

## Watermark Capture and Processing with Contemporary Desktop Applications

### ABSTRACT

The *Calendarium*, written by Johannes Regiomontanus ca. 1474 and printed in Nuremberg the same year, is part of the Rosenwald Collection in the Rare Book and Special Collections Division at the Library of Congress. This book is a superb example of block book printing, and is essentially a picture book in which the text and image were carved in relief into a block of wood, inked, and then pressed against paper, leaving an impression of words and pictures. Block-book printing emerged in the 15th century as a form of duplication for the purpose of educating a semi-literate population, in much the same way that stained glass windows rendered the lives of the saints to a religious congregation. In this case, Regiomontanus's scientific observations were intended for an audience of astronomers and astrologers. Block books were originally thought to be the precursor of printing with movable type, but modern research has indicated that these scarce books were created during the same period in which Gutenberg introduced printing to Western Europe.

This block-book edition of the *Calendarium* is printed on 31 leaves of paper, some of which contain watermarks indentifying the paper mill that produced the paper. These watermarks are important to researchers interested in establishing the dates on which various sections of the calendar were printed. Watermarks present on the pages were heavily obscured by diagrams and text, so various techniques were employed utilizing desktop applications to enhance the watermarks for ease of viewing and identification. Initial spectral imaging (reflected and transmitted) captured information in 14 wavebands; the registered images were then stacked and run through a simple principle component analysis (PCA) algorithm to enhance variation between text, diagrams, and paper. Selected PCA bands were then imported into Photoshop layers, and hue, saturation, and brightness changes were made to generate the best composite image. The overlying text was

changed to match the background in tone and coloration. Hue changes included changing reds to yellow, changing blue text to gray to decrease the saturation, and darkening greens. The Photoshop draw tool was then used to connect the segments and reveal the watermark. If watermark sections were on different sheets, these were stitched together to form a rendering of the complete watermark. Similar watermarks could also be overlaid in Photoshop to check for changes in the mold. Four distinct watermarks and variations were captured. In addition, the processing revealed a section of hidden printed text in the gutter of the folio, with the same text present on a number of folio sheets. This technique allows conservators, curators, and researchers to capture and easily manipulate and process watermarks using contemporary software tools, for improved provenance of historic book and paper materials.

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