking
- Image registration
- Crack restoration
- Color restoration
- Stylistic Painting Analysis
- Computational Aesthetics

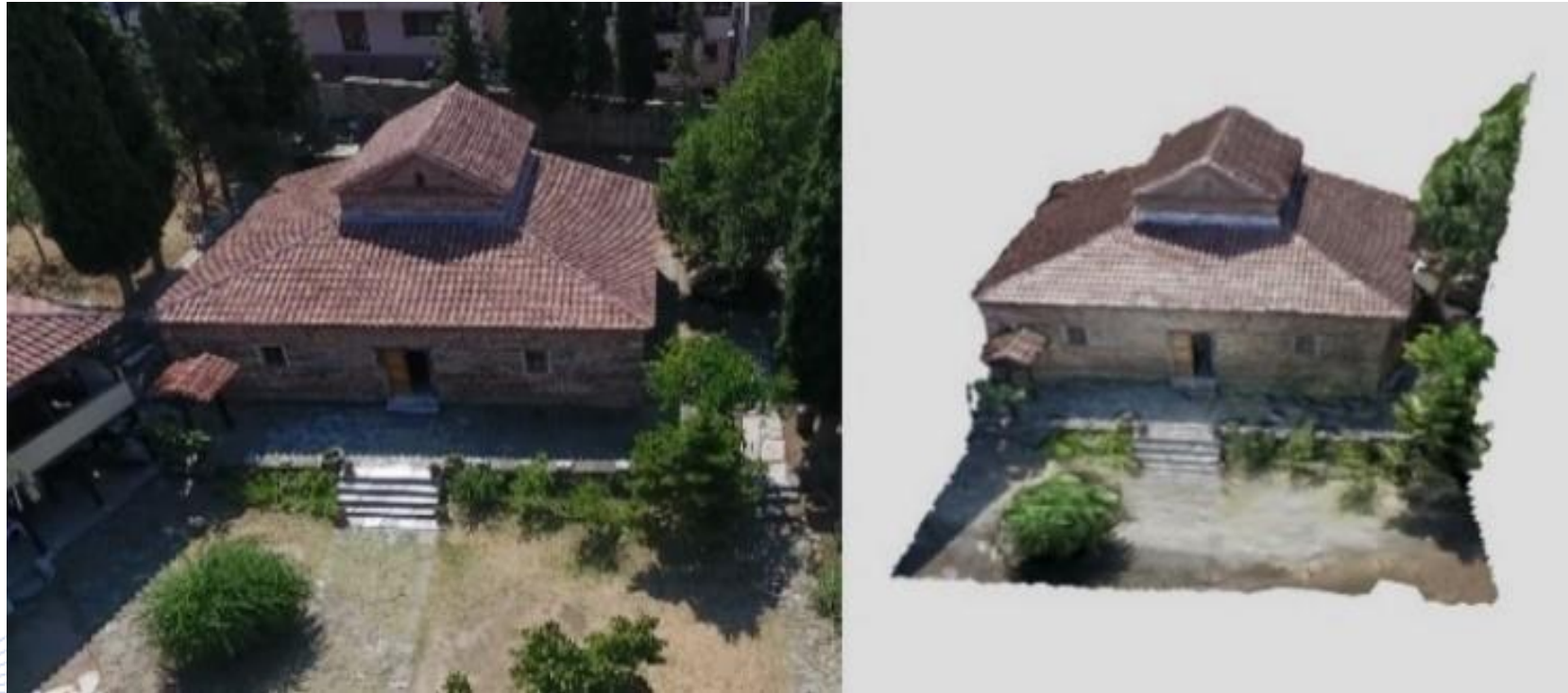


Structure from Motion (SfM) in 3D monument reconstruction



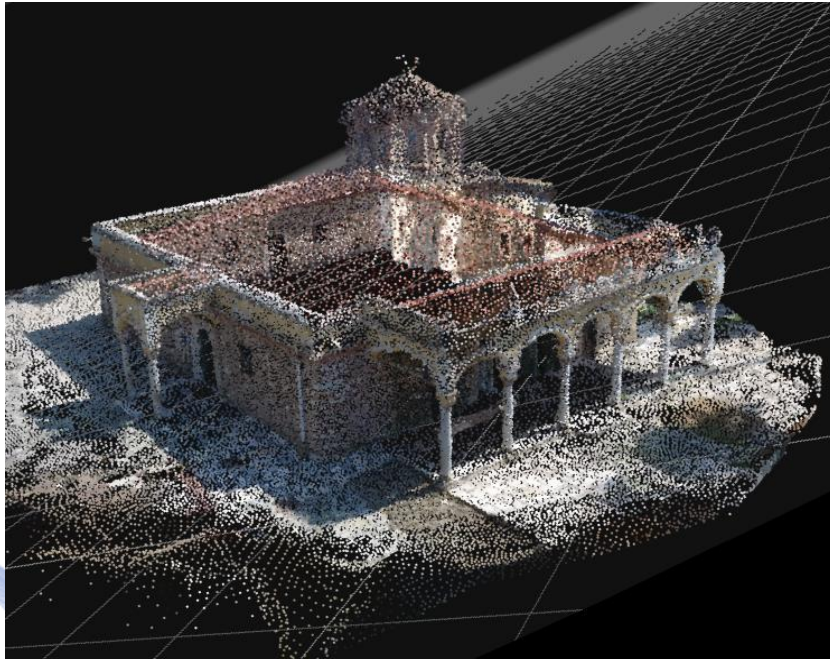
St Nicolas Orphanos church, Thessaloniki, Greece [HEL2002].

Structure from Motion (SfM) in 3D monument reconstruction



a) Real image; b) Synthetic 3D model view of St Nicolas Orphanos church.

Structure from Motion (SfM) in 3D monument reconstruction



Polygonal surface mesh of Vlatadon Monastery.

Painting mosaicing



Flattened mosaick of a mural that was painted on a church arch

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Fragmented Artefact re-assembly



Painting re-assembly from its fragments.

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IR reflectography



Anthivola (preliminary drawings), Hionades painters [ART2023].

IR reflectography



IR reflectography and anthivolon (preliminary drawing)
(Matteo di Giovanni 1430 – 1495) [ART2023].

IR reflectography



IR reflectography and anthivolon (preliminary drawing)
(Matteo di Giovanni 1430 – 1495) [ART2023].

IR reflectography and Overpainting



'Massacre of the Innocents' (P. Bruegel) [GER2013] .

IR reflectography and Overpainting



Overpainting in 'Massacre of the Innocents' (P. Bruegel) [GER2013] .

IR reflectography and mosaicking



IR reflectography and mosaicking of a Byzantine icon.

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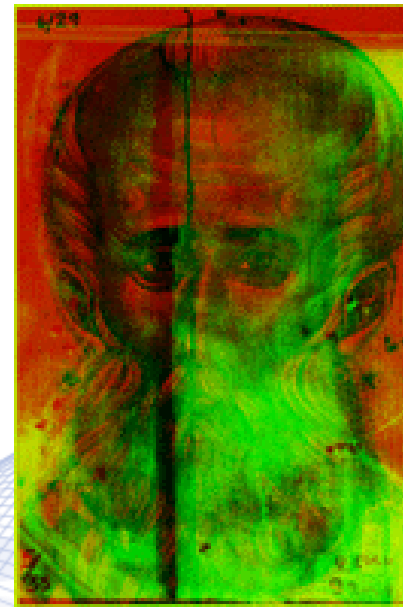


Multimodal Imaging



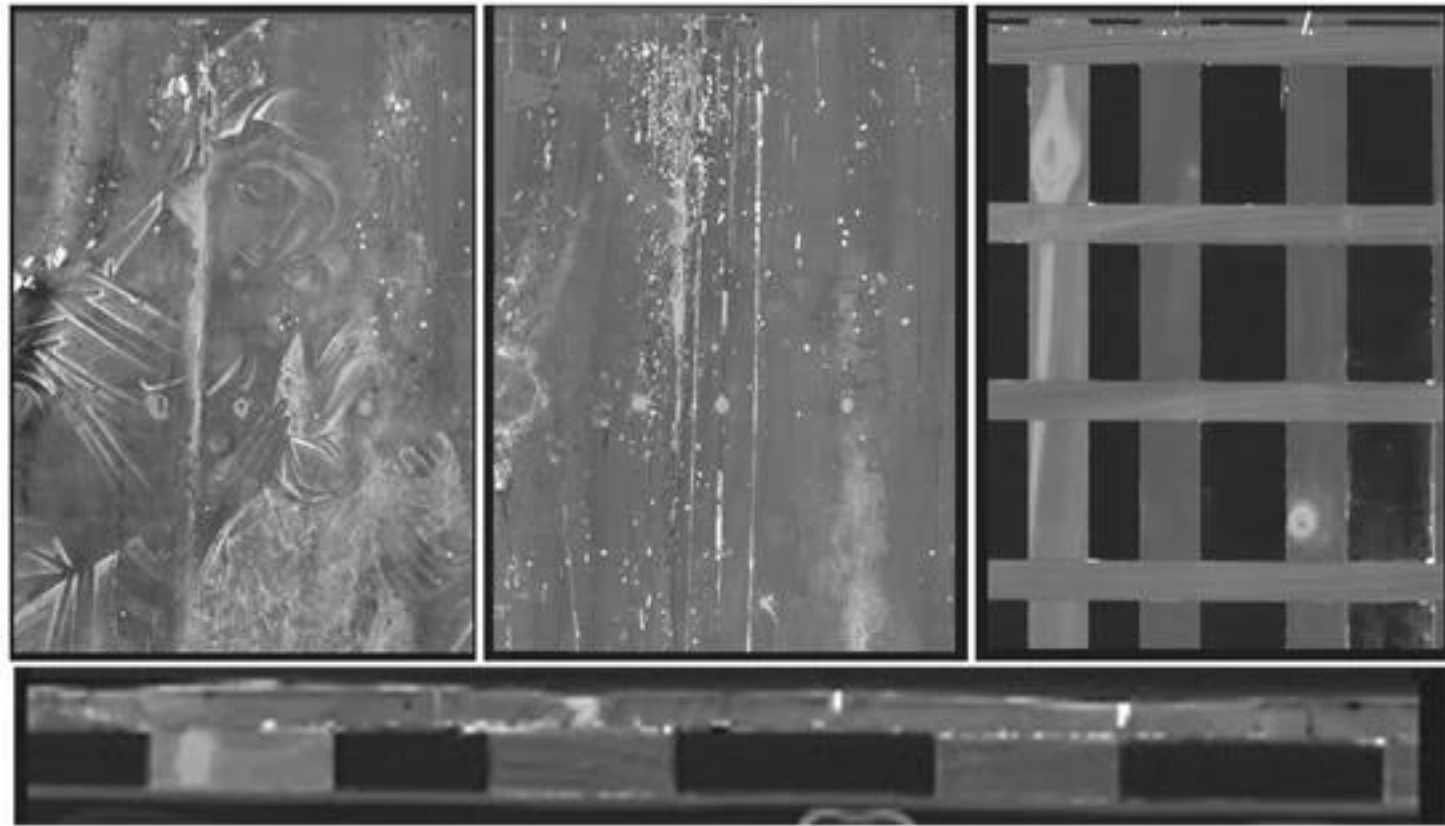
Madonna dell'Elemosina (Biancavilla, Italy). Left to right: diffused visible light; visible grazing light; UV fluorescence; IR reflectography [ARM2021] .

Image registration



Visible and X-ray Image registration.

Computer Tomography Imaging



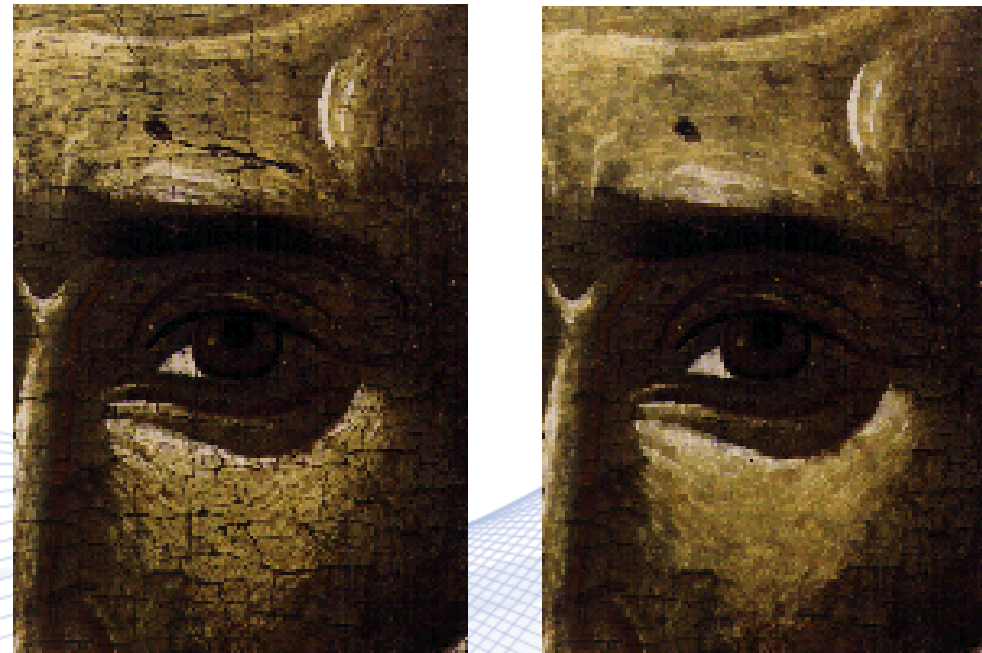
CT of Madonna dell'Elemosina (Biancavilla, Italy). Left to right: front Icon, towards the Icon, parking area. Down: the lower and upper section. [ARM2021] .

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Crack restoration



Crack restoration of a Byzantine icon.

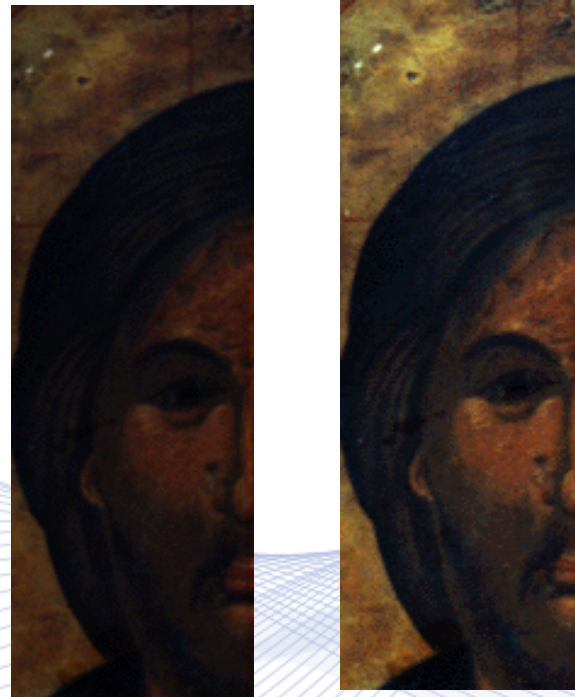
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Color restoration



Color restoration of a Byzantine icon.

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Stylistic Painting Analysis

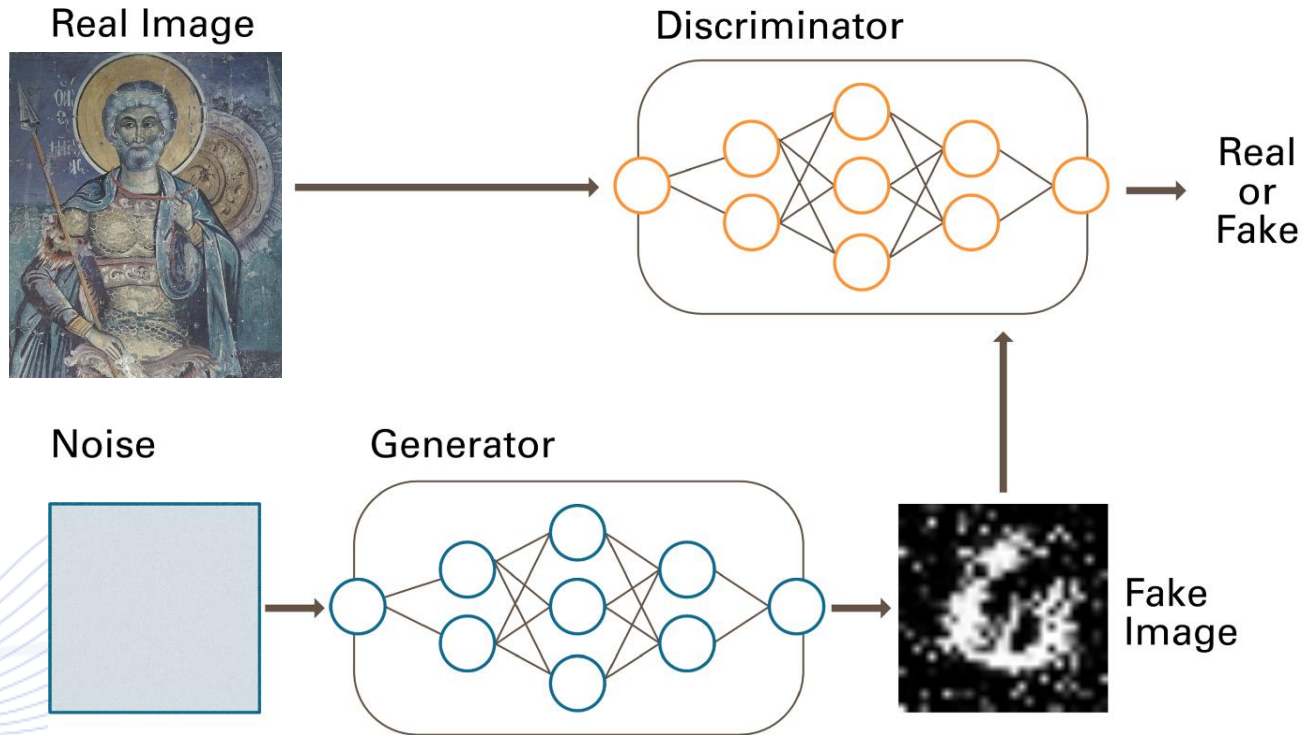


Stylistic Painting Analysis



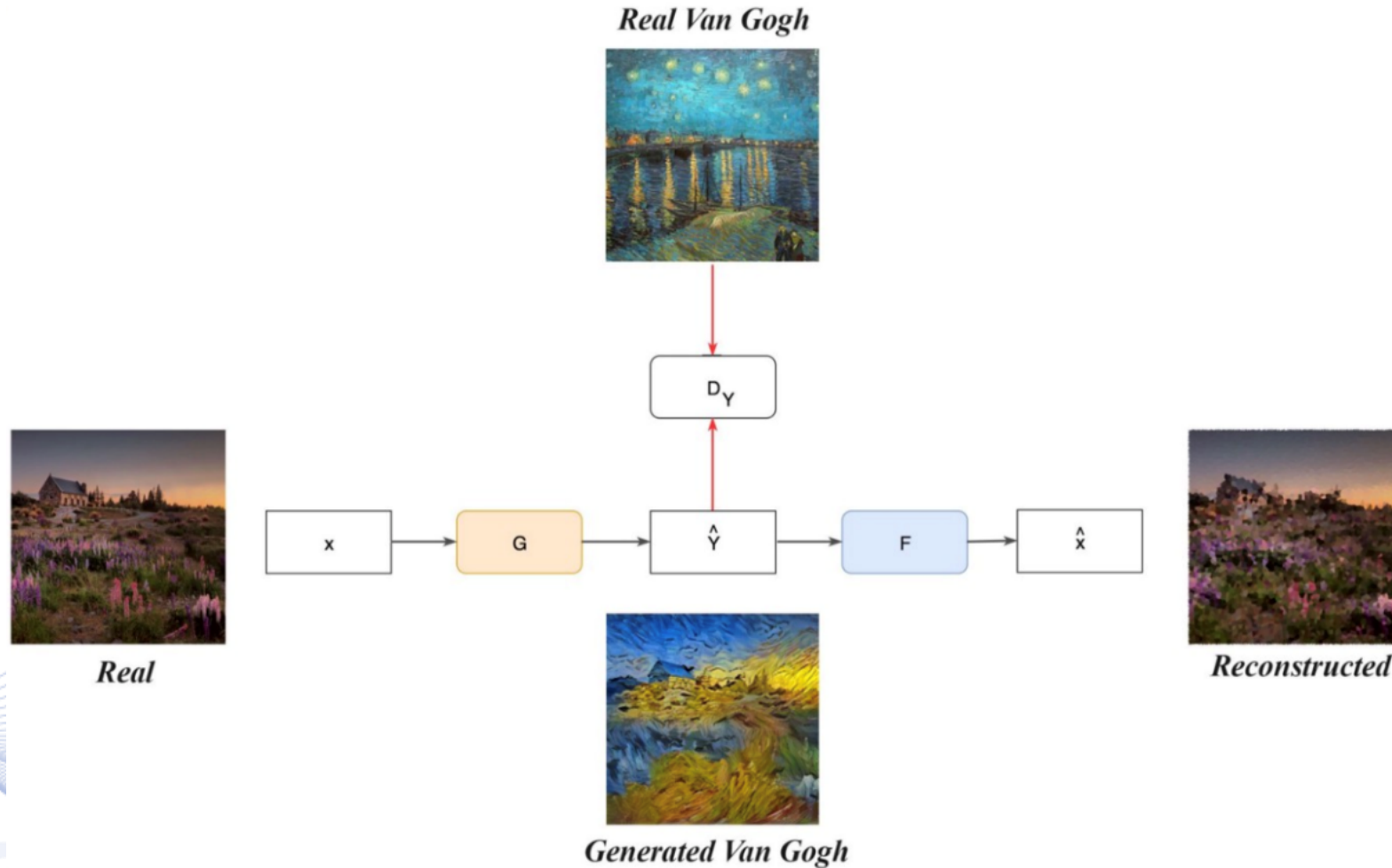
a) Ag. Minas (in Ag. Nikolaos), b) Ag. Demetrius, (in Ag. Georgios), Eratyra, Greece

Stylistic Painting Analysis



Synthetic Image Generation by Generative Adversarial Networks (GANs) [1].

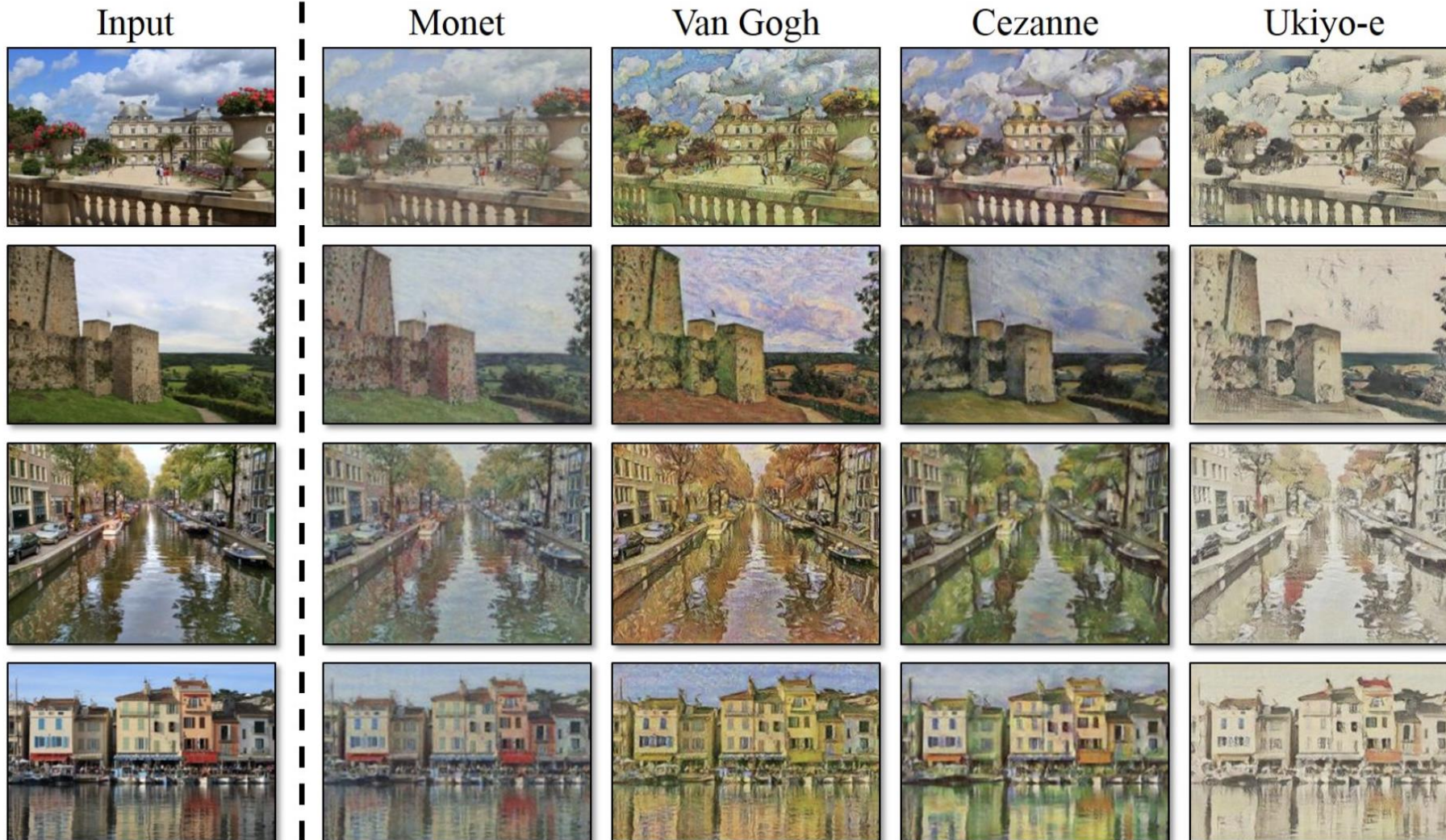
Stylistic Painting Analysis



GAN Image-to-Image Translation [ZHU2017].

Stylistic Painting Analysis

Collection Style Transfer



GAN Image-to-Image Translation [ZHU2017].

Stylistic Painting Analysis

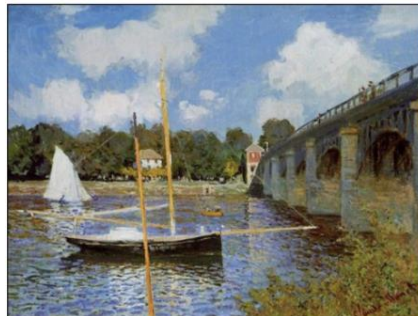
Monet Paintings to Photos

Input

Output

Input

Output

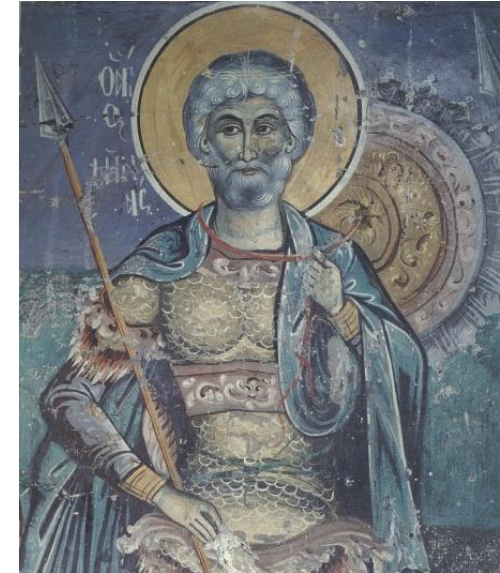
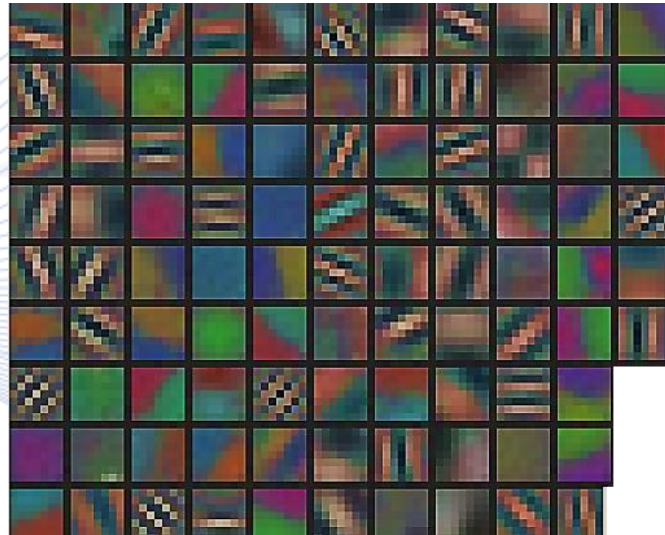


GAN Image-to-Image Translation [ZHU2017].

Stylistic Painting Analysis

DNN painting style recognition

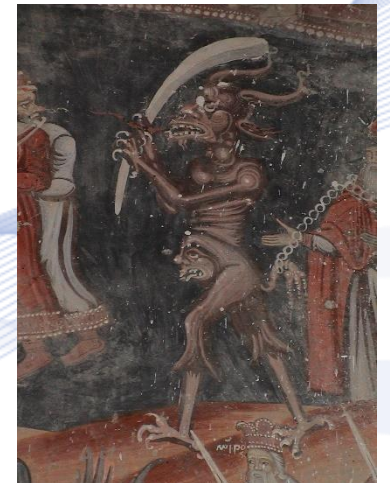
- Classification/retrieval problem:
 - ***Find the painting style.***
- Convolutional Neural Networks.
- CNN Visual features:



Stylistic Painting Analysis

Questions [SKO2018]:

- Visual painting elements
- Focal points or other key features
- Eyes fixation on the painting
- Connection of painting elements
- Dominant color harmony
- Notan structure
- Brushwork visibility
- ***What Is the painter trying to say?***



Stylistic Painting Analysis

Visual painting style elements:

- Color
- Texture
- Structure/composition.

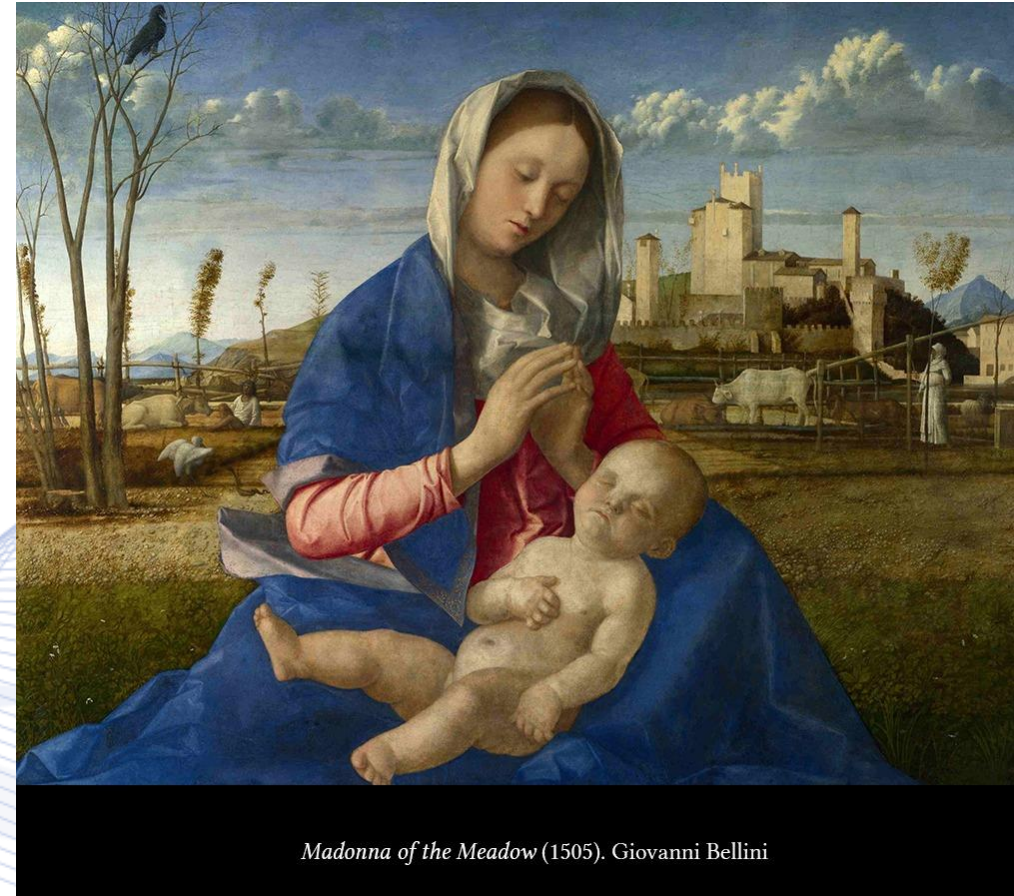
Explainability of Stylistic Painting Analysis.



Stylistic Painting Analysis

Stylistic elements:

- Color
 - Pigment analysis:
 - Ultramarine blue.
 - Cinnabar (Red of Onoufrios).

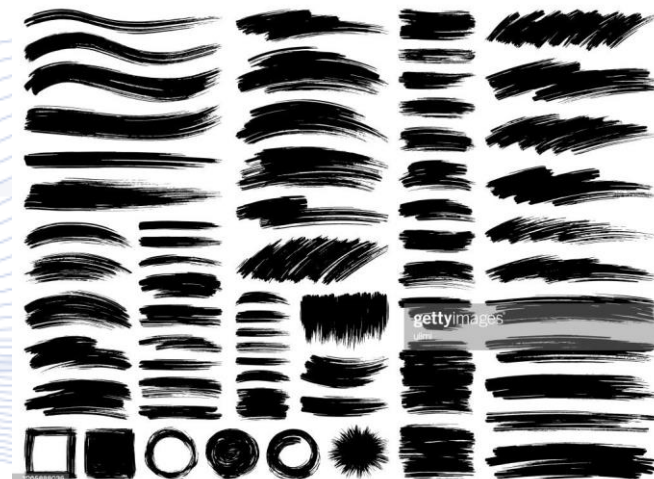


Madonna of the Meadow (1505). Giovanni Bellini

Stylistic Painting Analysis

Stylistic elements:

- Image texture
- Brush stroke coarseness, orientation.



Stylistic Painting Analysis

Stylistic elements:

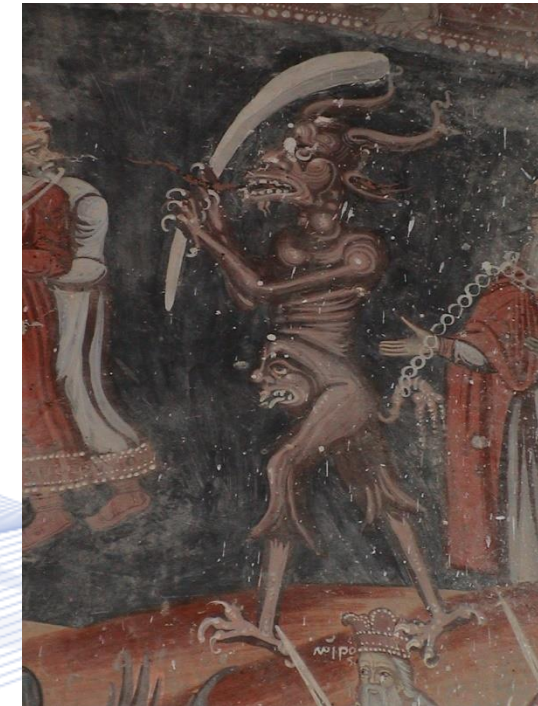
- Image texture
- 3D brush stroke structure
 - Van Gogh's brush strokes.



Stylistic Painting Analysis

Stylistic elements of Byzantine art:

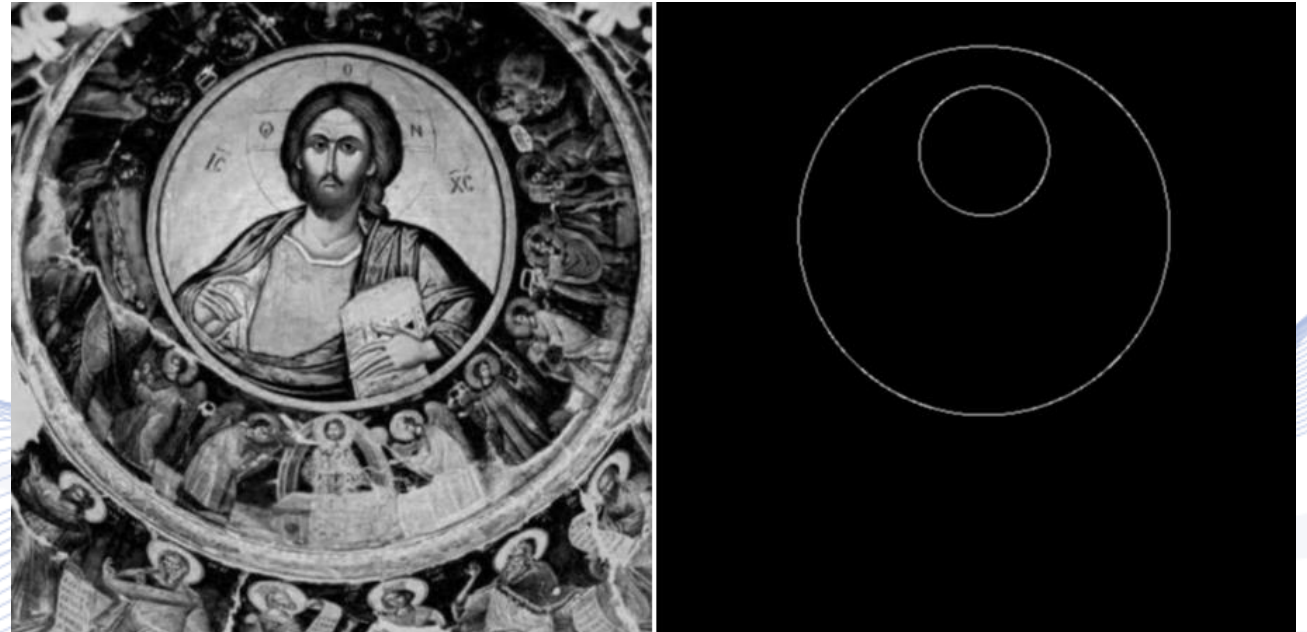
- Structure/composition
 - Iconographic cycle:
 - Dogmatic cycle
 - Liturgical cycle
 - Iconographic cycle.



Stylistic Painting Analysis

Stylistic elements:

- Structure/composition
 - Iconographic cycle.



Counting the number of saints depicted in a painting.

Digital Painting Analysis and Conservation

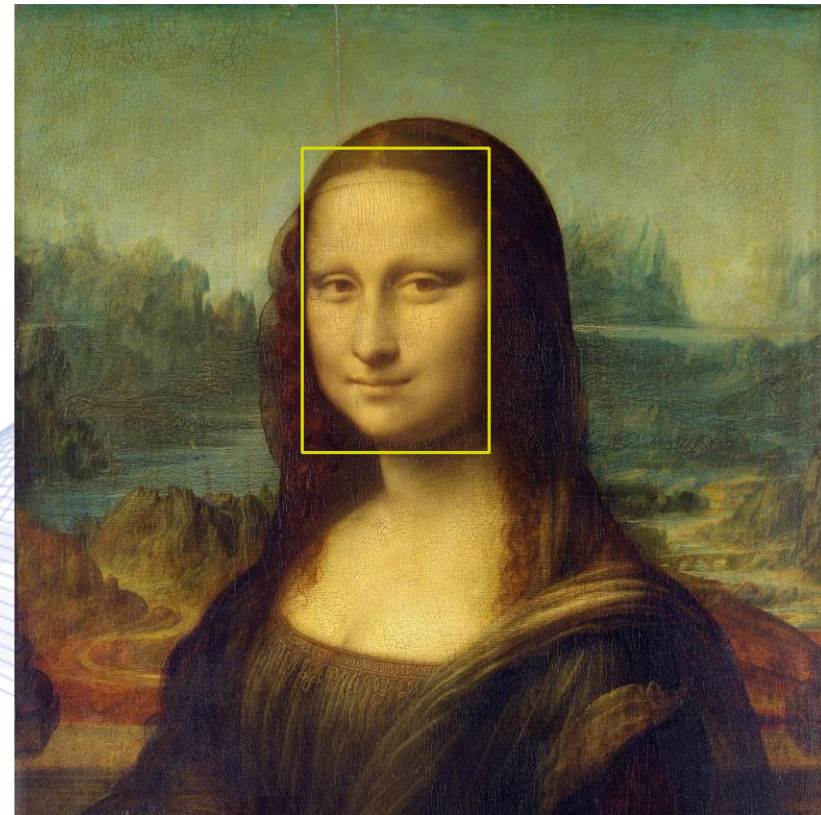


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Computational Aesthetics

- Rule of thirds (photography).
- Golden ratio.
- In portraits:
 - Facial symmetry
 - Direct eye gaze.
- Aesthetics and painting **appeal**:
 - Use of likes in social media.
 - DNN estimation of appeal.



Golden Ratio in Mona Lisa's facial region.

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Q & A

Thank you very much for your attention!

**More material in
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