

THREAD COUNT REPORT

Portrait of Alphonse Maureau

Édouard Manet

1880

(RW6(pastel) / 1950.123)

from the Art Institute of Chicago

Presented by the
Thread Count Automation Project

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Acknowledgments: The thread counting software arose from a collaboration between the van Gogh Museum (Amsterdam) and the Thread Count Automation Project initiated by Professor C. Richard Johnson, Jr. in the School of Electrical and Computer Engineering at Cornell University. The thread count software was written by Professor Don Johnson (Rice University) based on the technique described in Johnson et al., “Weave analysis of paintings on canvas from radiographs,” *Signal Processing*, **93**: 527–540, 2013. The software used here has been in development since 2007 in a collaboration among researchers B. Sethares, R. Arora, and H. Lee at the University of Wisconsin, A. Klein at Worcester Polytechnic Institute, D. Johnson at Rice University, and R. Johnson and J. Ng at Cornell University. A student team at Cornell (J. Ng, C. Cheung, M. Cho, P. Kung, S. Lok, B. Stubler, M. Wu, L. Zhang) plus a “corresponding” student at WPI (I. Ozil) are responsible for testing numerous early versions of the software suite and performing the manual counts used to assess the candidate thread counting algorithms. For more information on the software used, contact Professor Don Johnson at dhj@rice.edu.

Summary

This report provides the canvas weave densities and local thread angle variations of *Portrait of Alphonse Maureau* (RW6(pastel) / 1950.123) by Édouard Manet held in the collection of the Art Institute of Chicago. Automatic counts were made from high resolution digital scans of x-rays (618 dpi, 1:1 with painting surface; 8-bit greyscale). These x-rays, at sufficient enlargement, expose the canvas weave to be in the “plain” category. Software automates the process of determining, across the entire scanned x-ray, the thread count of the canvas weave pattern in two directions (nearly vertical and nearly horizontal in the x-ray) and the angles of these threads referenced to true vertical and horizontal respectively. The thread-count processing software revealed the average (avg) and standard deviation (σ) of the thread counts for the horizontal and vertical threads for the entire painting to be

RW6(pastel)	avg	σ
horizontal thread density (th/cm)	32.1	0.9
vertical thread density (th/cm)	31.0	0.7
horizontal thread angle (degrees)	1.8	1.2
vertical thread angle (degrees)	-0.1	2.3

The warp-thread direction was determined by visual examination of the weave and angle maps to correspond to the vertical threads. From the x-rays, the weave was determined to be a plain (rectilinear) pattern.

This report provides a horizontal thread count deviation map, a vertical thread count deviation map, a horizontal thread angle map, a vertical thread angle map, and histograms of horizontal and vertical thread counts. A table of contents occurs on page 3.

Introduction

This report provides a series of figures representing visualizations of various thread count and angle data for *Portrait of Alphonse Maureau*. All x-ray scans used in this report were provided at 618 dpi. When scans included a portion of the canvas's front edge, it was used to align the corresponding edge of the cropped image, thereby enabling a consistent orientation of the cropped images with respect to the painting. A composite x-ray of the entire painting was created with an automatic stitching program. This composite was used in the thread count calculations according to the following protocol.

- The DENSITY MAPS record the average thread densities (in threads/cm) computed in overlapping 1.25 cm squares on 0.5 cm centers for each x-ray. The density at each location is indicated by a color. Separate maps are provided for (near) horizontal and (near) vertical threads. Canvases taken from the same roll should have a very close (within tenths of a thread/cm) match of average densities of threads in the warp direction and a close match (within ± 1 thread/cm) in the weft direction. The warp- and weft-thread directions were determined subjectively. Warp-direction weave patterns have thread counts that tend to have a smaller variance, to change little in the thread direction and to change much more in the perpendicular direction. Weft-direction weave patterns are less consistent in the thread direction and tend to have thread counts that change slowly in the perpendicular direction.
- The THREAD ANGLE MAPS indicate with color the values of the average thread angle (relative to horizontal and vertical alignment of the x-ray) in the 1.25 cm squares examined to compose the weave maps. Separate maps are provided for the (near) horizontal and (near) vertical threads. These angle maps vividly display cusping when present by a succession of color patterns alternating gracefully between the extremes of the colorbar (between red and blue then back again).

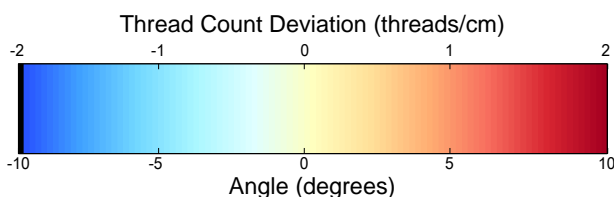


Illustration of the calibrated colorbar for both the weave deviation maps and the weave angle maps.

- The HISTOGRAM plots the number of evaluation squares having average densities within each range increment (of 0.1 th/cm) along the x -axis. This plot is useful for visualizing the distribution of the thread densities. Canvases from the same roll should have quite similar histograms in both directions. Often, the threads in the warp direction show less variability, i.e. a narrower distribution, in their count than the weft threads.

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Portrait of Alphonse Maureau (RW6(pastel) / 1950.123)

[54.7 × 45.2 cm, 1880, Art Institute of Chicago]



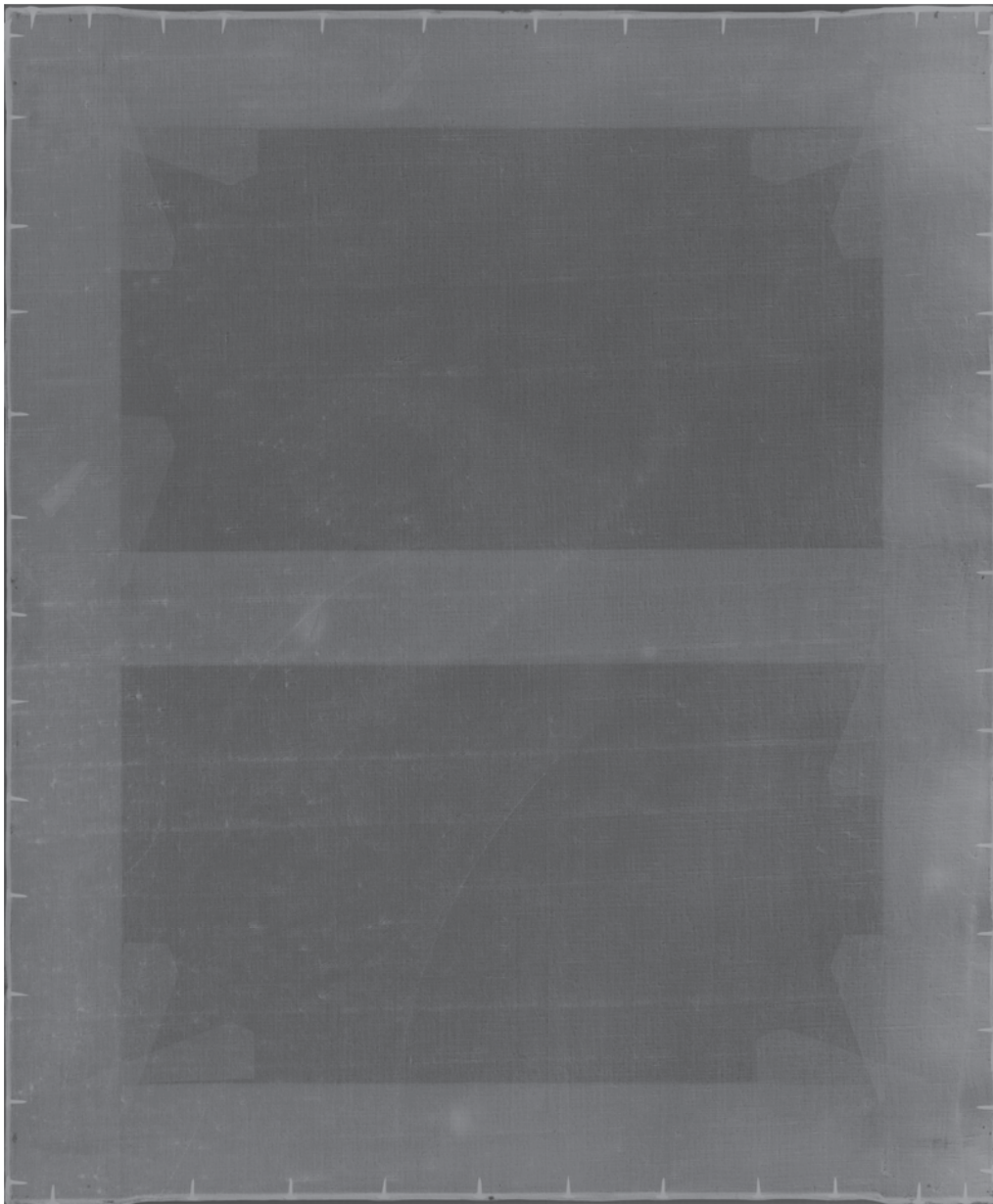


Figure 1: Composite x-ray created with automatic stitching software.

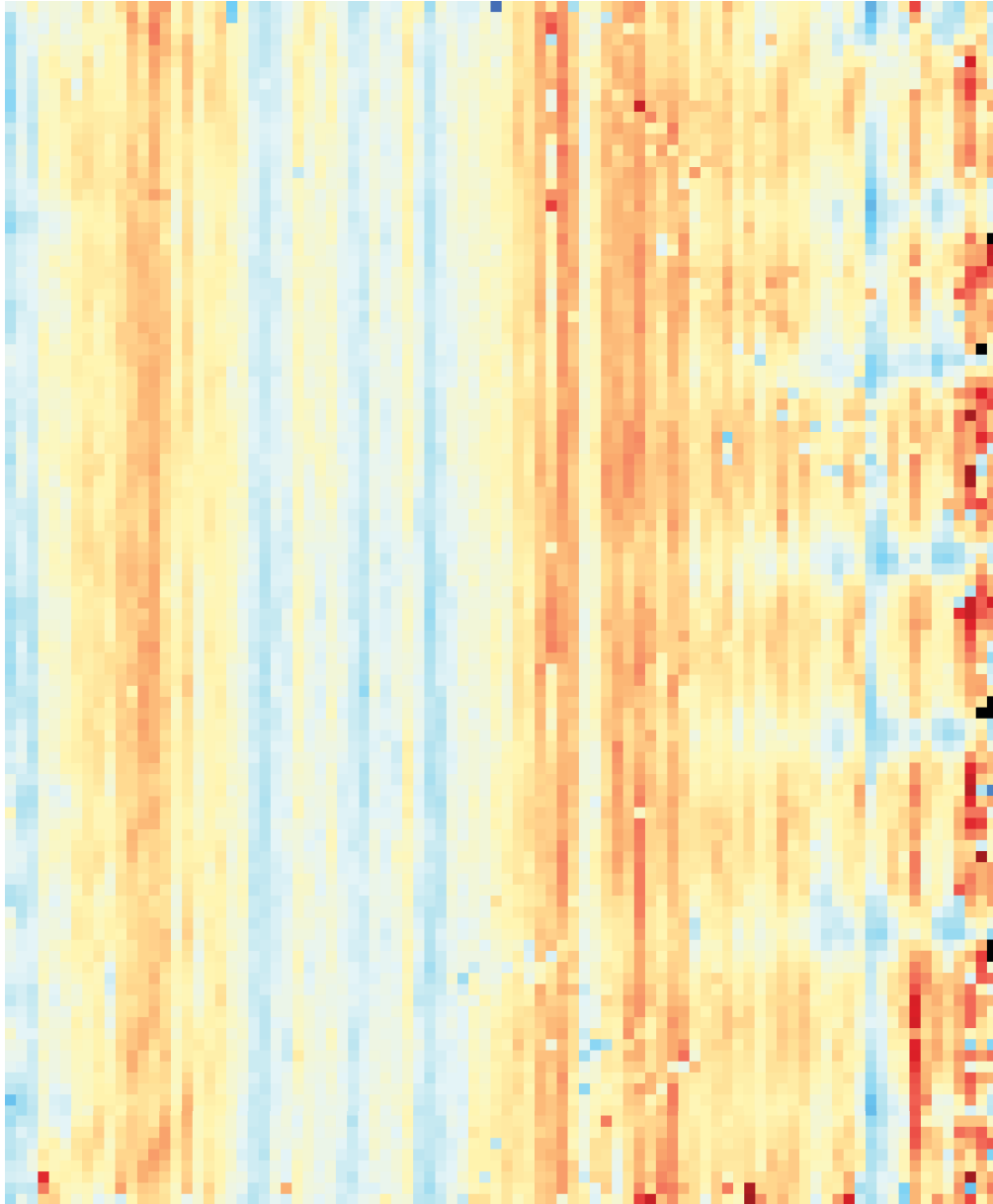


Figure 2: Vertical (presumed warp) thread count deviation map for the entire painting.

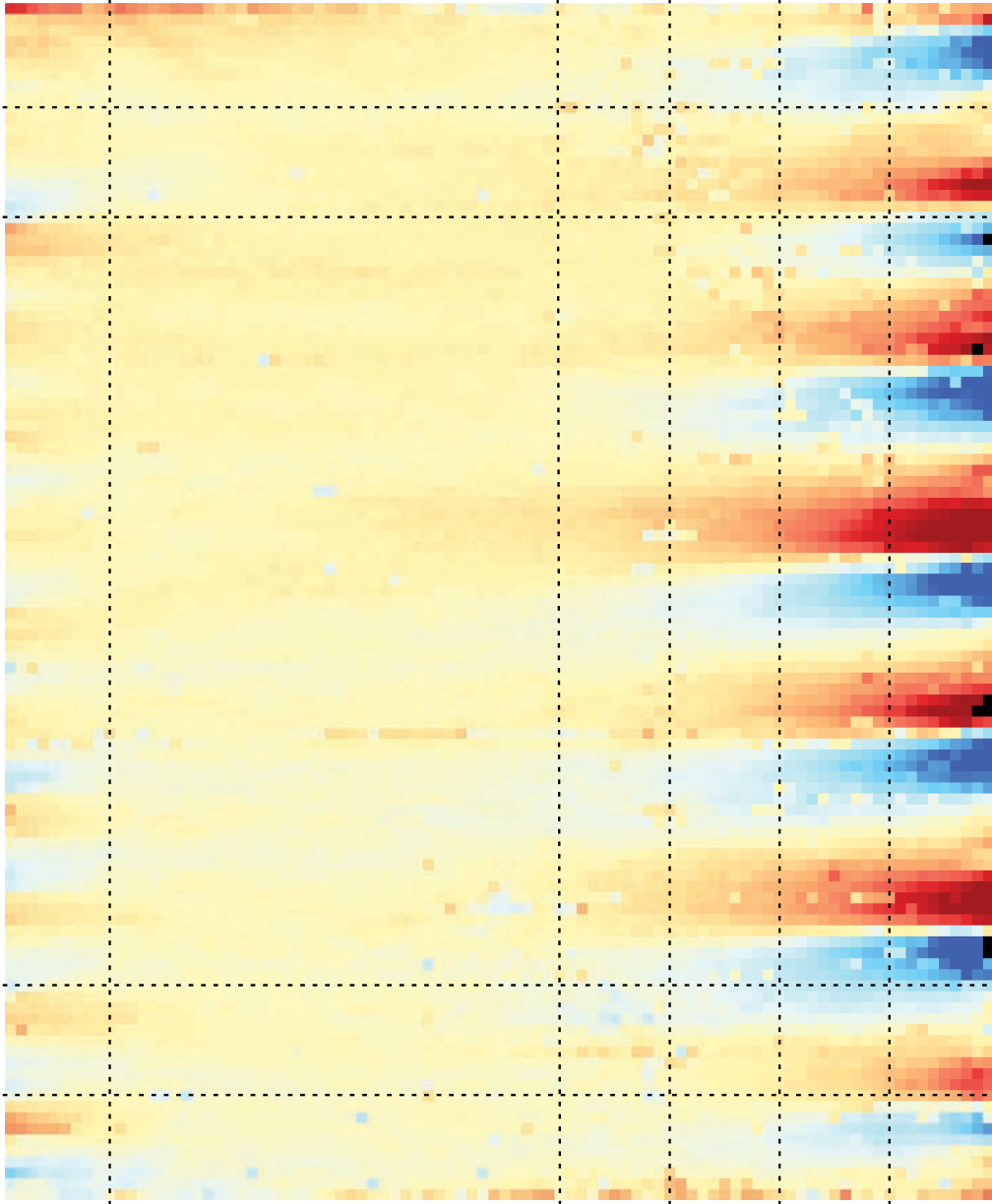


Figure 3: Vertical (presumed warp) thread angle map for the entire painting. Horizontal and vertical dashed lines are separated by 5 cm and can be used to judge cusping depth and separation.

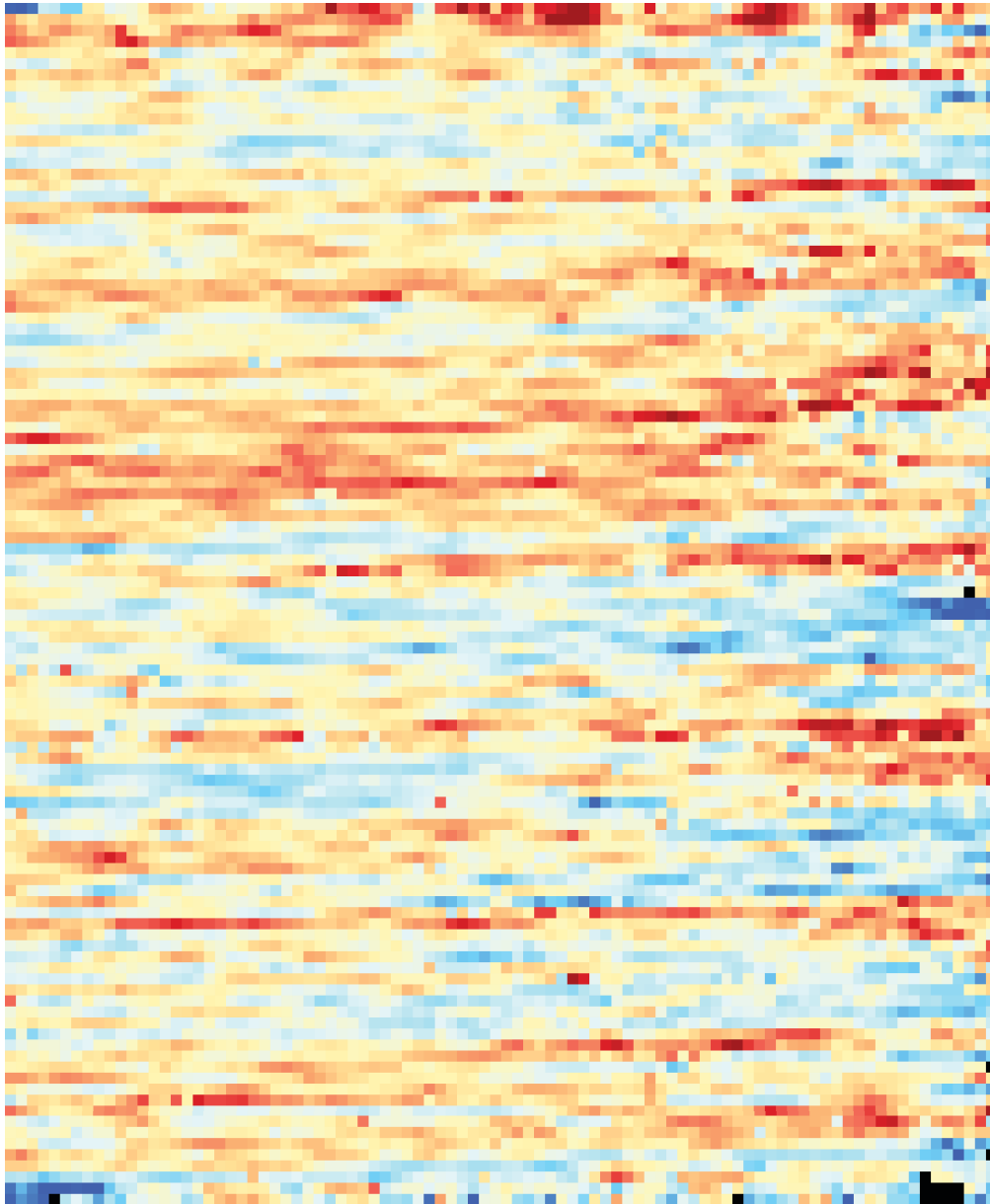


Figure 4: Horizontal (presumed weft) thread count deviation map for the entire painting.

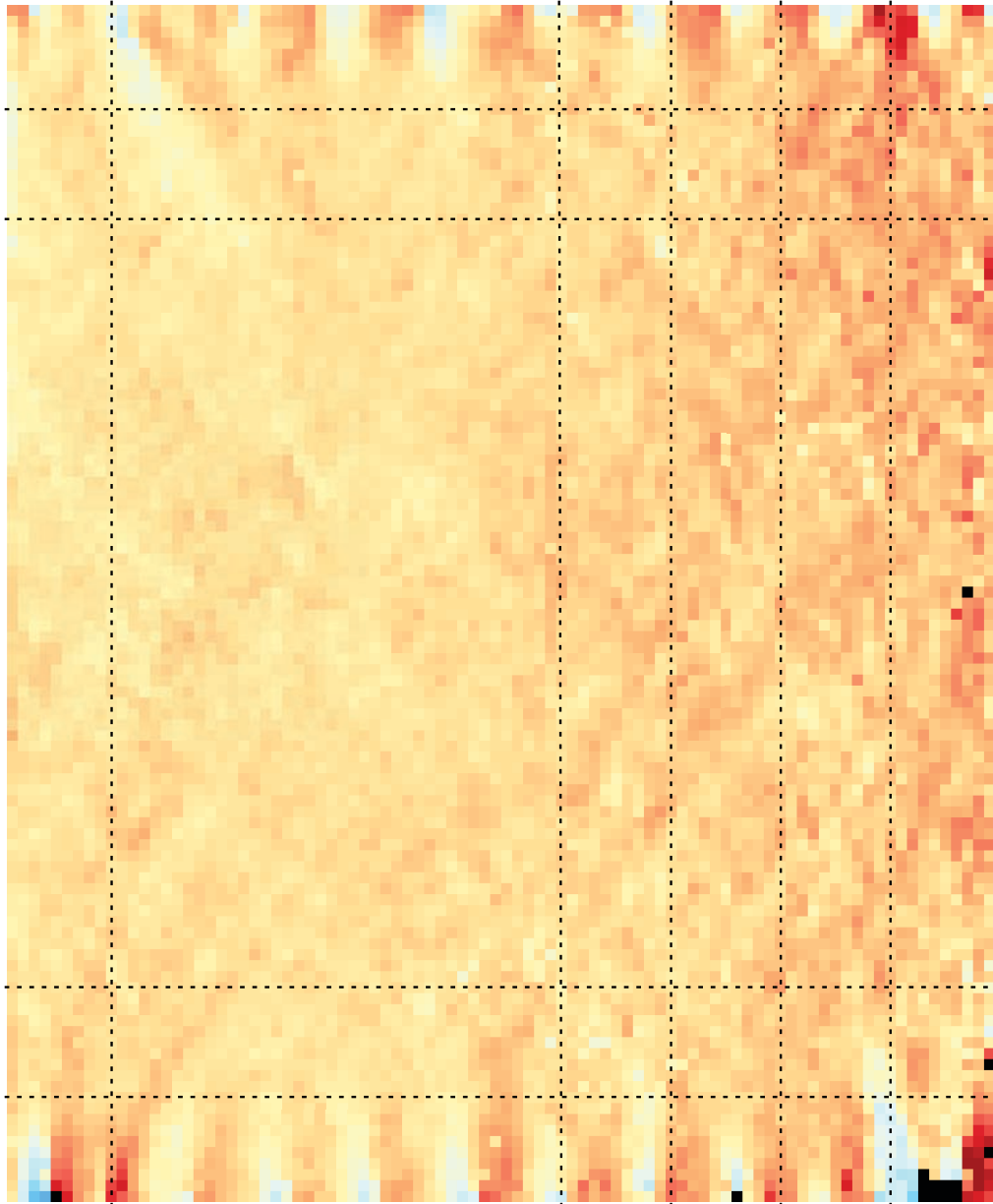


Figure 5: Horizontal (presumed weft) thread angle map for the entire painting. Horizontal and vertical dashed lines are separated by 5 cm and can be used to judge cusping depth and separation.

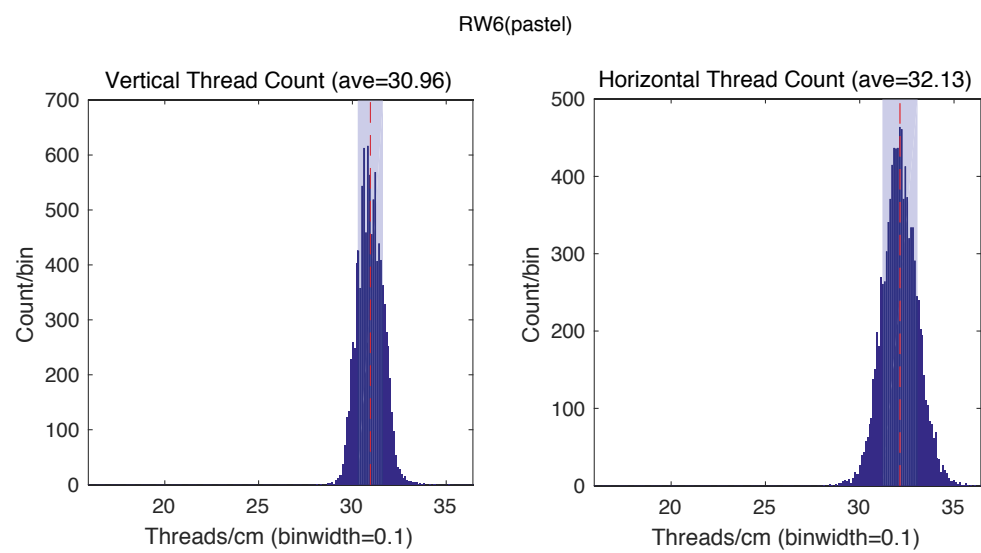


Figure 6: Thread count histograms for the entire painting. Shaded areas indicate a thread count spreads of one standard deviation about the averages.