THE MASTER's HAND:

Can image analysis distinguish originals from copies?

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May 9, 2016

Green Lecture, IPAM, UCLA

How it all started:

Rick Johnson (Cornell):

sabbatical in France

visits Van Gogh Museum

conservator department

use of chemical analysis,

X-rays, infrared, ..

why no image analysis?

This led to the first IP4AI workshop

IP4AI: Image Processing for
Art Inverstigation

Since then: 5 workshops
Typically held at a museum
(van Gogh Museum, MoMA,
Belgian Academy, NCMA)
Mix of “art people” & “data people”

First IP4AI workshops:
focused tasks.

Example: distinguish work from different periods in artist's life

or: characterize “style”

(movie with swirling paintings)

Analysis method: study images at different scales

In particular:

- determine image content at different scales

- which information “lives” at different scales?

- find local hierarchical relationships governing information at these scales

Determine information at different scales

Determine information at different scales

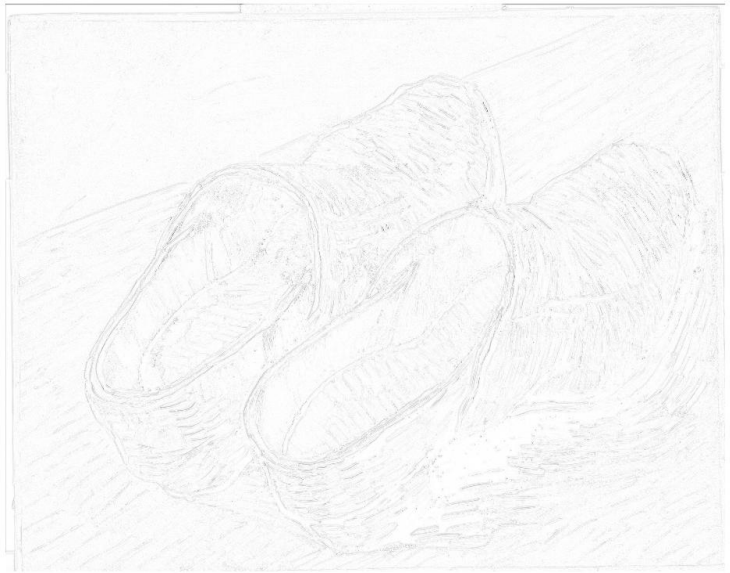
blur

Determine information at different scales

blur

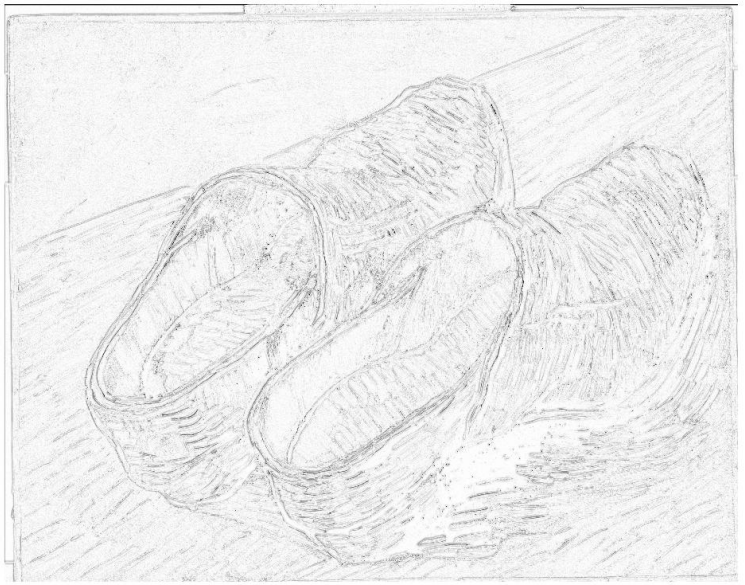
and find the
difference

Determine information at different Scales



Difference = A - B

Determine information at different Scales



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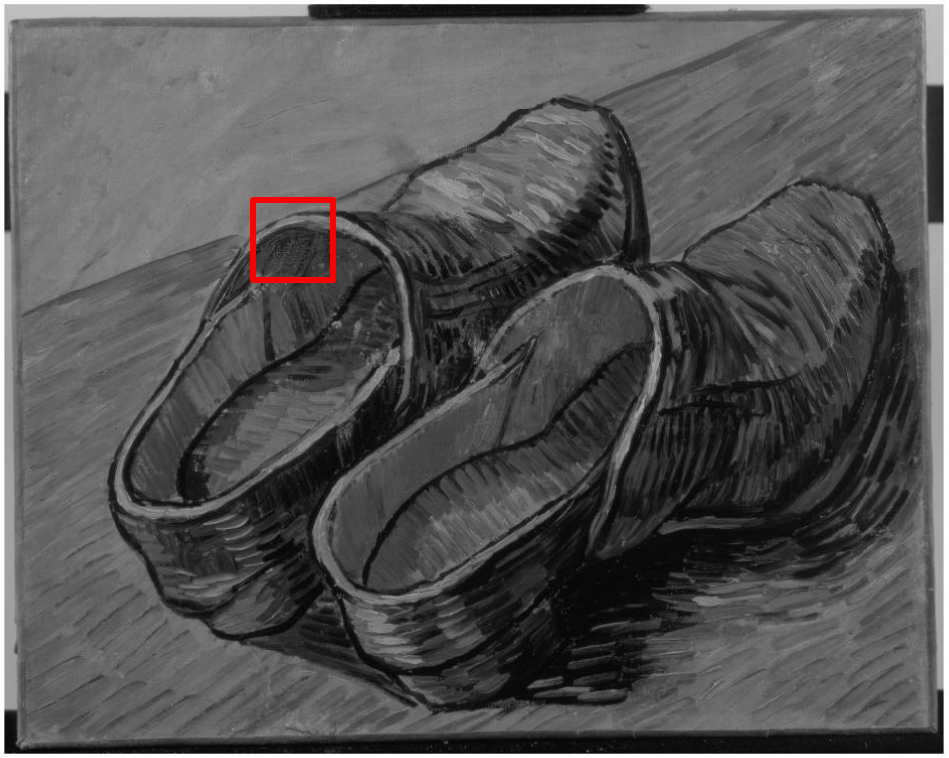
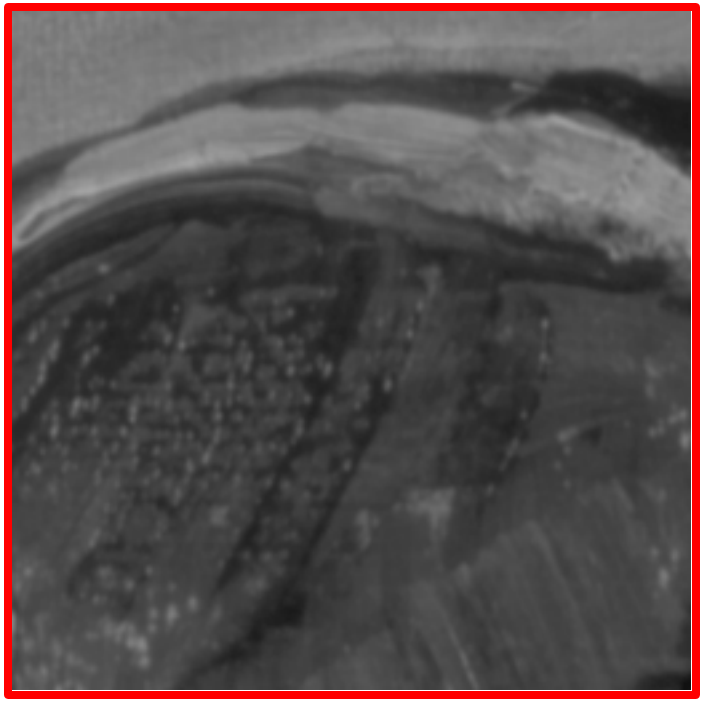
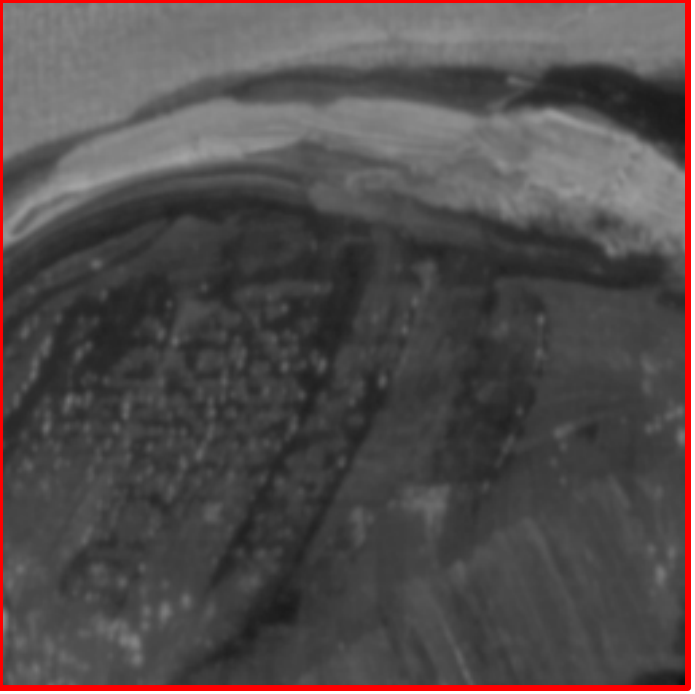
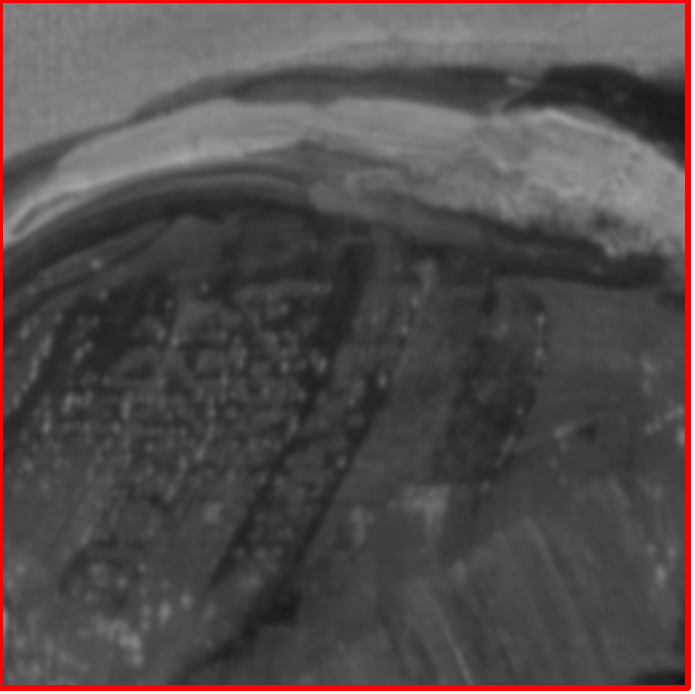
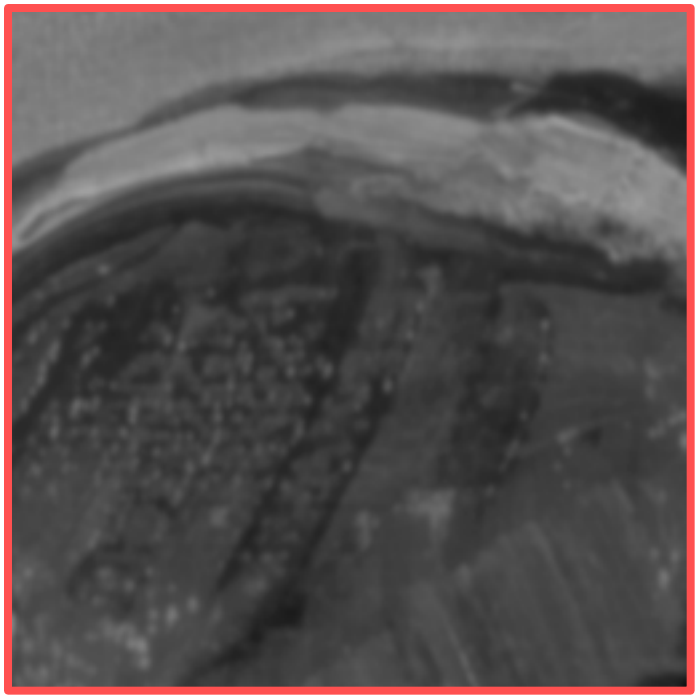
Determine information at different Scales

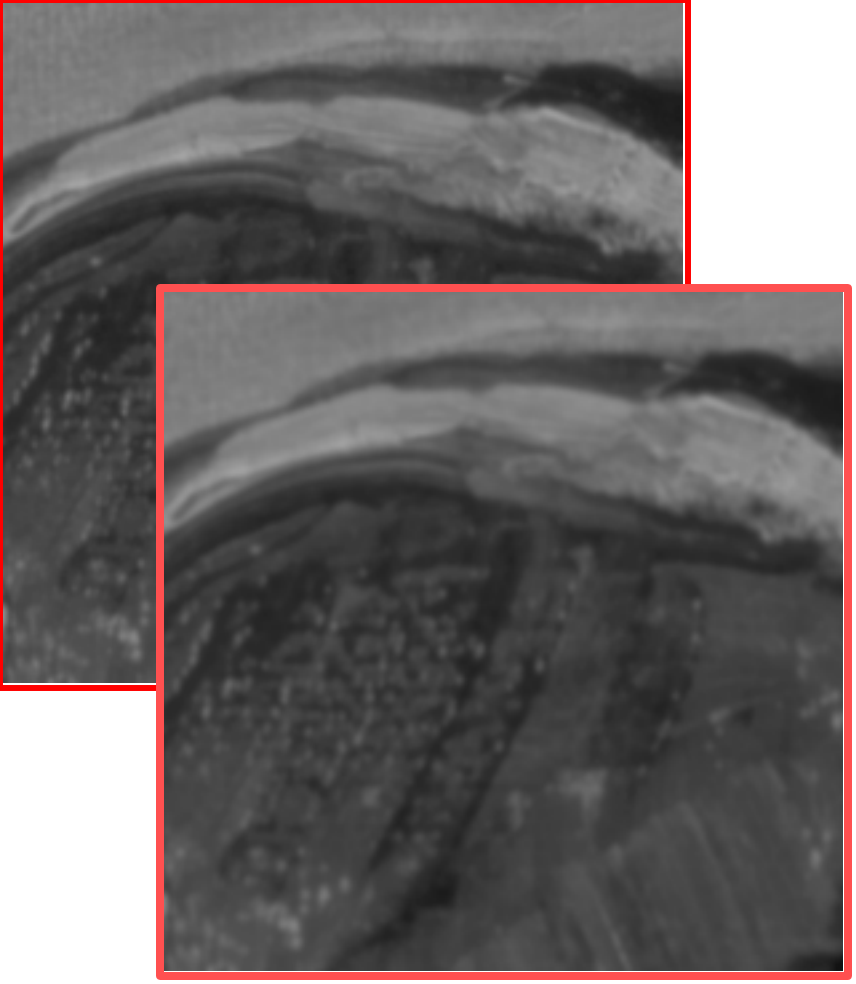


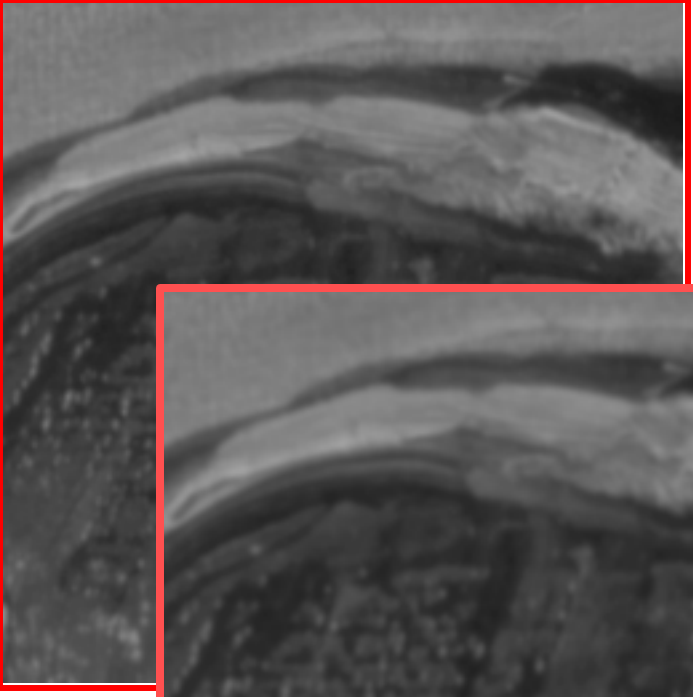


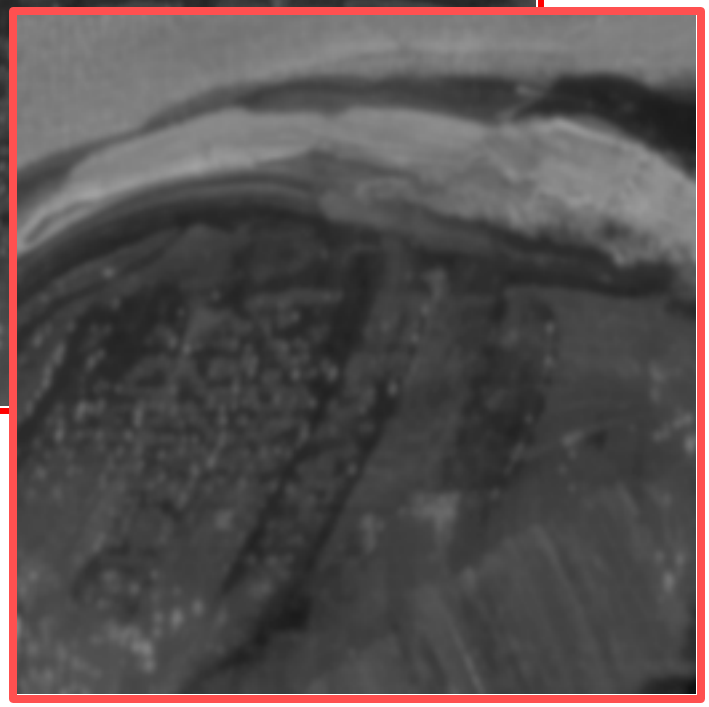


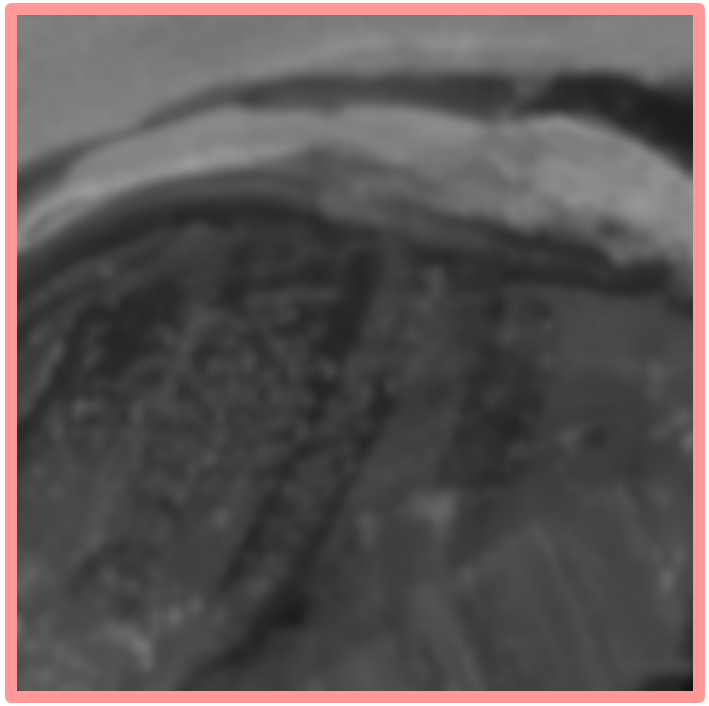


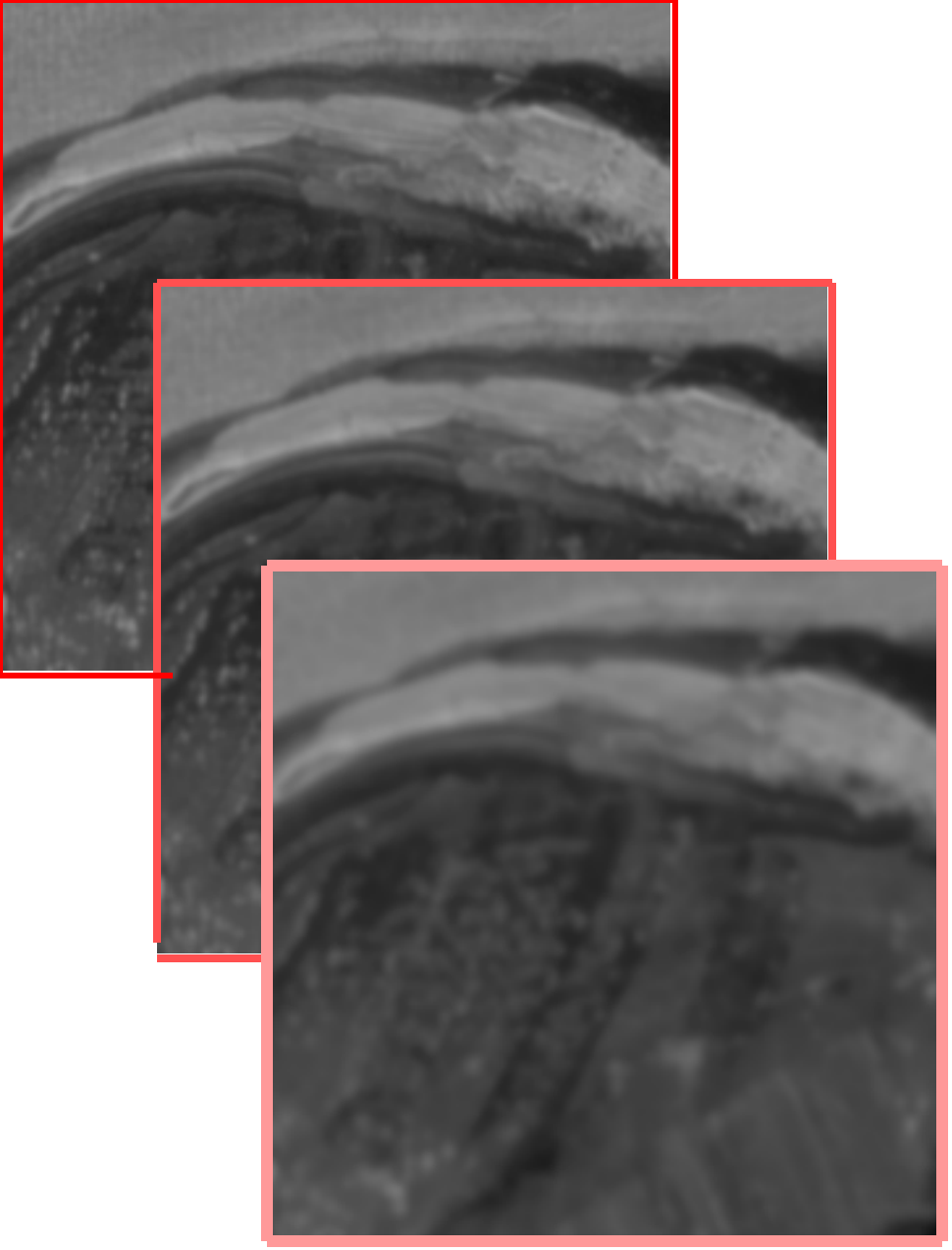


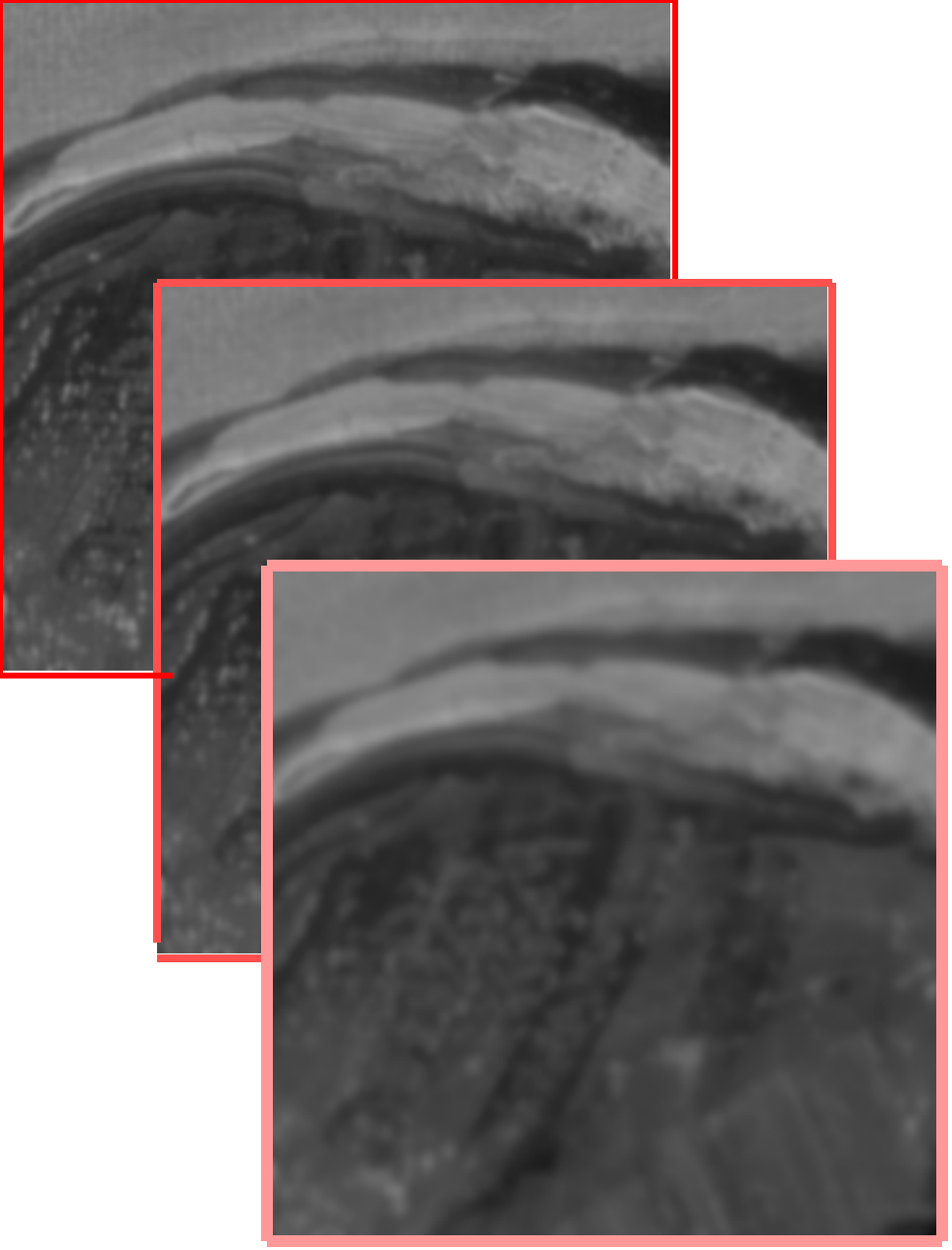


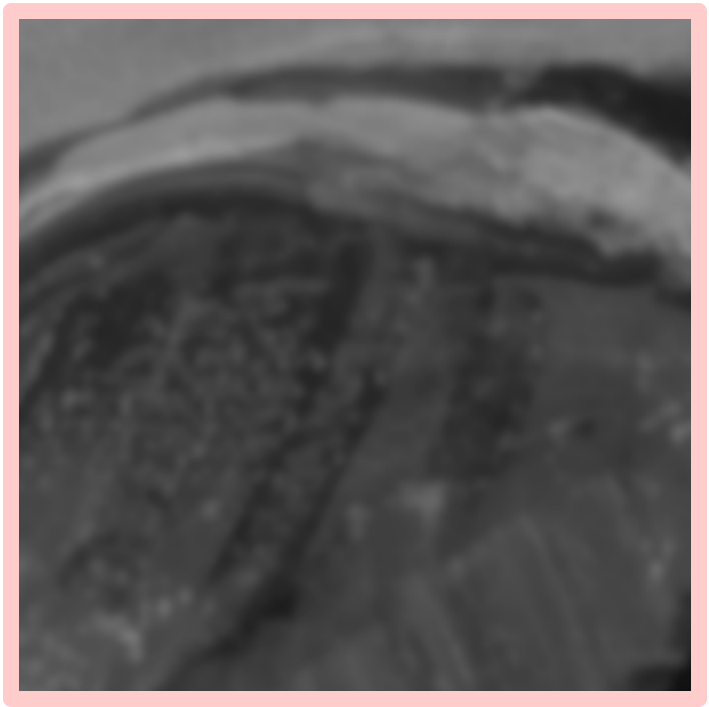


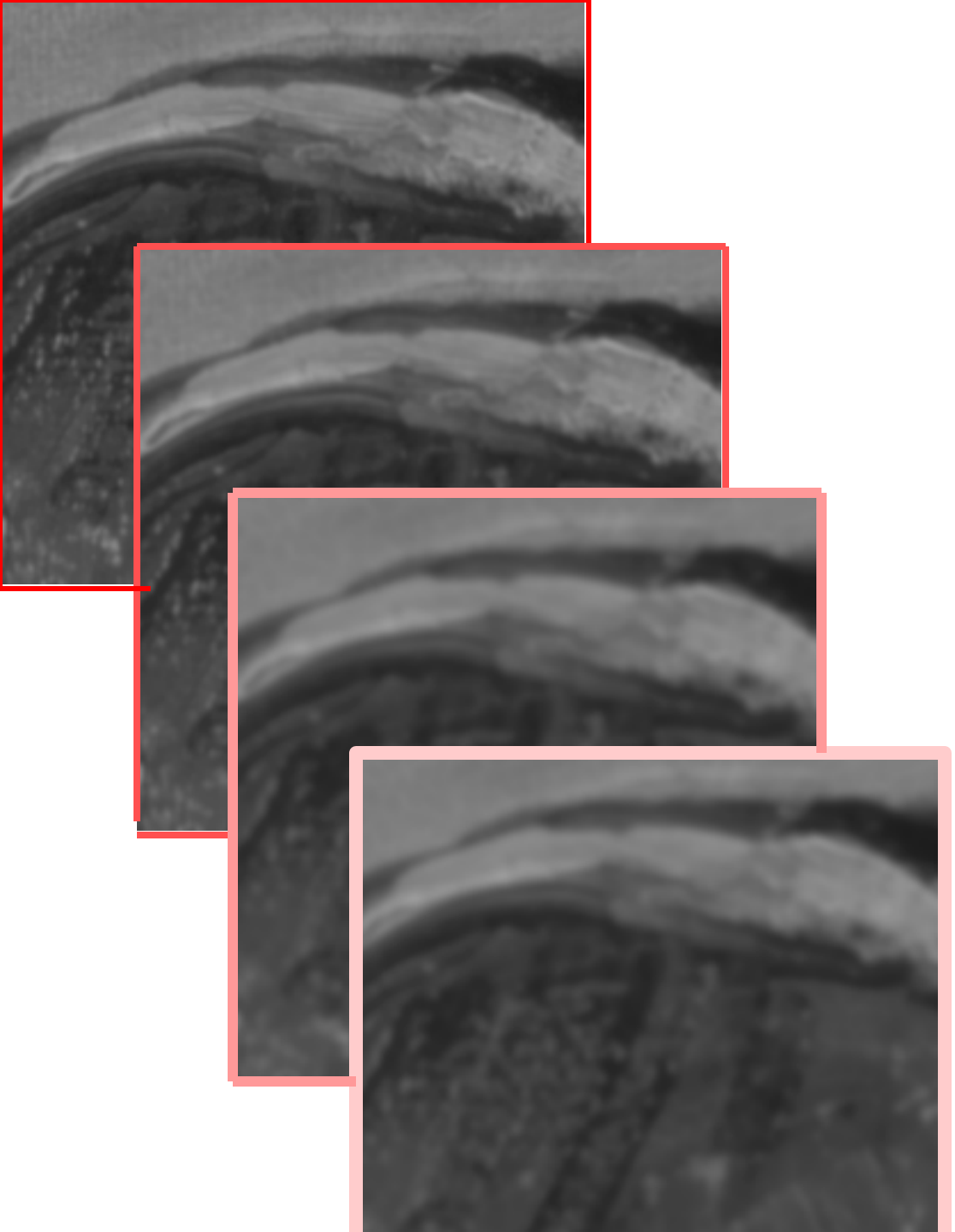


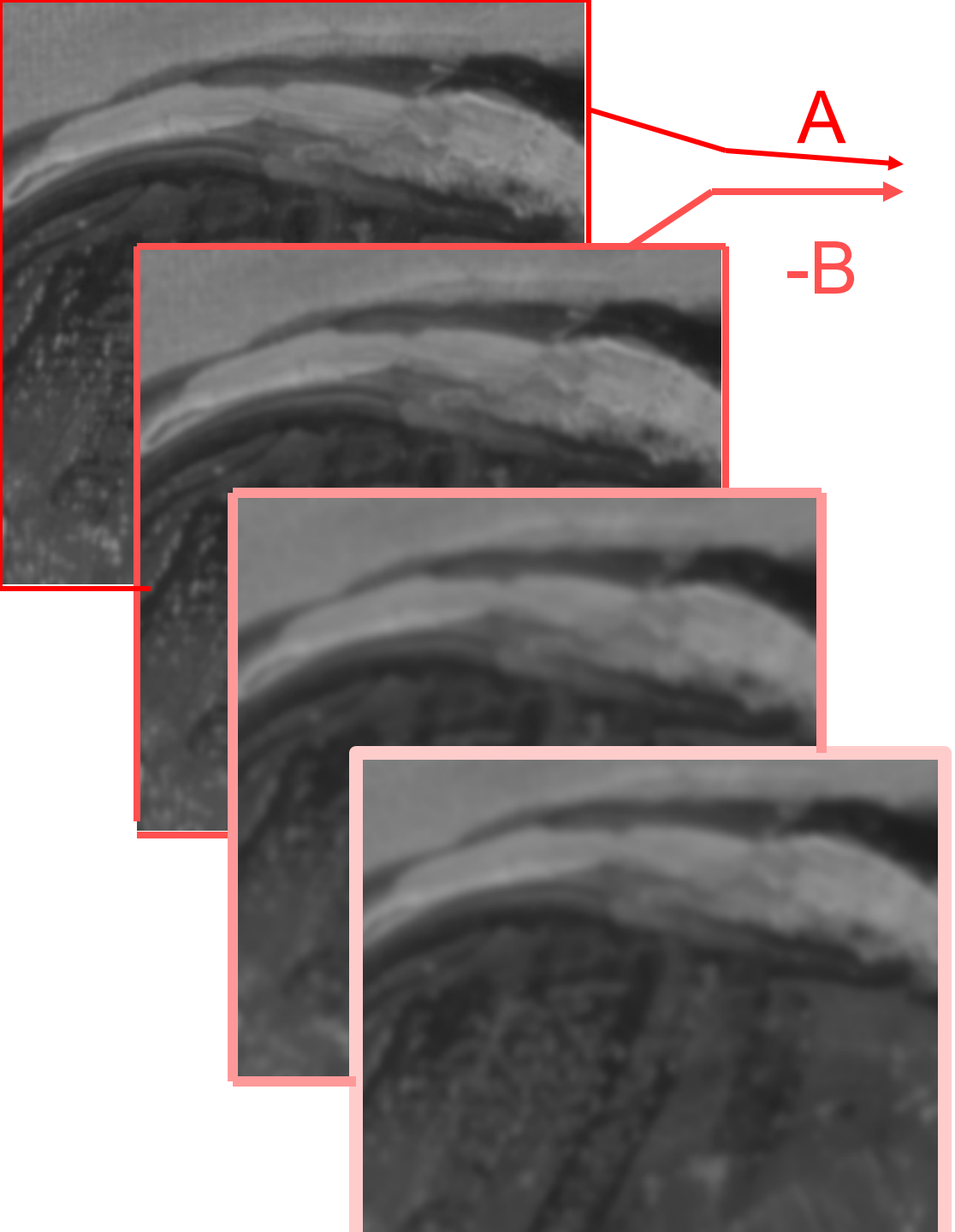


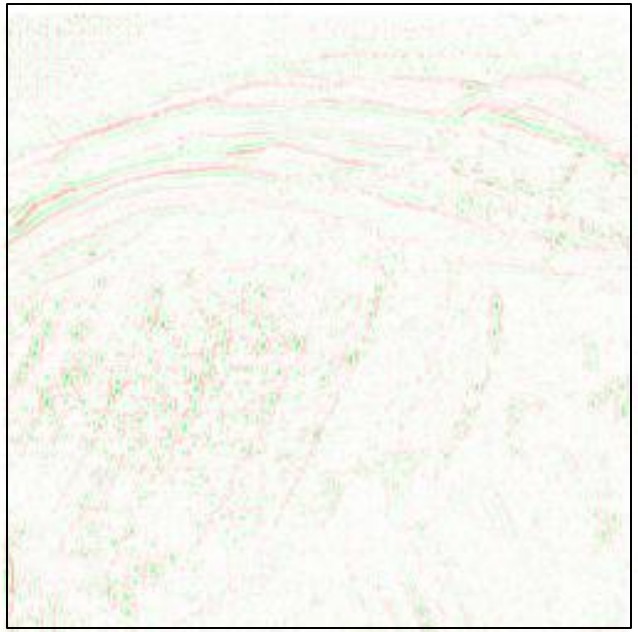


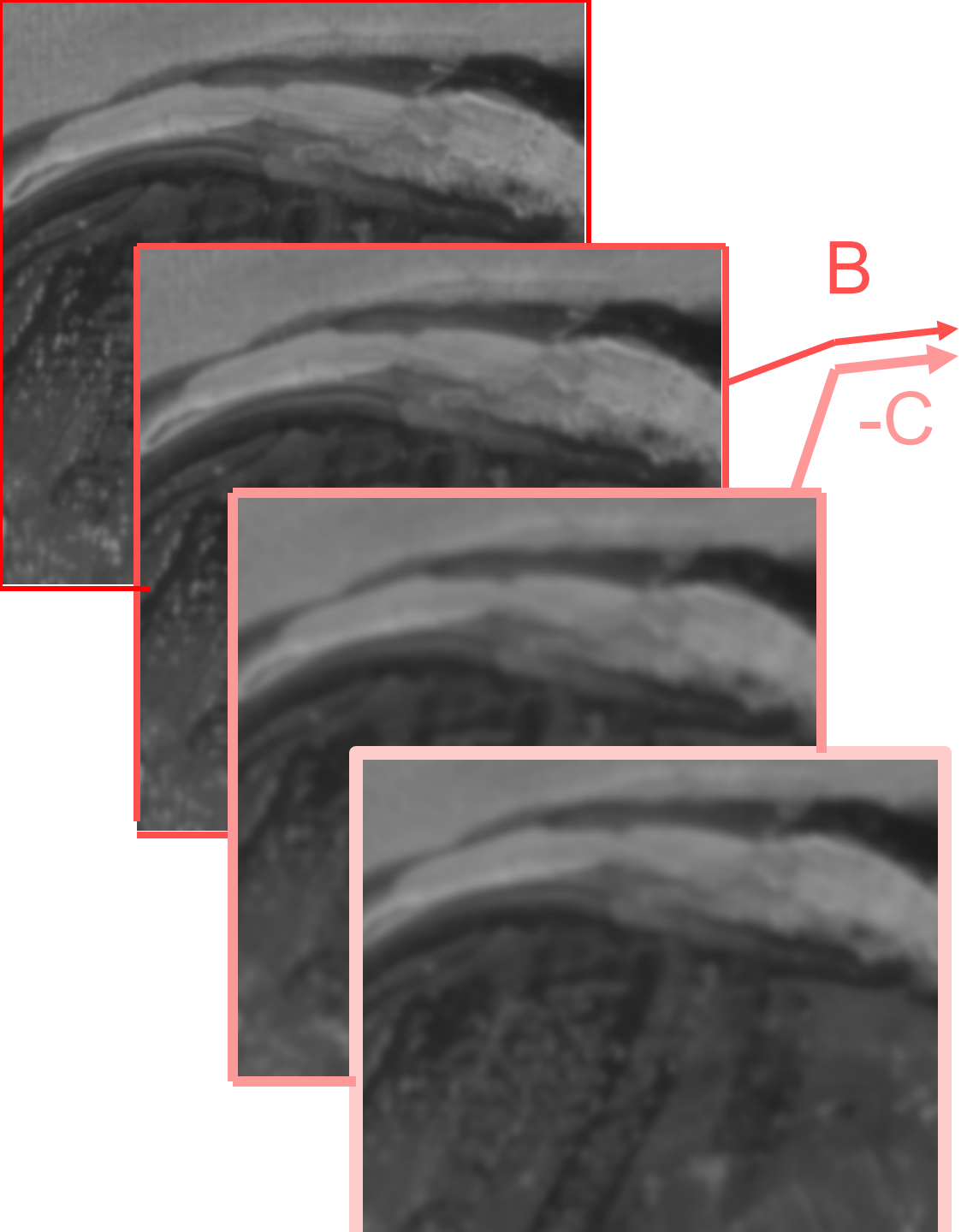


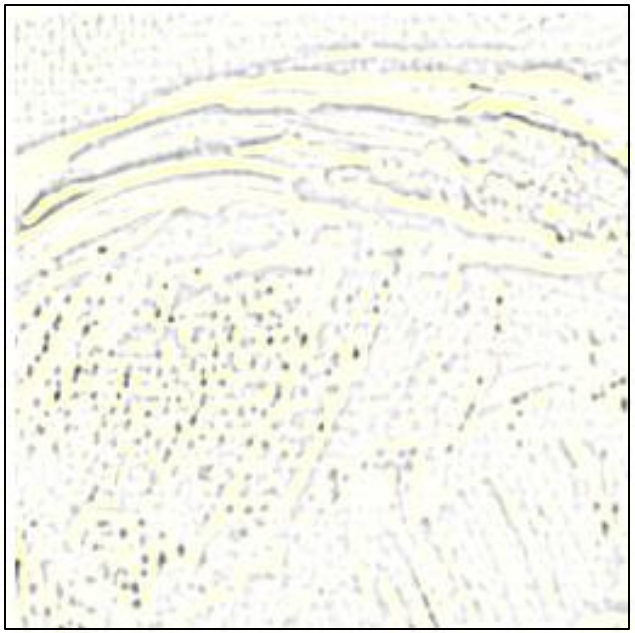


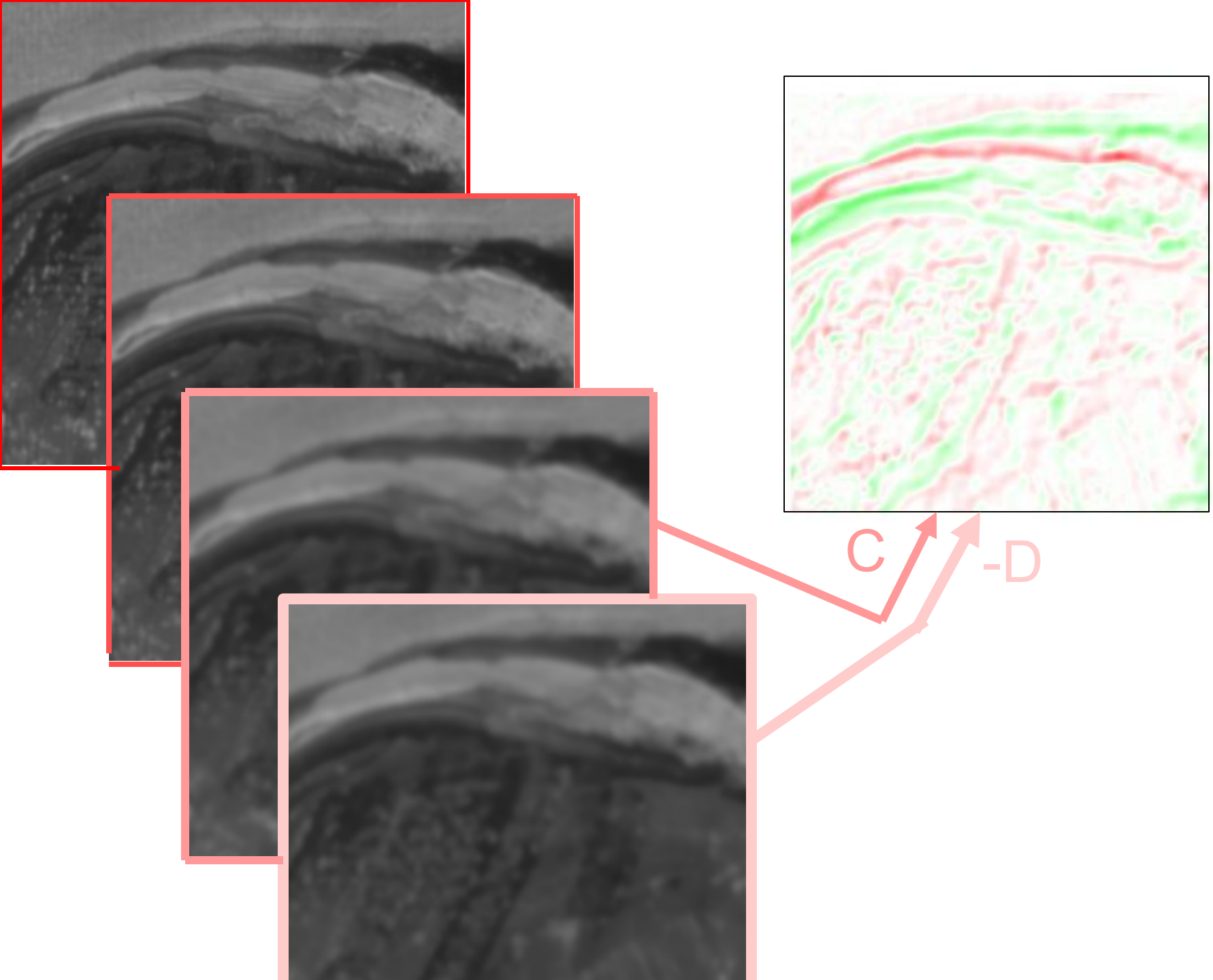


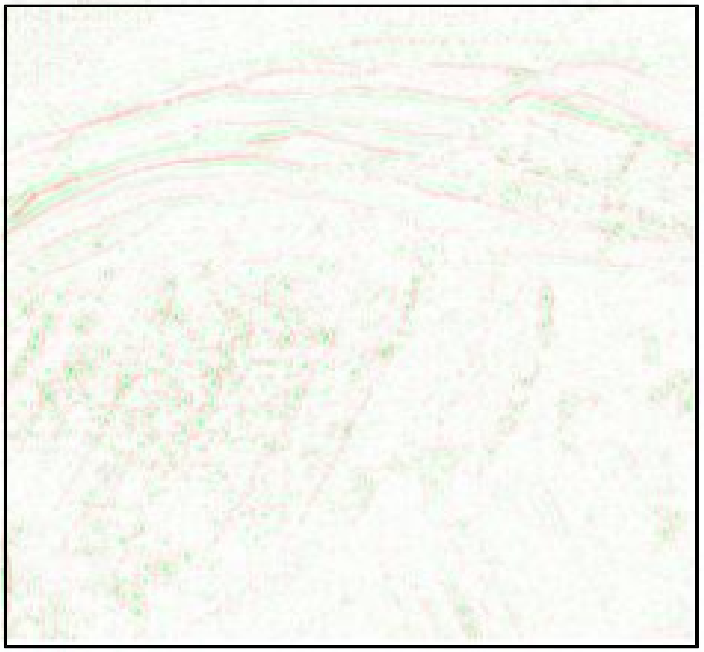

A
-B

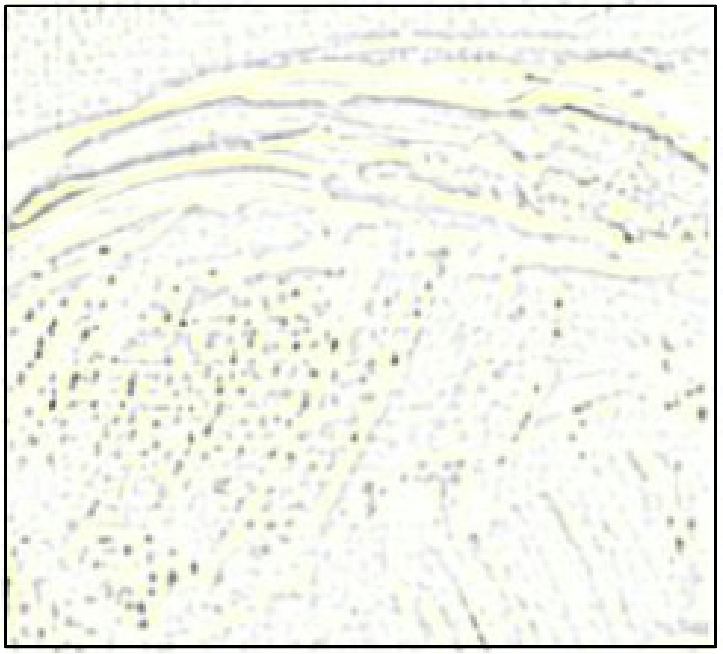


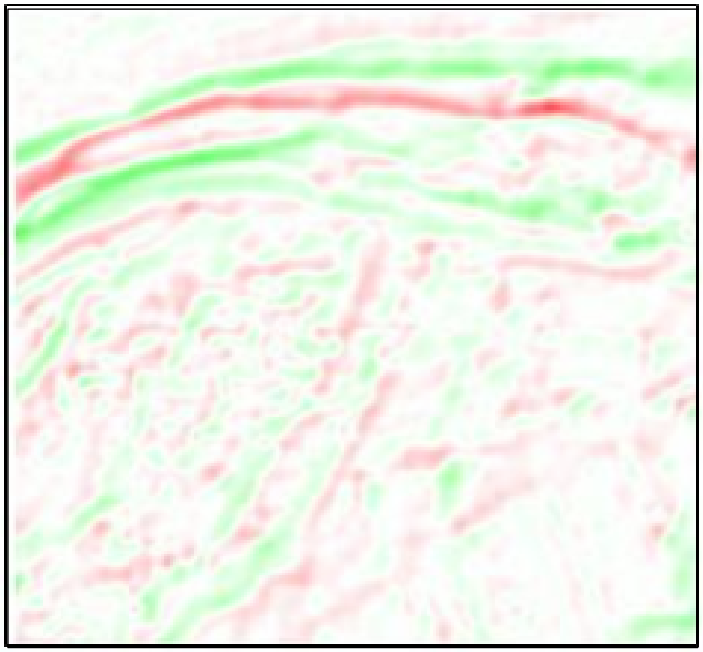

B
-C

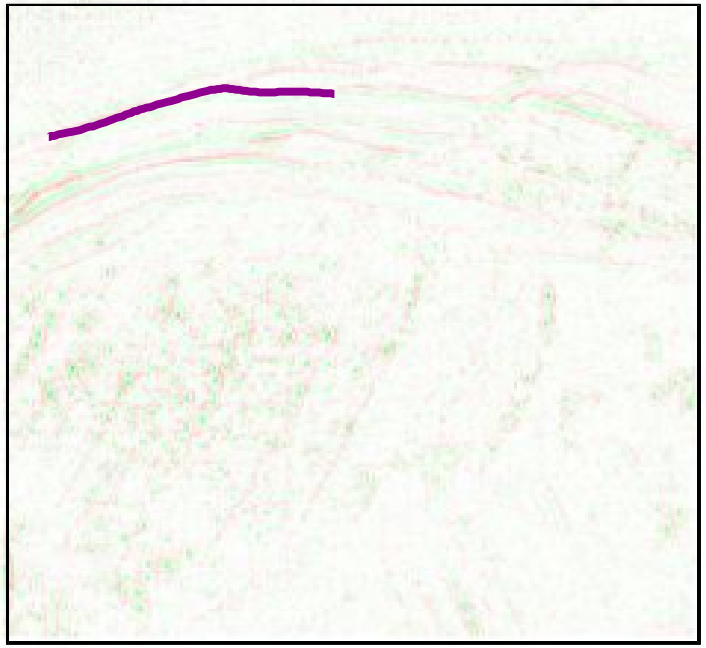


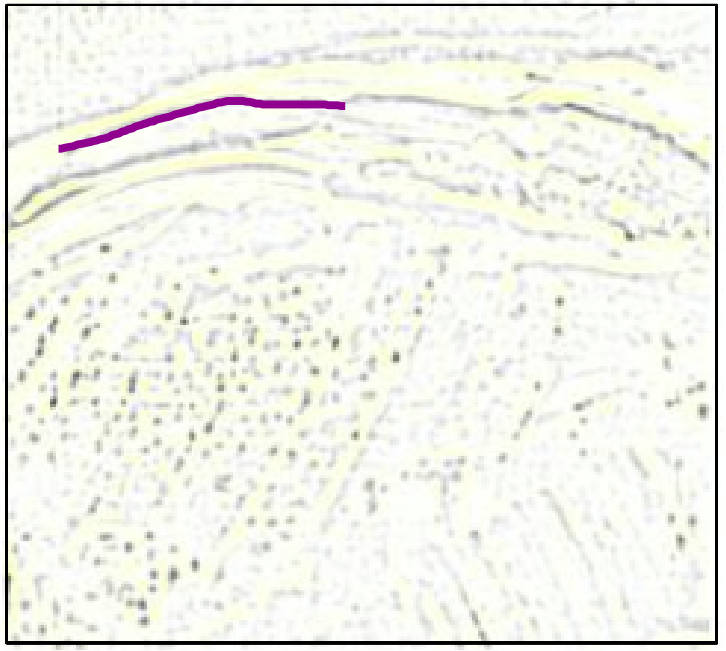

C
-D

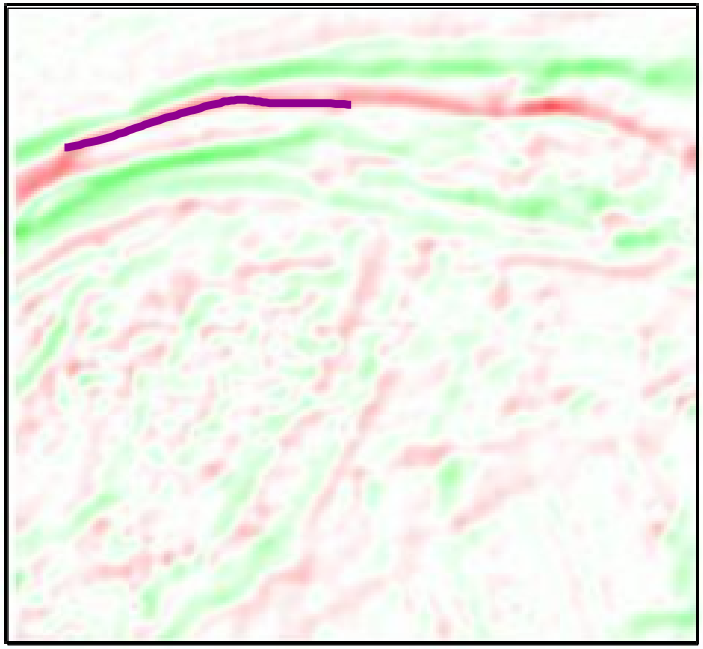


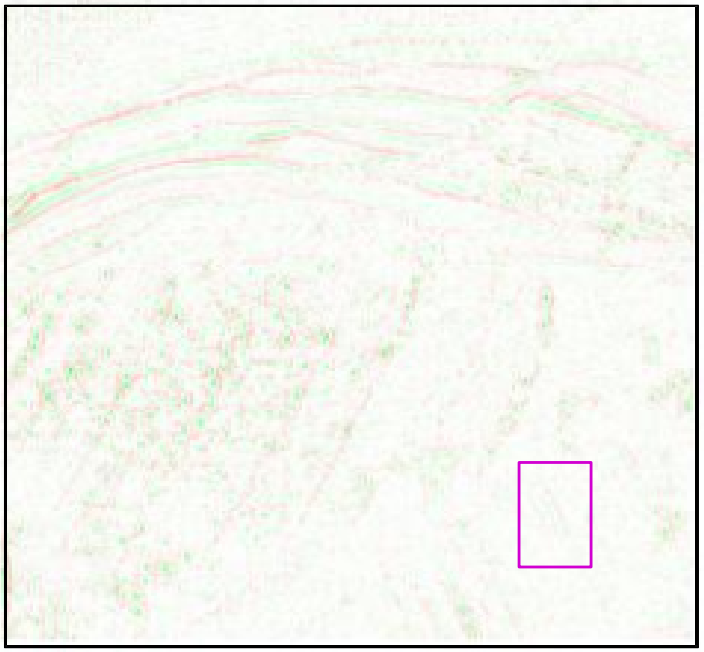


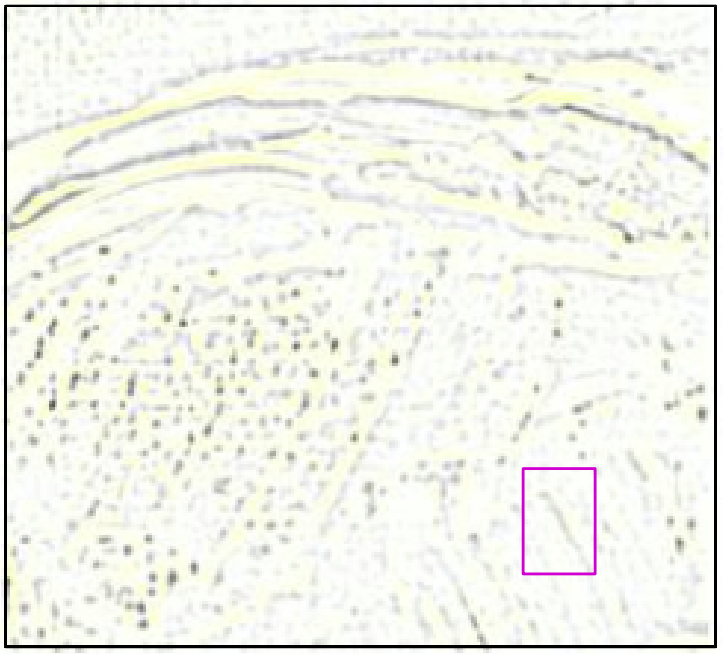


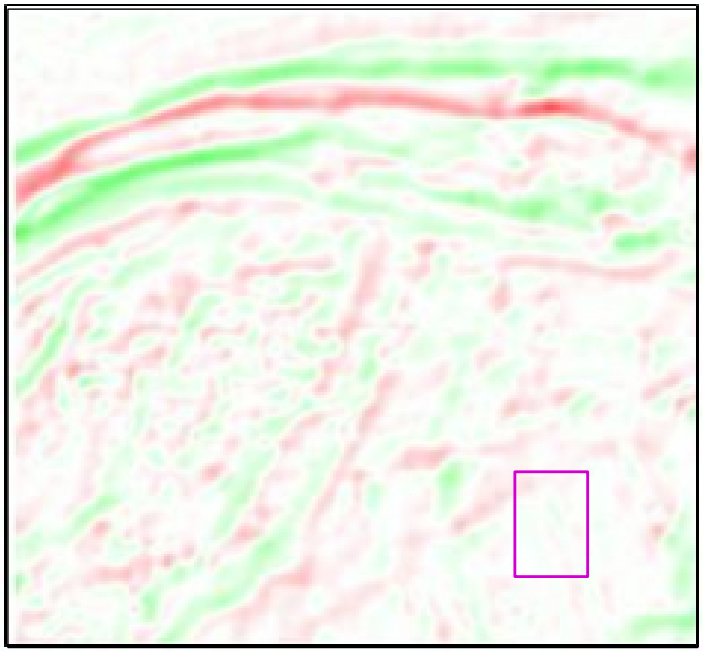












For each painting patch: 140 features

Compare paintings:

ensemble of feature vectors for patches within a painting

collection of these ensembles, one for each painting

leads to dissimilarity (distance) between paintings

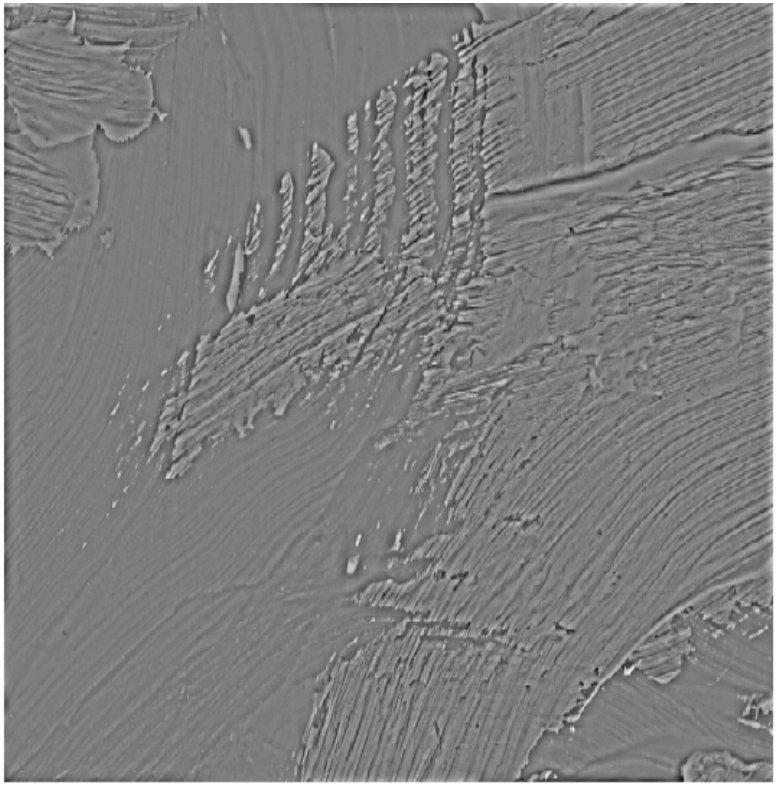
NOVA: had idea of making a small program.

www.pbs.org/wgbh/nova/teach/art-authentication.html

IP4AI1: The NOVA Challenge

The NOVA Challenge

Very Fine Scale Detail: fluency of brush stroke



IP4AI2:
Work on Expanded Dataset

To test our capability to detect copies, the dataset for IP4AI2 (2008) included a contemporary copy of a VG painting, as well as datasets for more VG paintings than before.

IP4AI2:
Work on Expanded Dataset

We looked at fine scale detail in the 21 newly added paintings to the dataset.

IP4AI2:
Work on Expanded Dataset

We looked at fine scale detail in the 21 newly added paintings to the dataset.

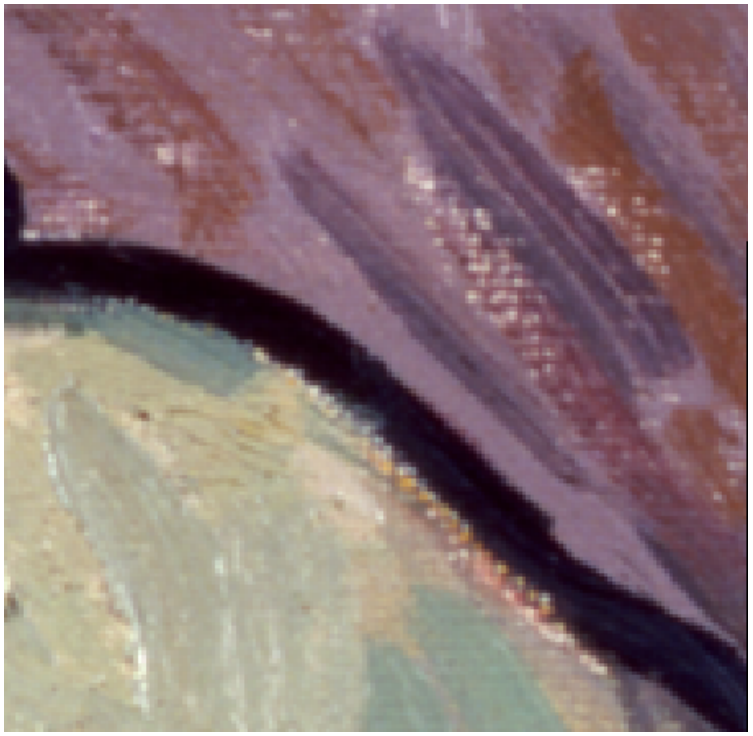
Our classifier considers **ALL** of the newly added paintings as “copies” or “fakes”

Sharpness

Eric Postma recently purchased a new slide scanner, on which the new images were scanned.

New images are crisper than our old ones.

Section of Previously Scanned F338



Section of Newly Scanned S506

Measuring Blur

We measured blur **quantitatively** in previous sets of paintings examined. For the NOVA 6:

0.65

0.98

0.99

0.93

0.90

Measuring Blur

We measured blur **quantitatively** in previous sets of paintings examined. For the NOVA 6:

0.65

0.98

0.99

0.10

0.93

0.90

Here the copy is by far the least blurry. This unfairly helped us detect it ...

A Second Validation Test

We asked Charlotte Caspers to paint a series of pairs of small paintings

In each pair: one original
one copy

Different pairs painted with different brushes, paint, background, ...

Charlotte Caspers - Reconstructions

Charlotte Caspers - Reconstructions

A Second Validation Test

Some of the originals and copies painted by Charlotte.

Variety of Materials and Styles

Advantages of this Dataset

Ground truth: we **know** which are “hesitating” copies and which are originals

Uniform digital imaging conditions:

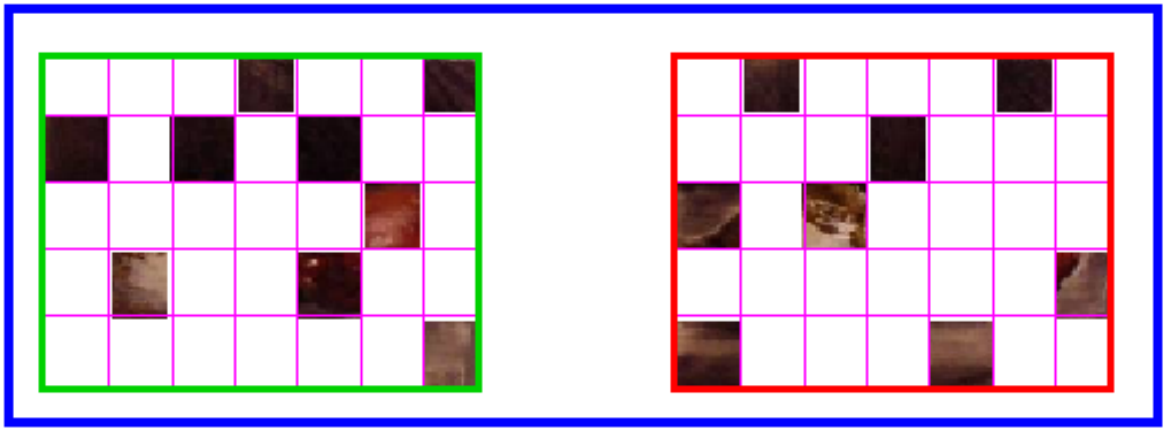
- Blur, lighting, etc. are same; high-quality direct digital scan of surface

Variety of materials and styles

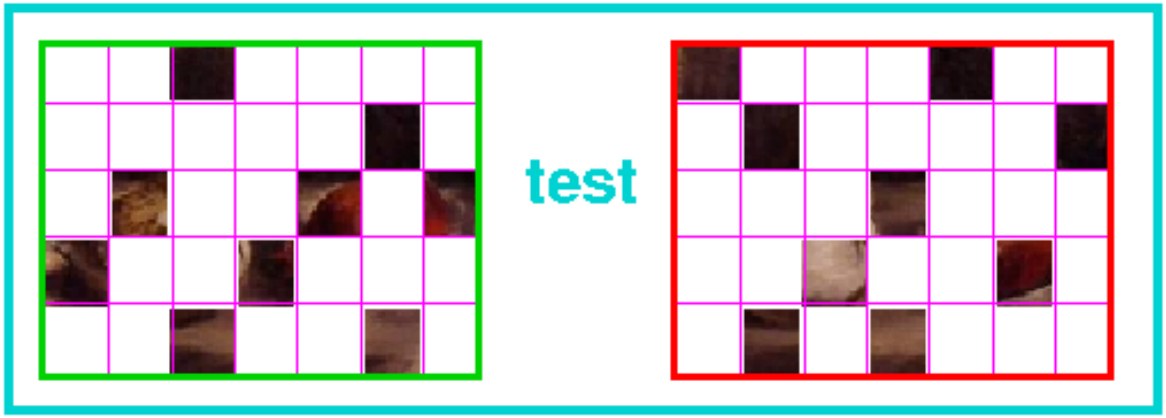
Results

We can distinguish copies from originals in Charlotte's paintings in all cases where she used both soft and hard brushes.

What makes the difference is fairly fine detail, but some other features too.



training



Follow-up study

We could distinguish copies from originals in Charlotte's paintings in all cases where she used both soft and hard brushes.

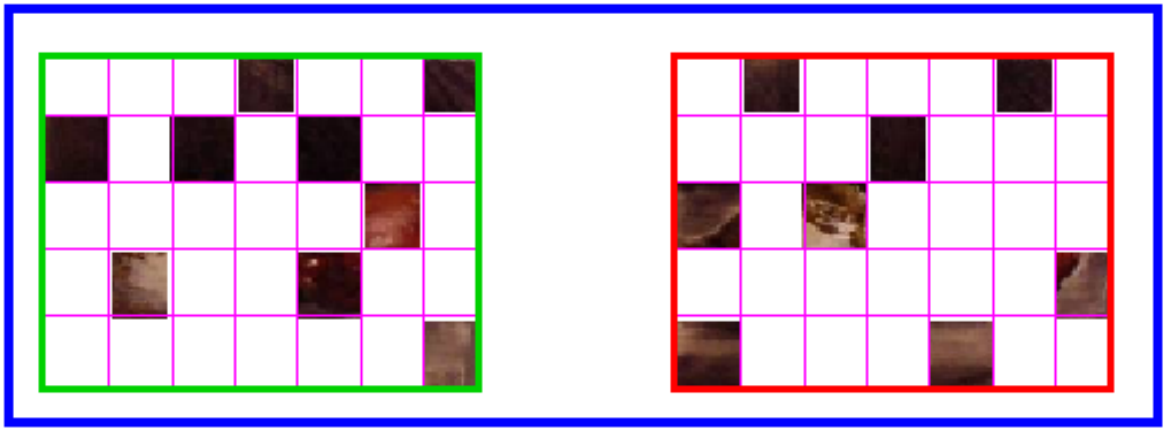
Express this in more “painterly” terms? Not only prediction accuracy is important ...

Revisited original study in 2013.

Revisiting first study

Revisited original study in 2013.

No “background” patches.



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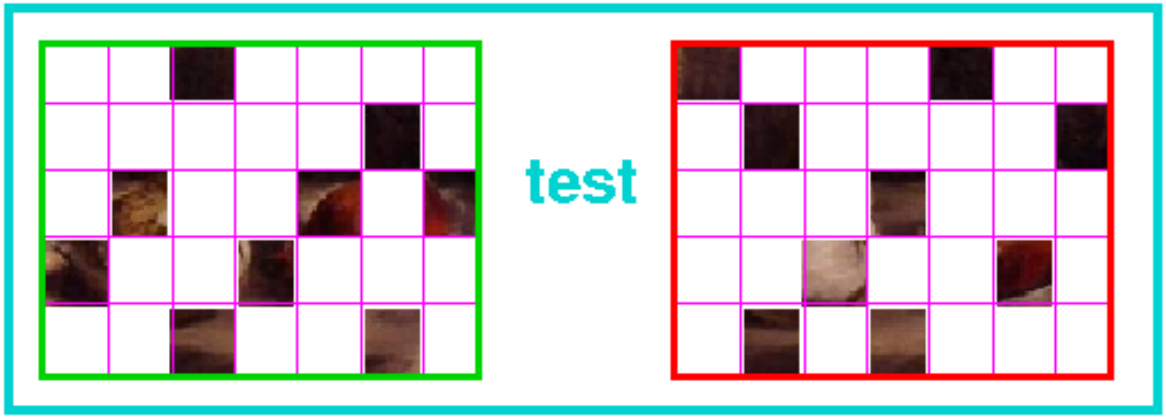

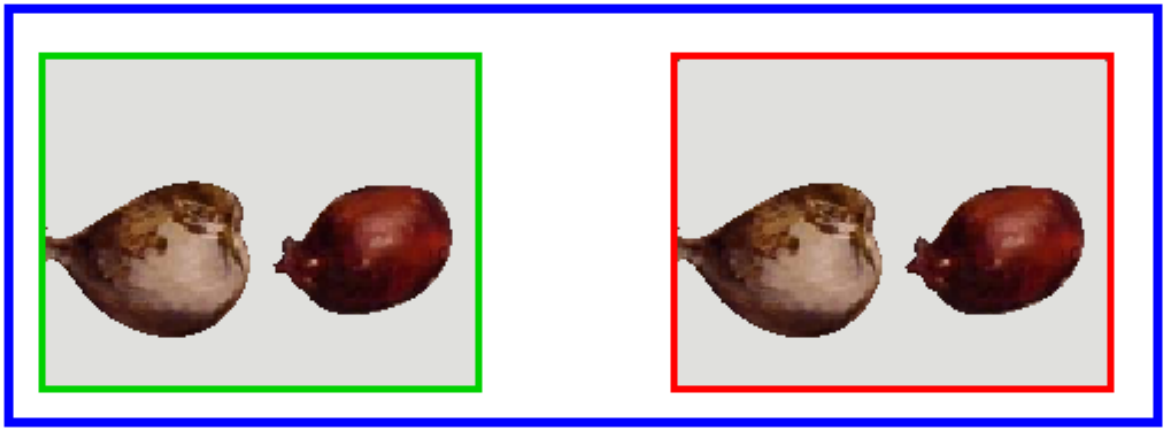

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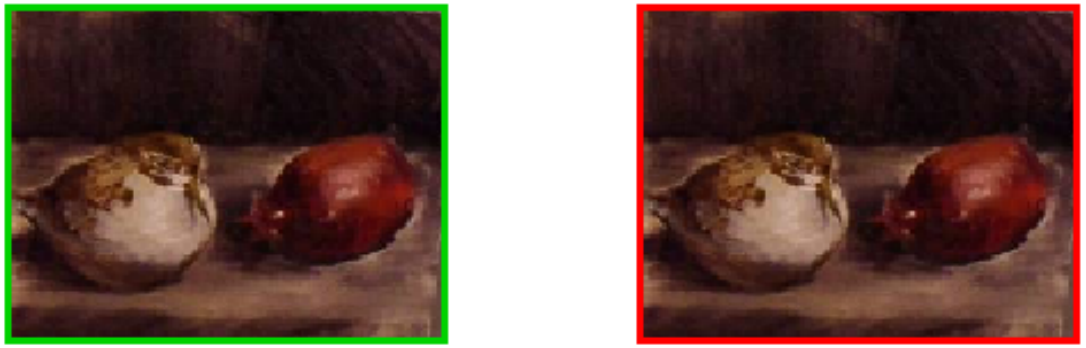
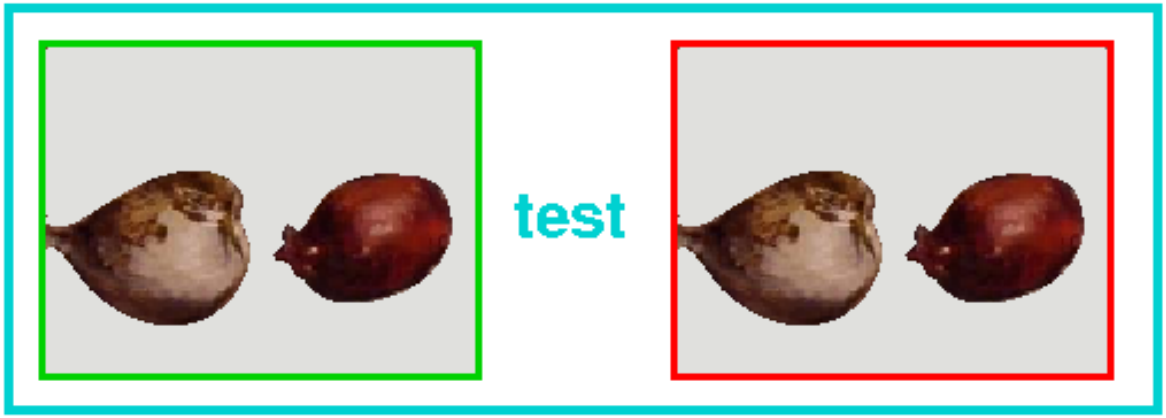




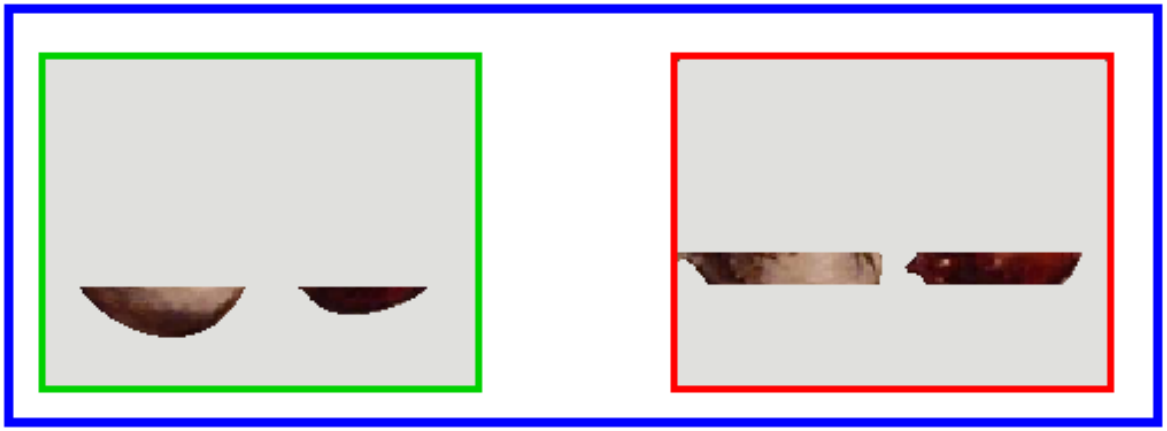
test

Revisiting first study

Revisited original study in 2013.

No “background” patches.

Different grouping of test/training patches



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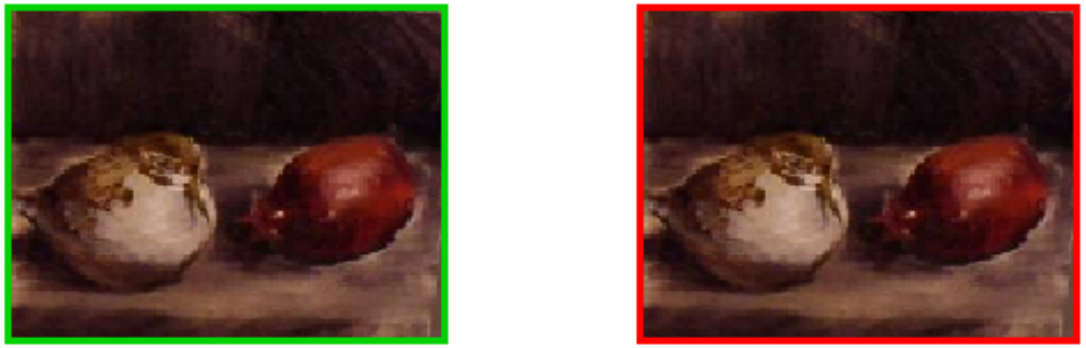

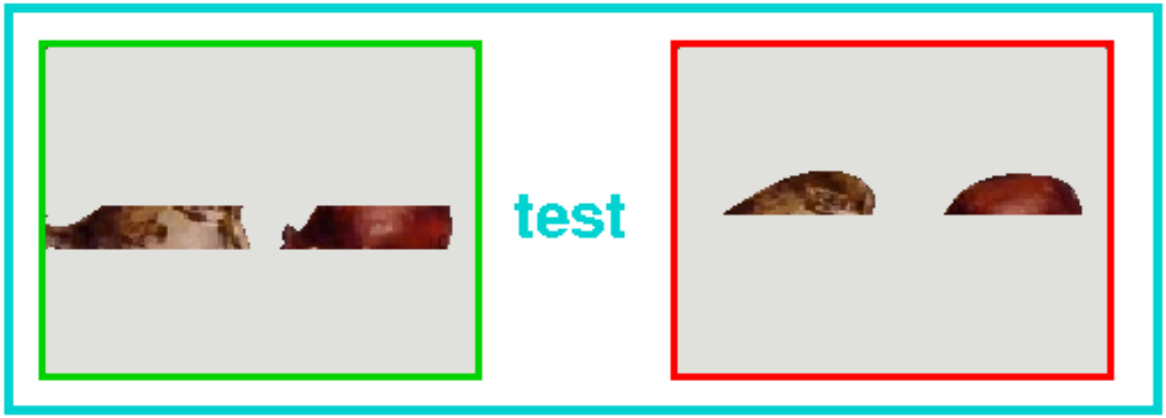

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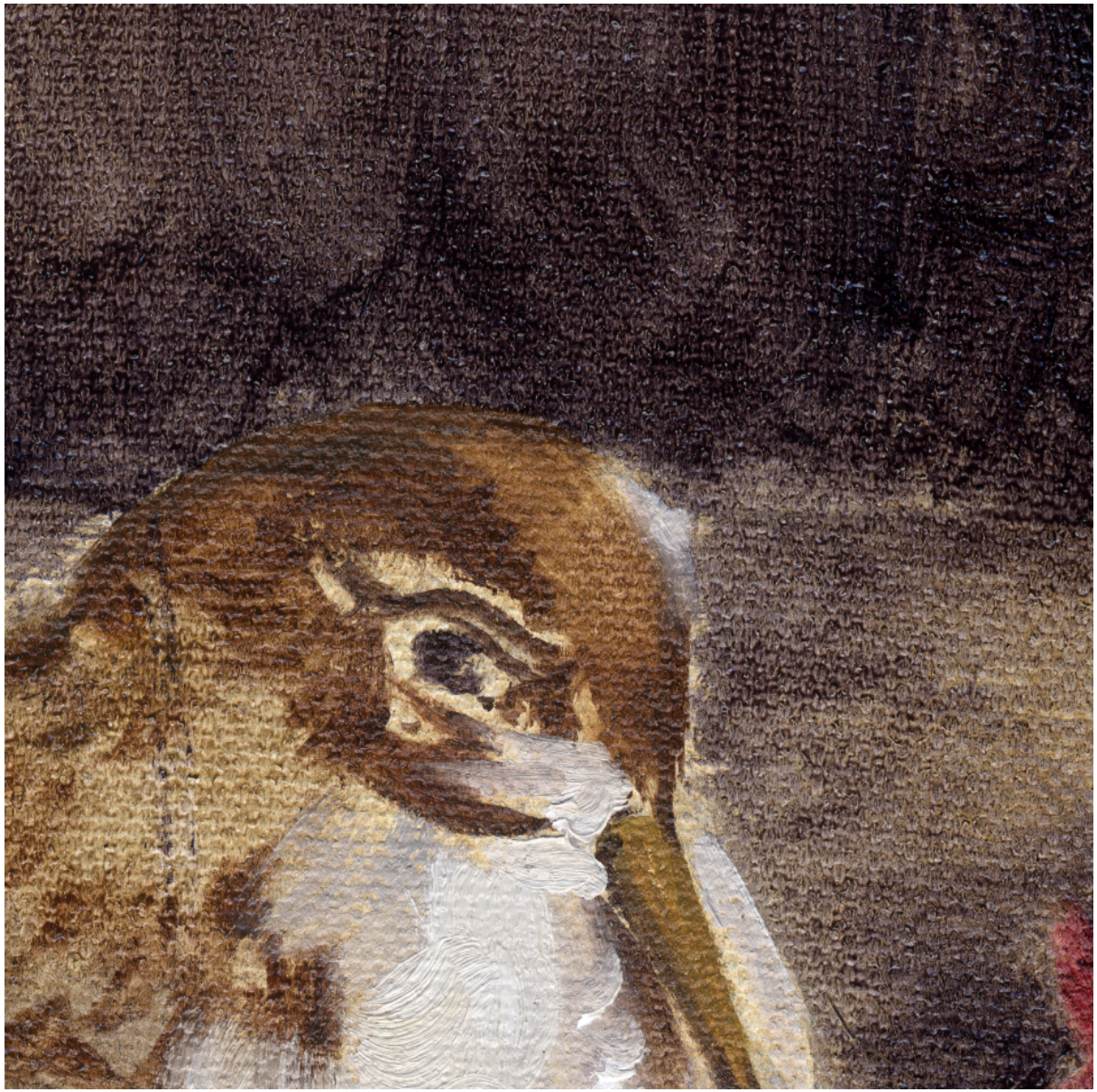
With same techniques as before: results less convincing …



Revisiting first study

Revisited original study in 2013.

With same techniques as before:
results less convincing …

but still significative!

In particular, also after
“canvas removal”

New data set

Again painted by Charlotte Caspers

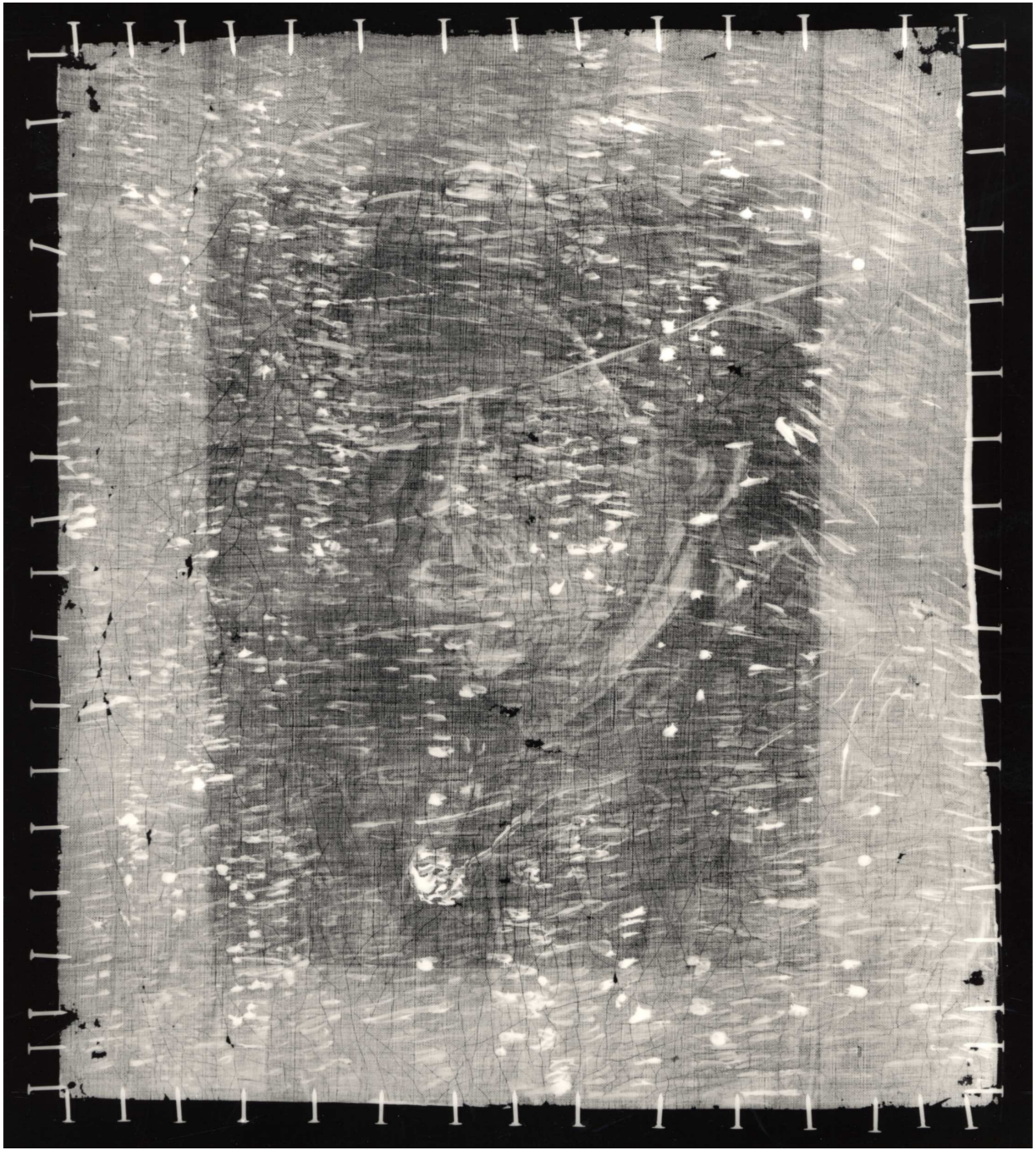
on masonite: no canvas structure!

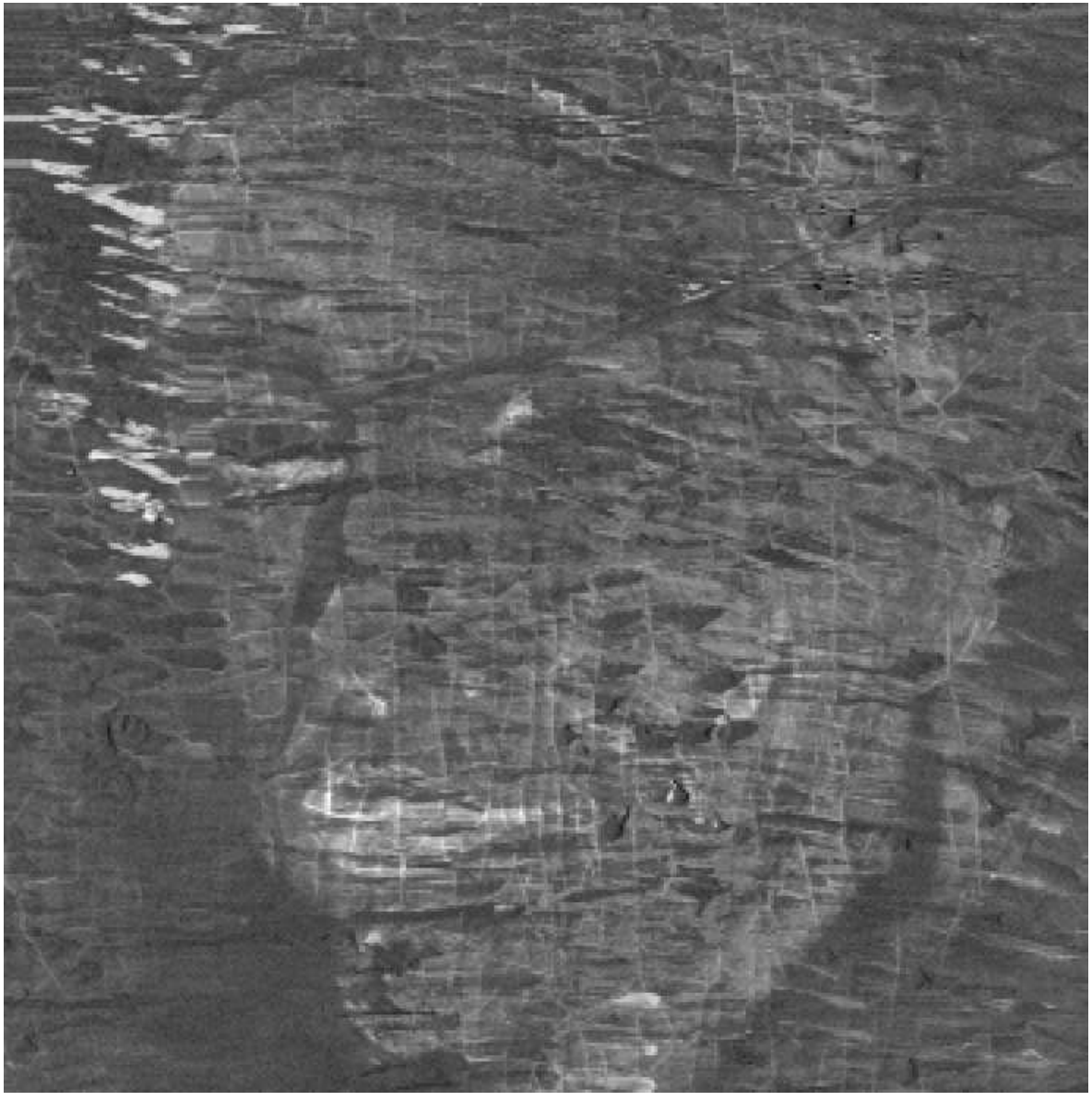
New data set

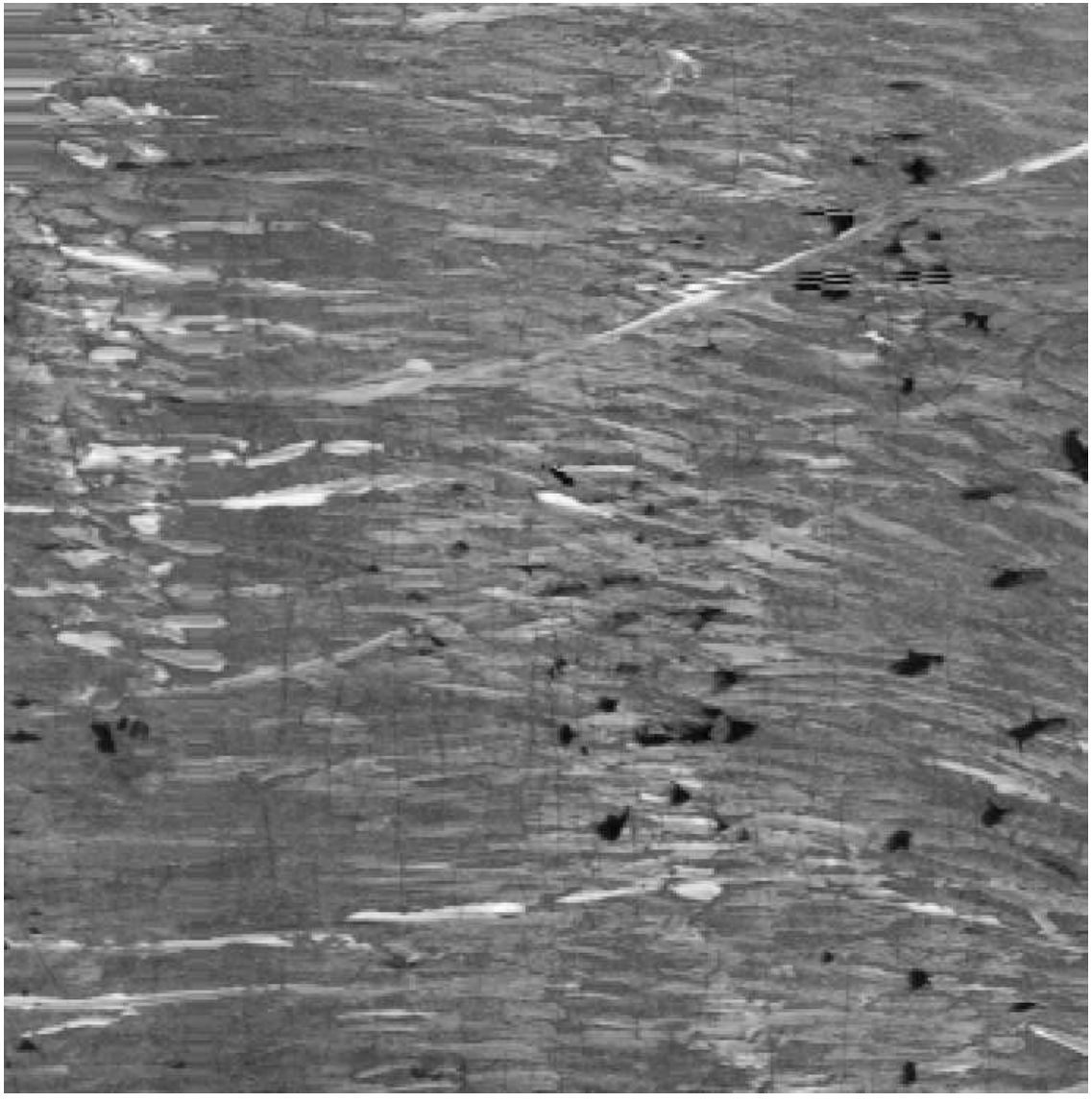
Again painted by Charlotte Caspers

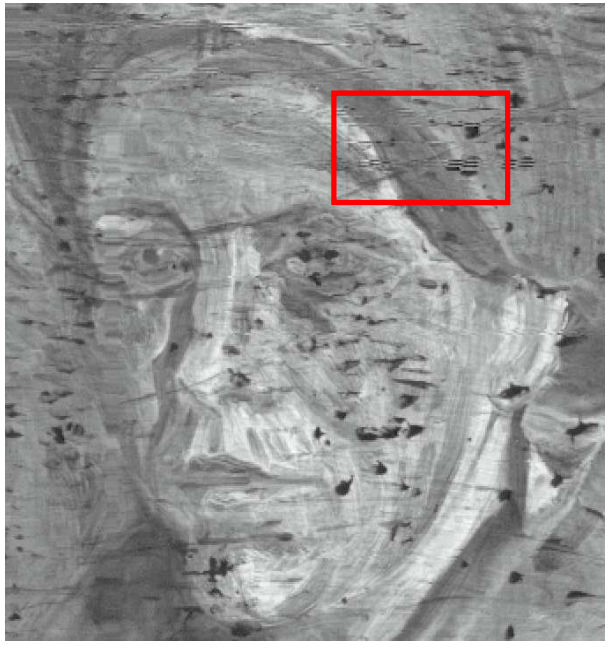
on masonite: no canvas structure!

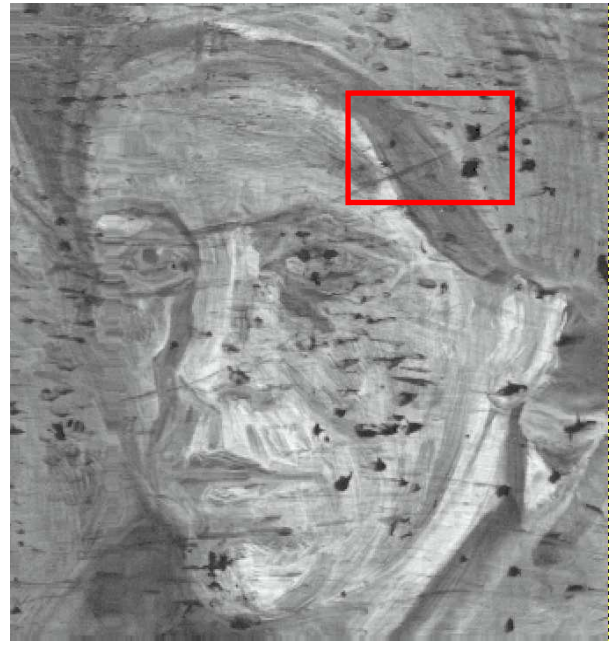
Truly blind

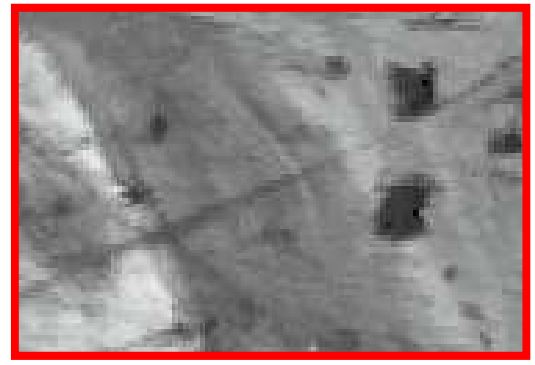


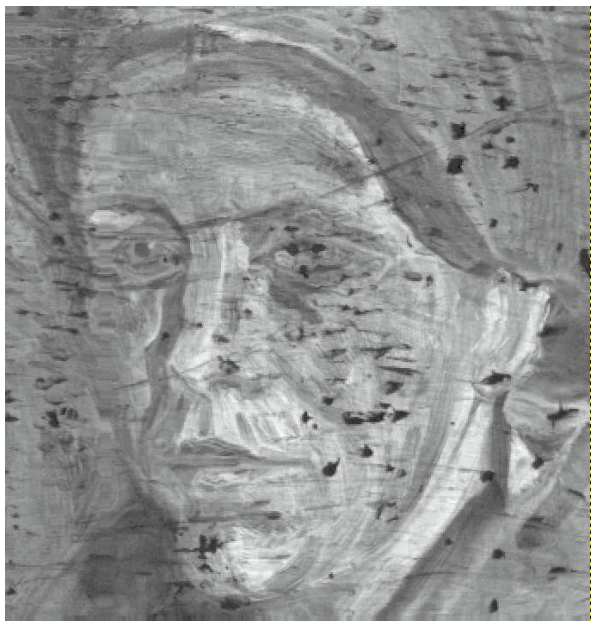


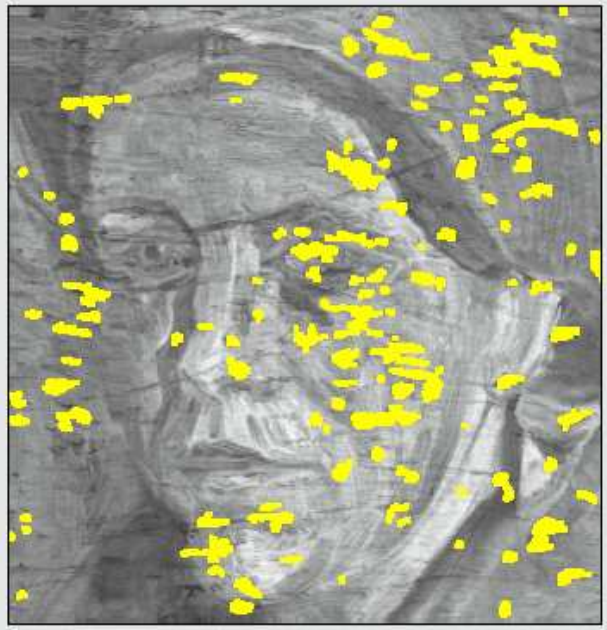


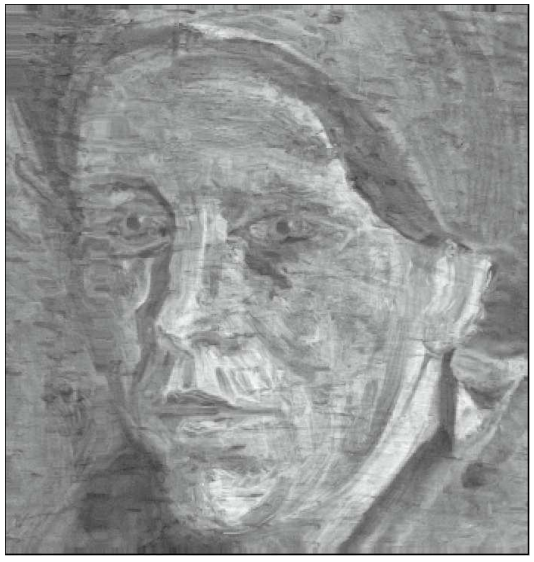


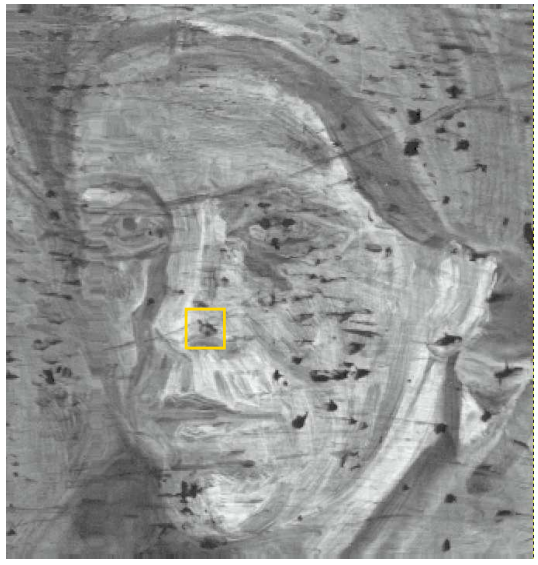


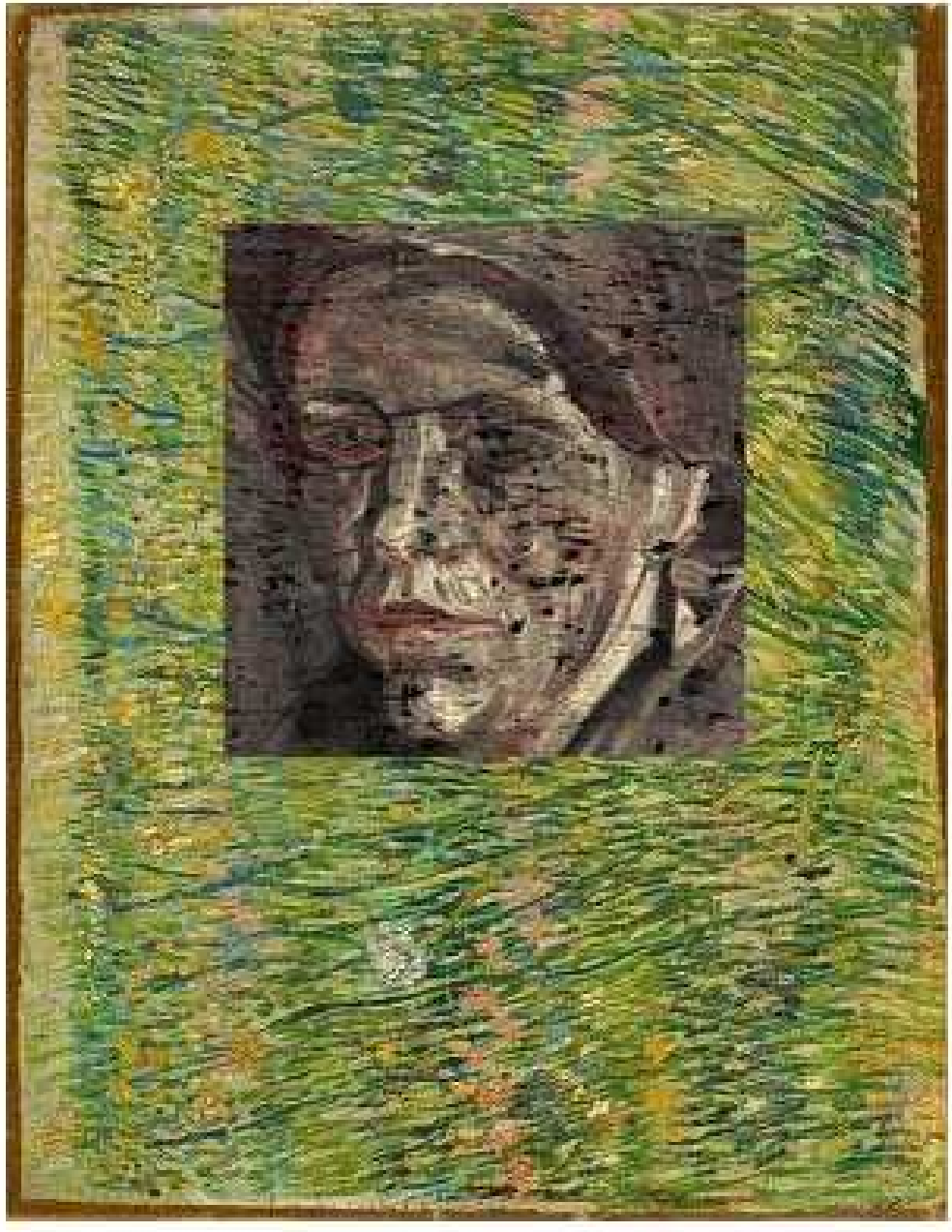












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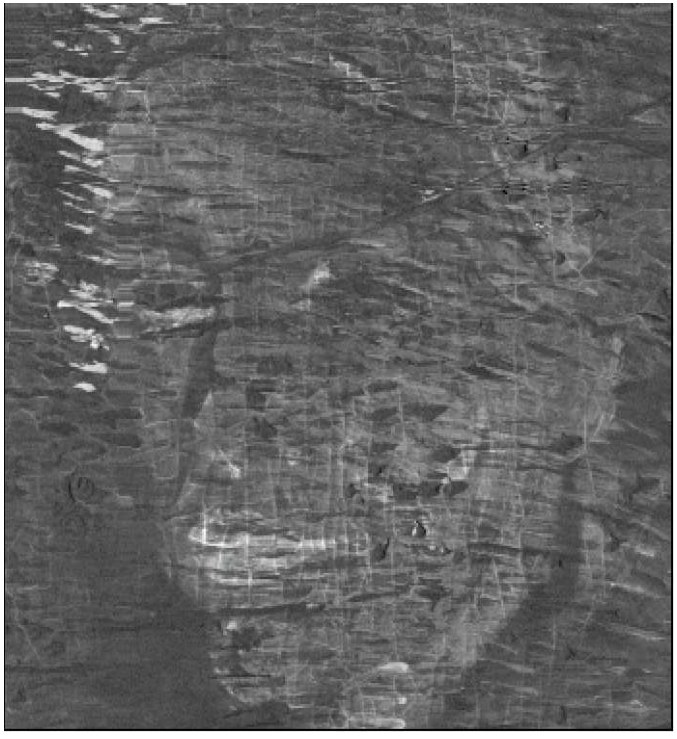
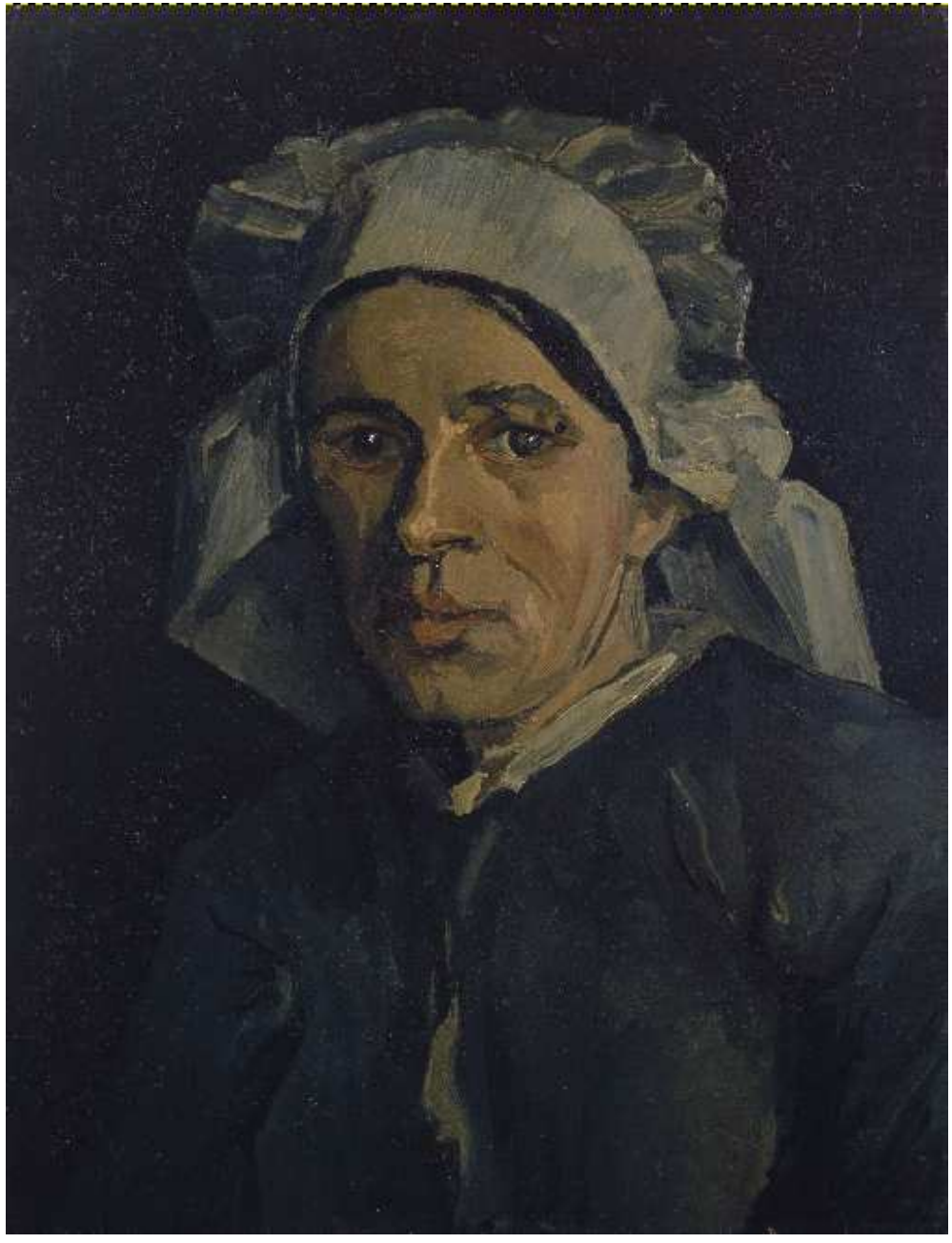
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