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From Thermographic Data to Watermark Images

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DRACMarkS Project

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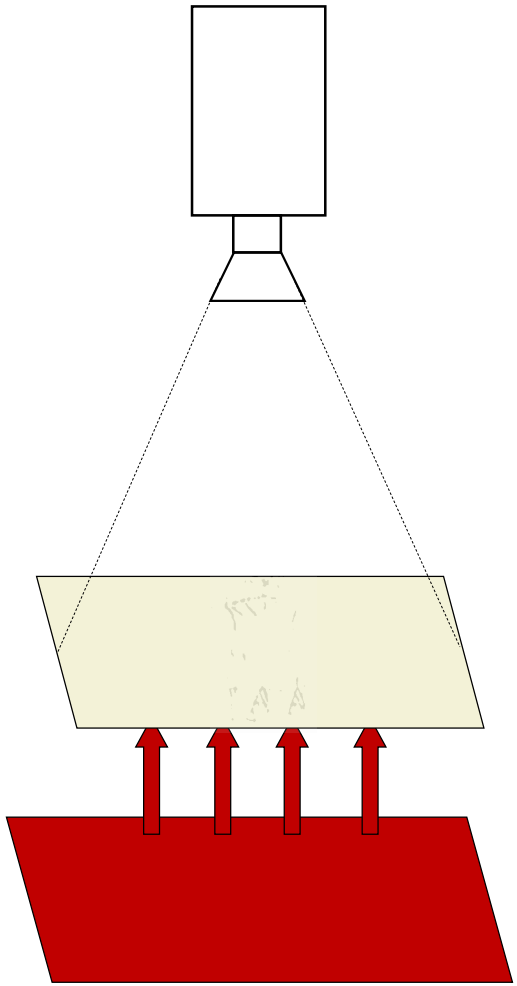
- Digitization, Recognition, and Automated Clustering of Watermarks in the Music Manuscripts of Franz Schubert
- Use a thermographic imaging device to digitize the music manuscripts
- Focus on capturing the whole page, not only the watermark
- Digitization of “raw data” as a goal
- As objective as possible

Thermographic Watermark Imaging

- IR-source (heating plate) emits IR-radiation
- IR-radiation traverses manuscript
- Intensity of IR-radiation is detected by IR-camera
- No direct conduction of heat



Benefits and Challenges

- Most writing materials are invisible in the IR spectrum
- No hazardous radiation
- Poor resolution (640 x 512 pixels)
- Challenging acquisition procedure
- Expensive components
- Difficult to capture watermarks close to binding
- No standardized procedure

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Acquisition Procedure

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- Gap between manuscript and IR source necessary
- Short exposure to IR radiation gives best contrast
- Difficult to locate watermarks in advance
- Only two to three seconds to place manuscript and record image

Data Pipeline

- Matrix of intensity values 0–65553
- Visualization as gray scale image
- White is the highest value, black the smallest

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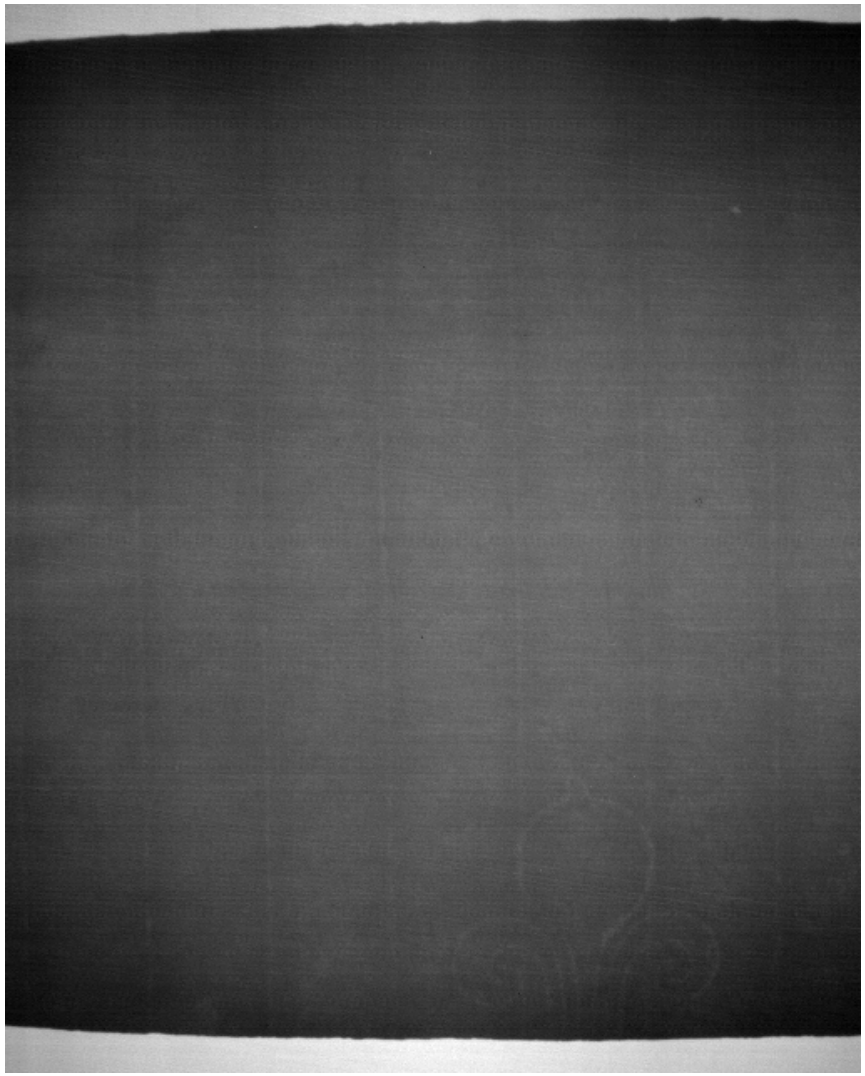

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Data Pipeline

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- Matrix of intensity values 0–65553
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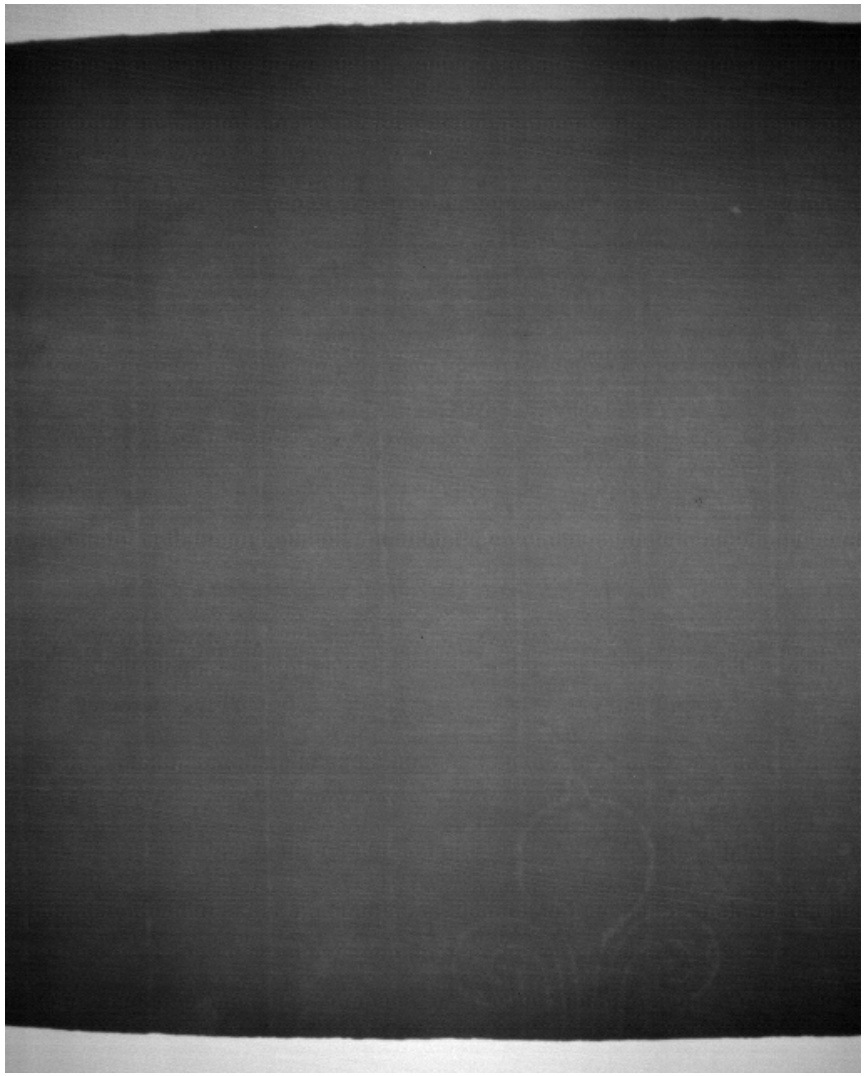
- Radial brightness effect (lens)



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- Subtract reference image
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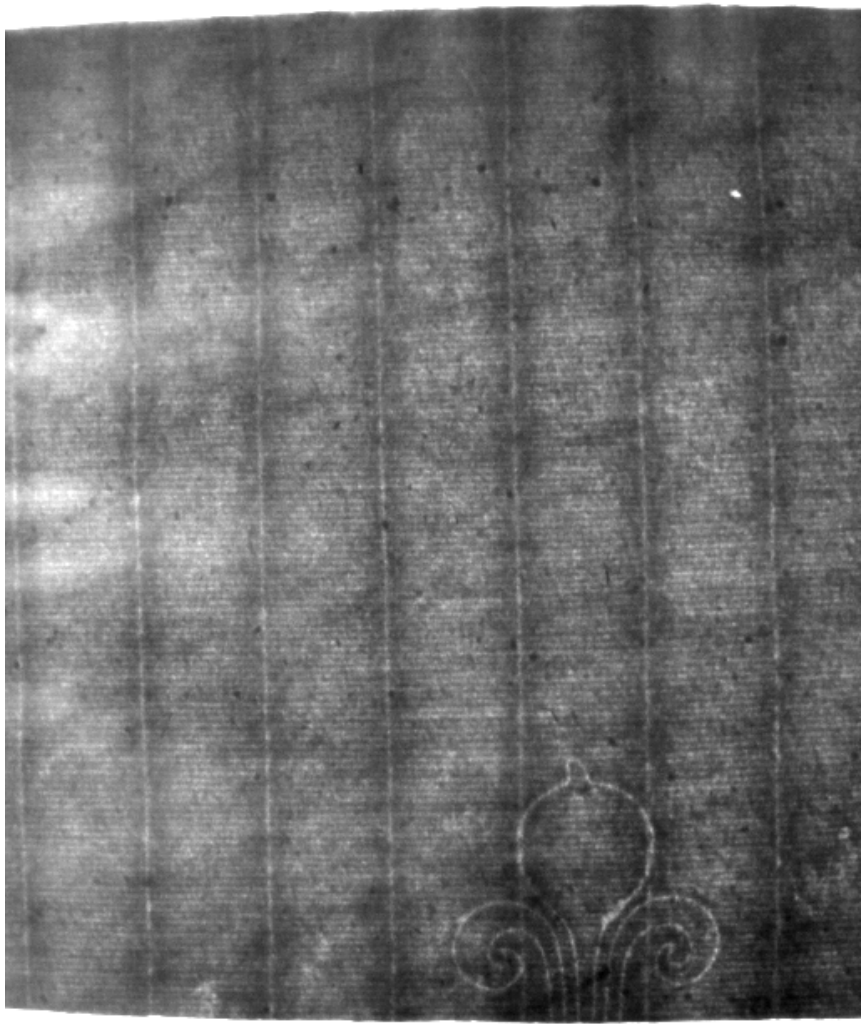

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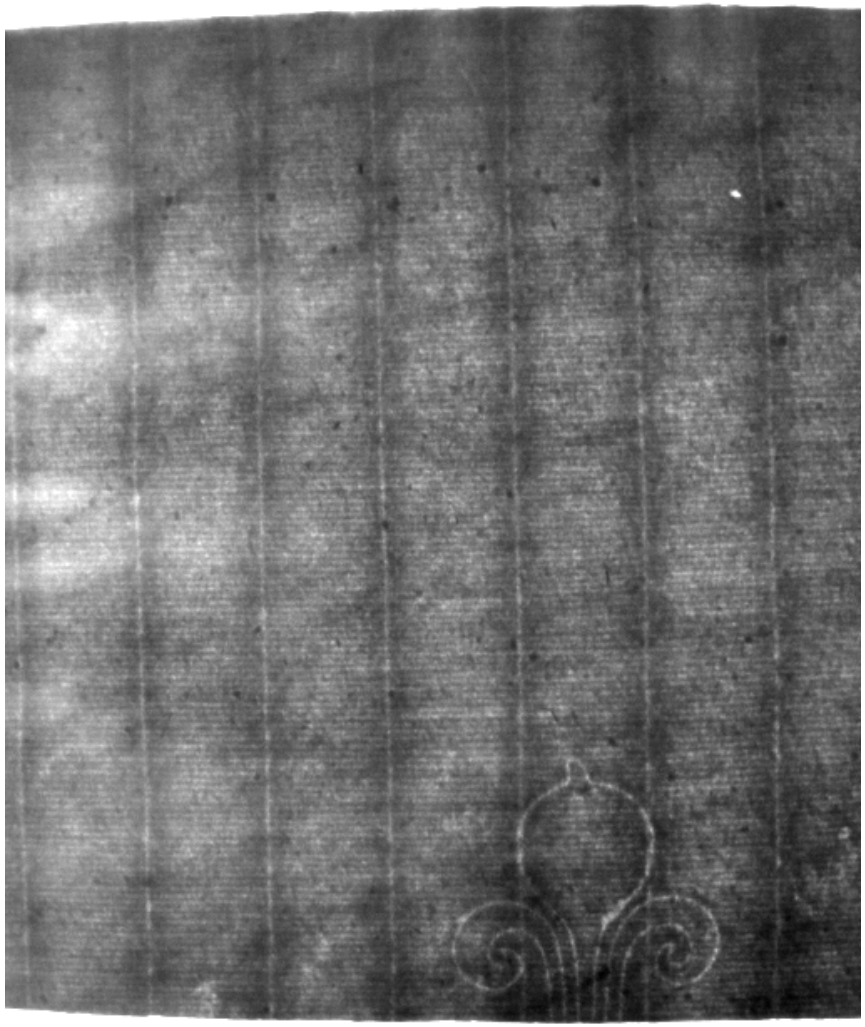
- Barrel effect (lens distortion)



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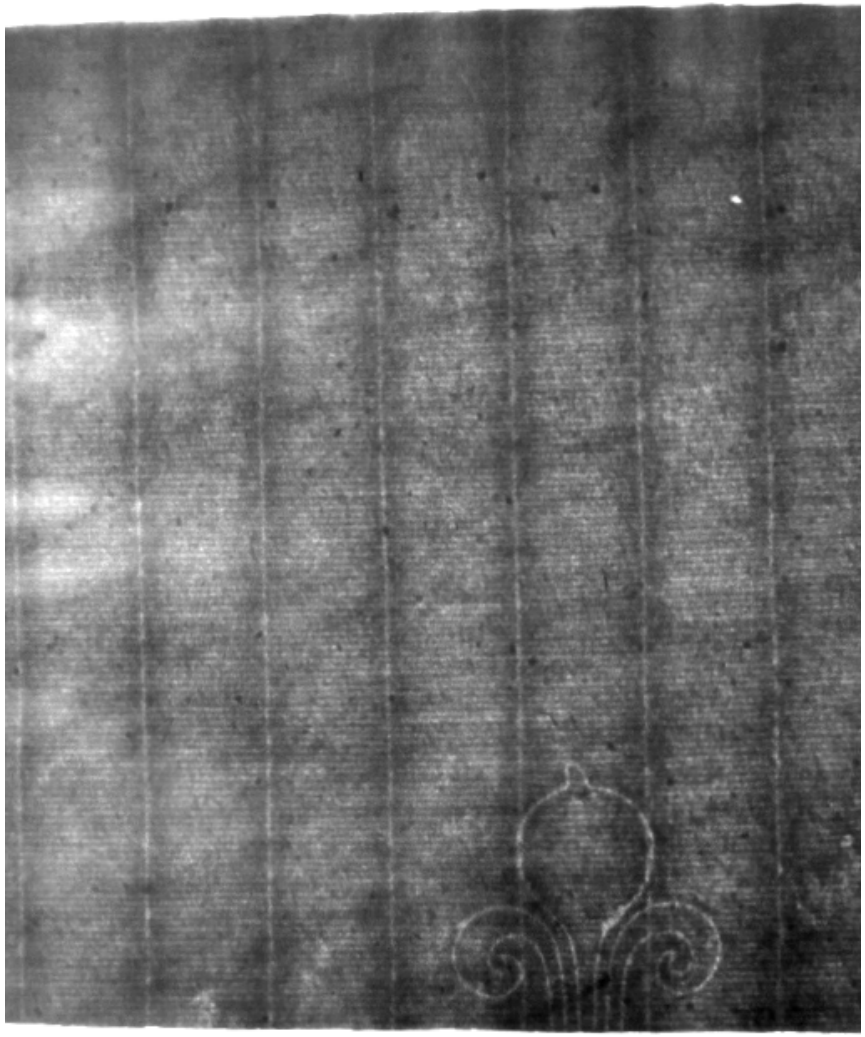

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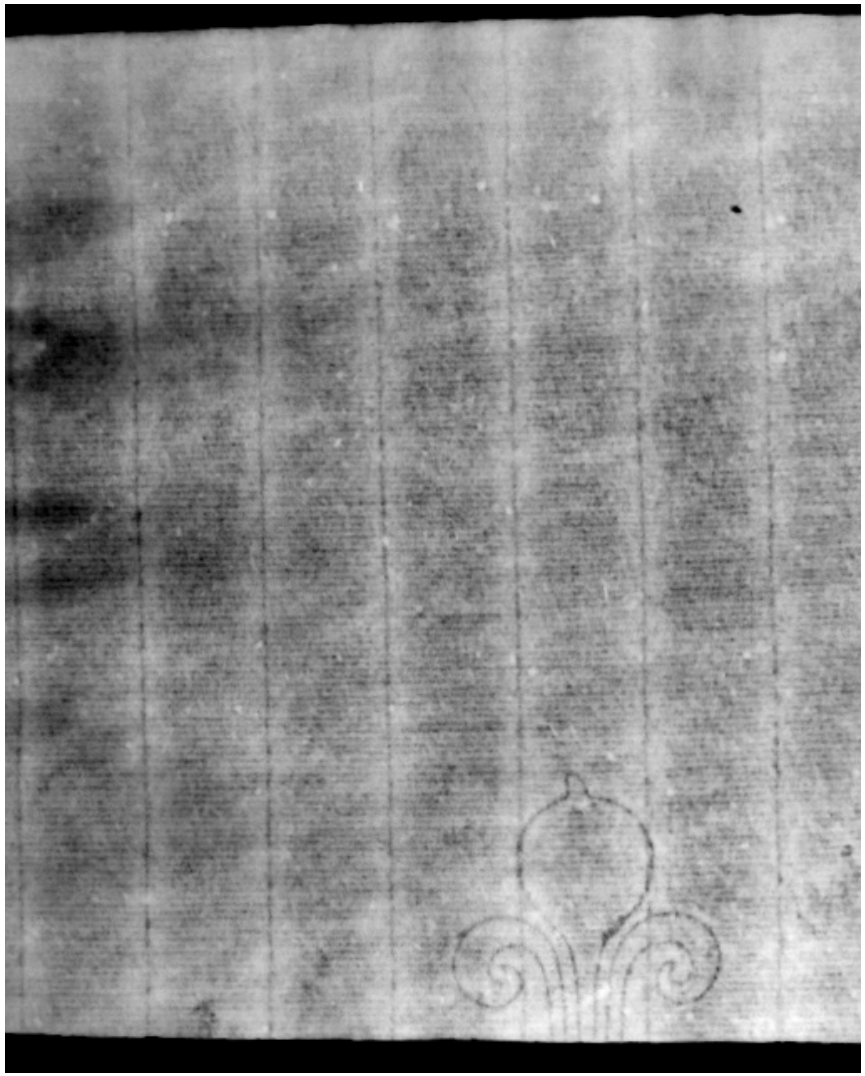

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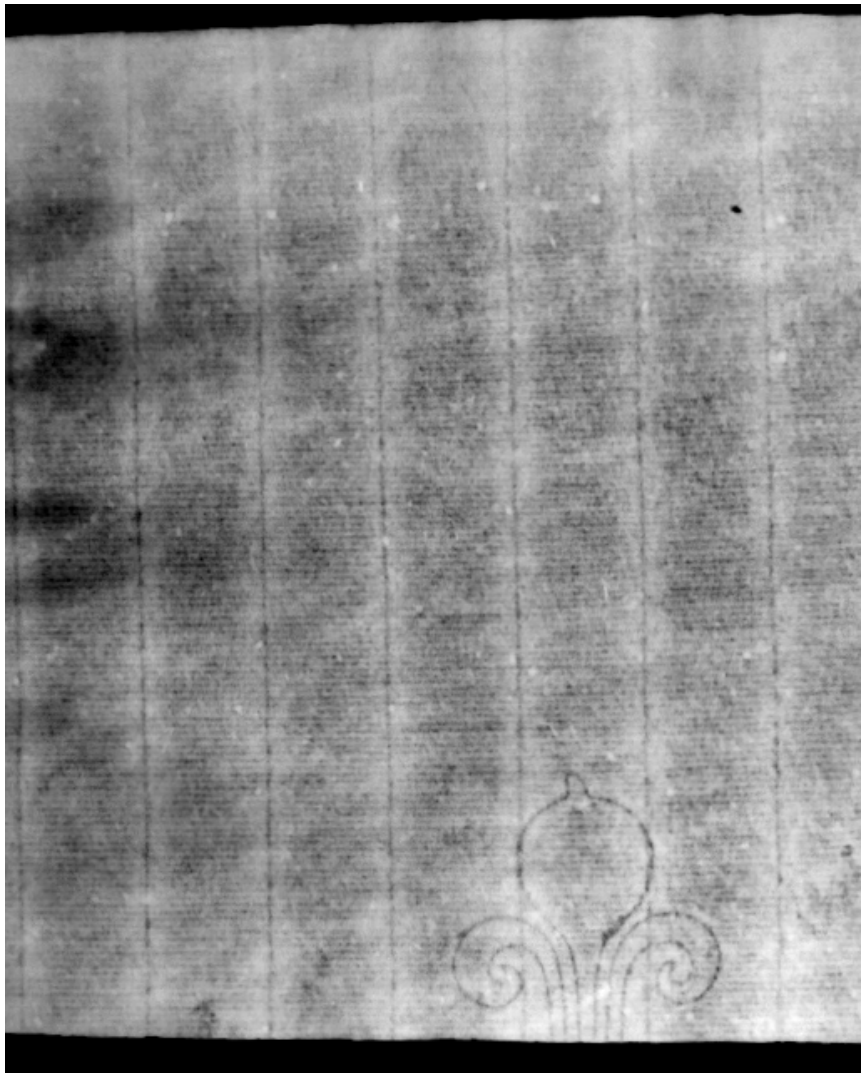
- Correction warranted?



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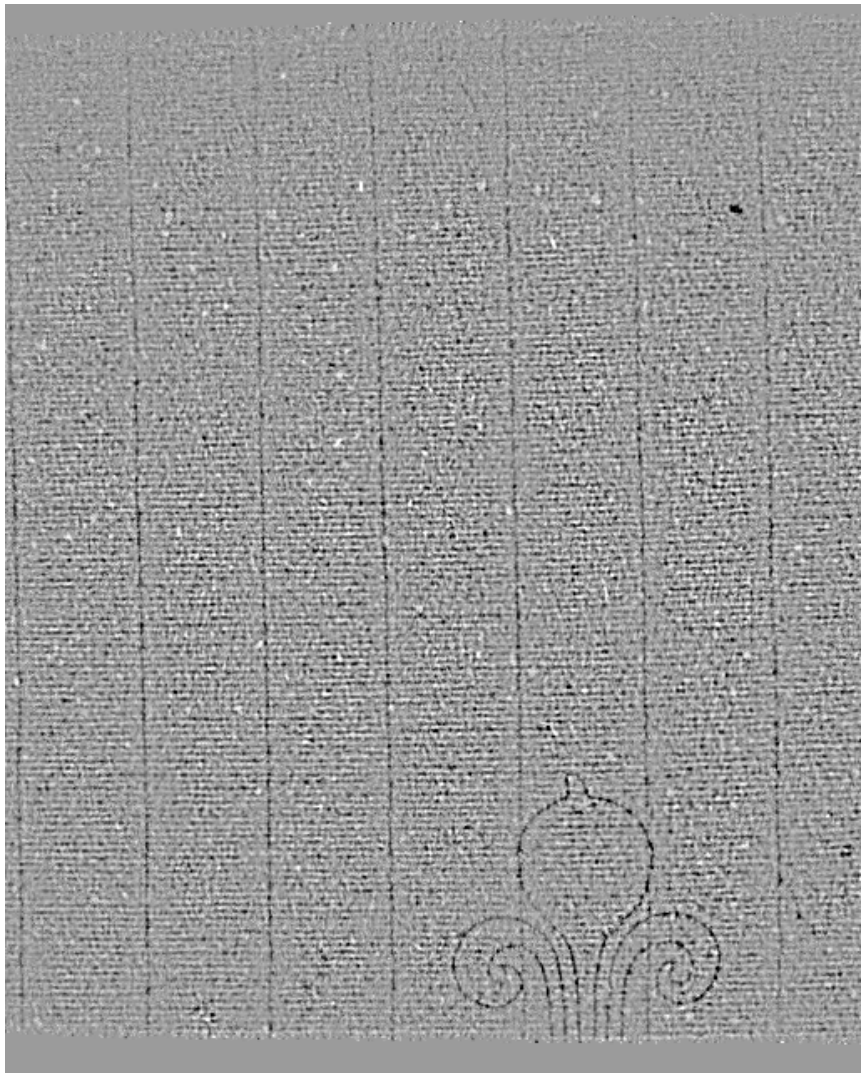

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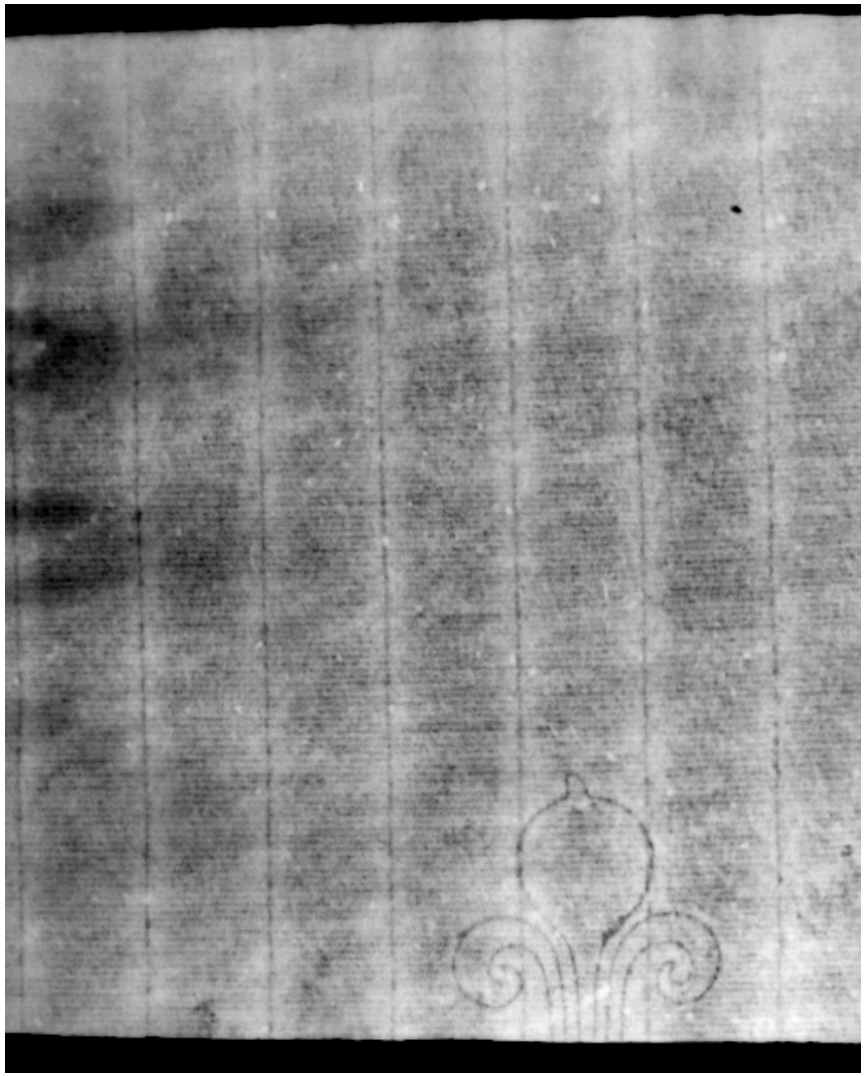
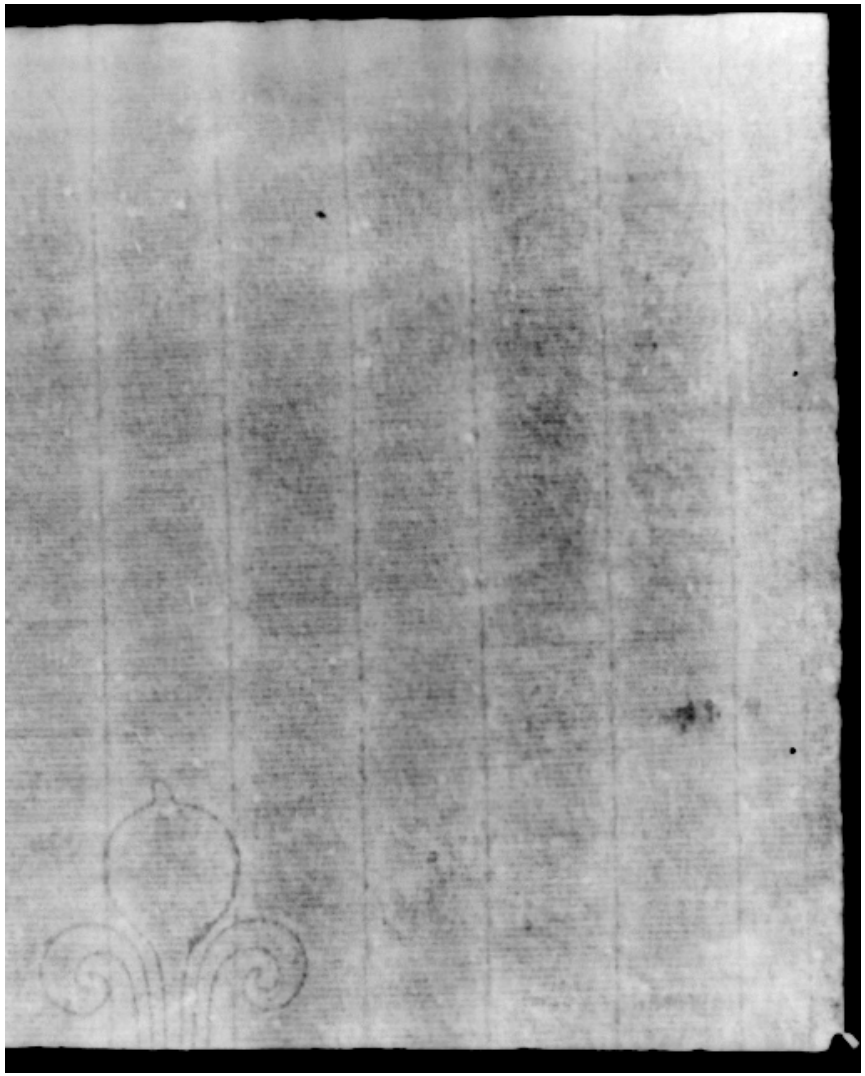
- Paper structure does not provide these features
- Had to develop our own stitching algorithm

Stitching





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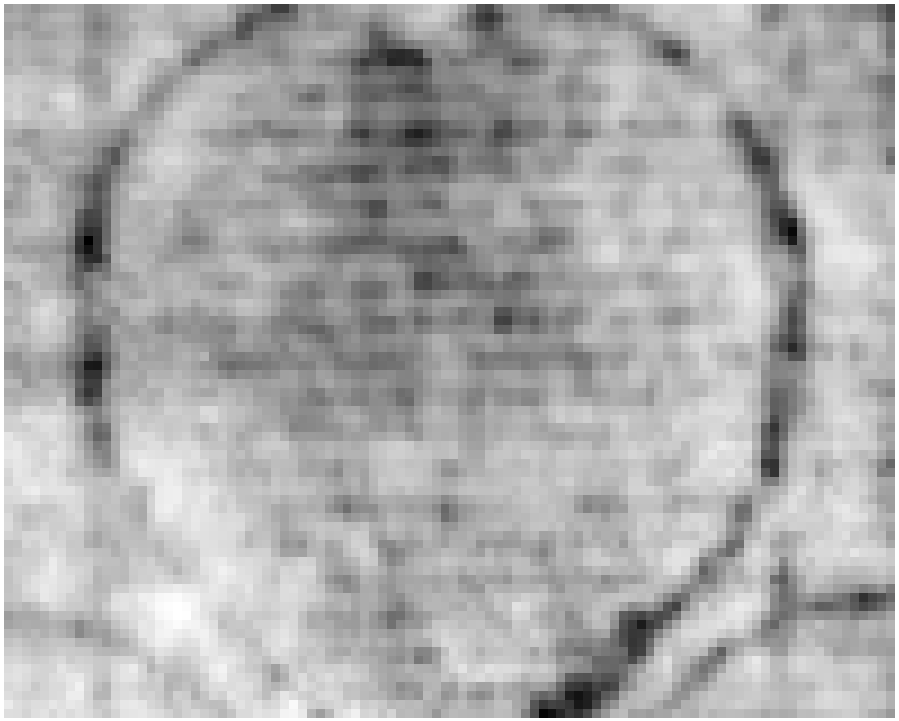

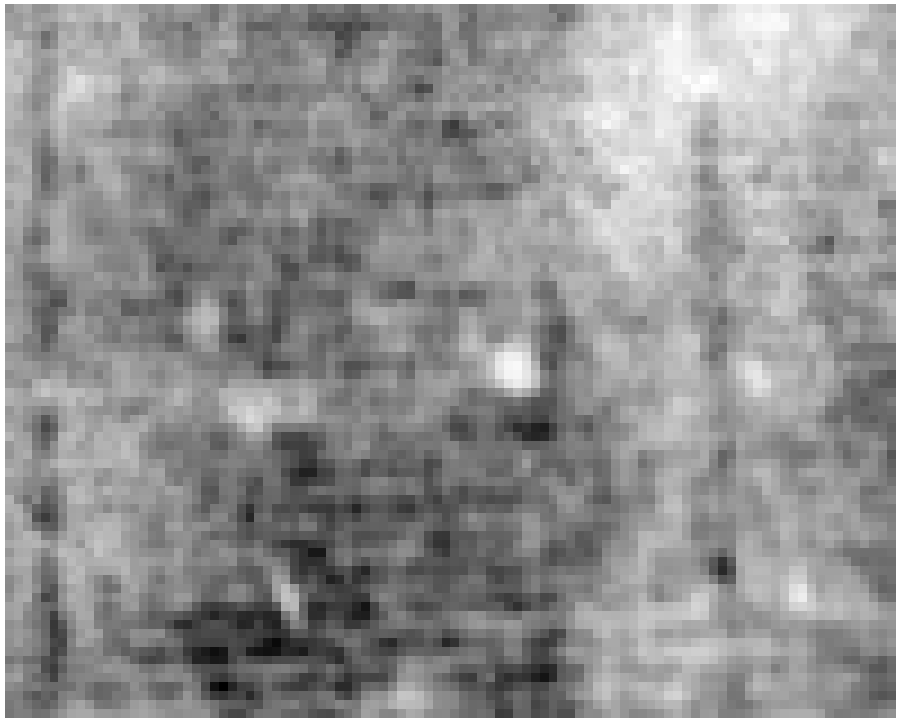

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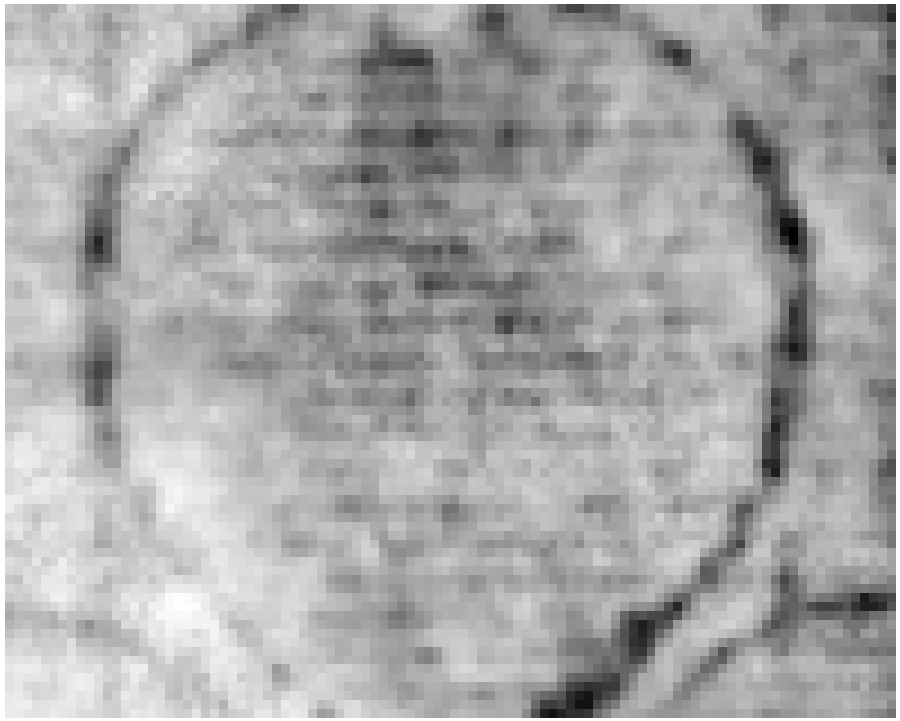
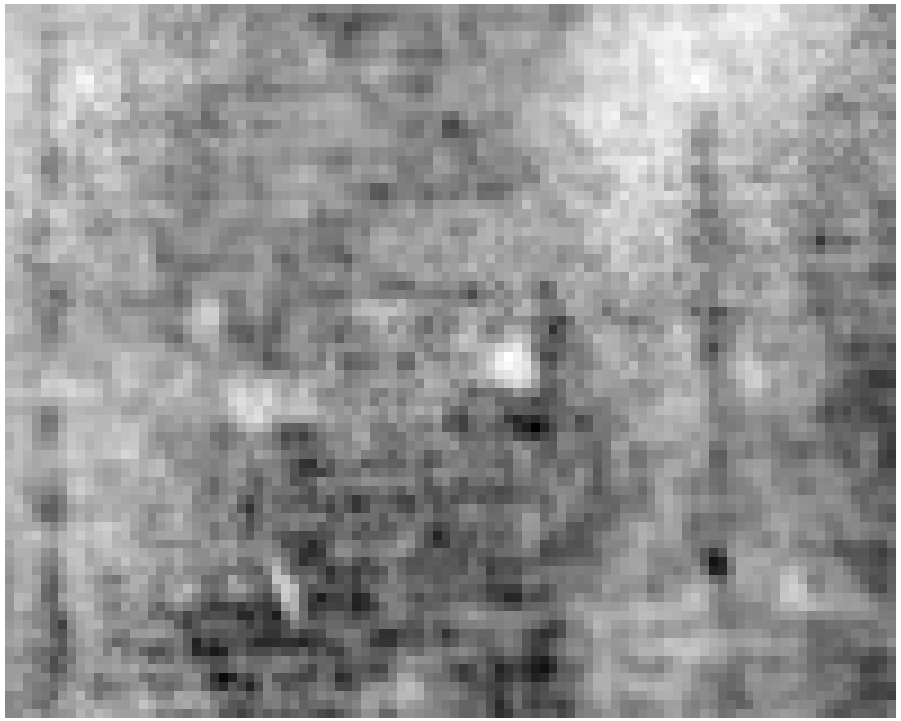
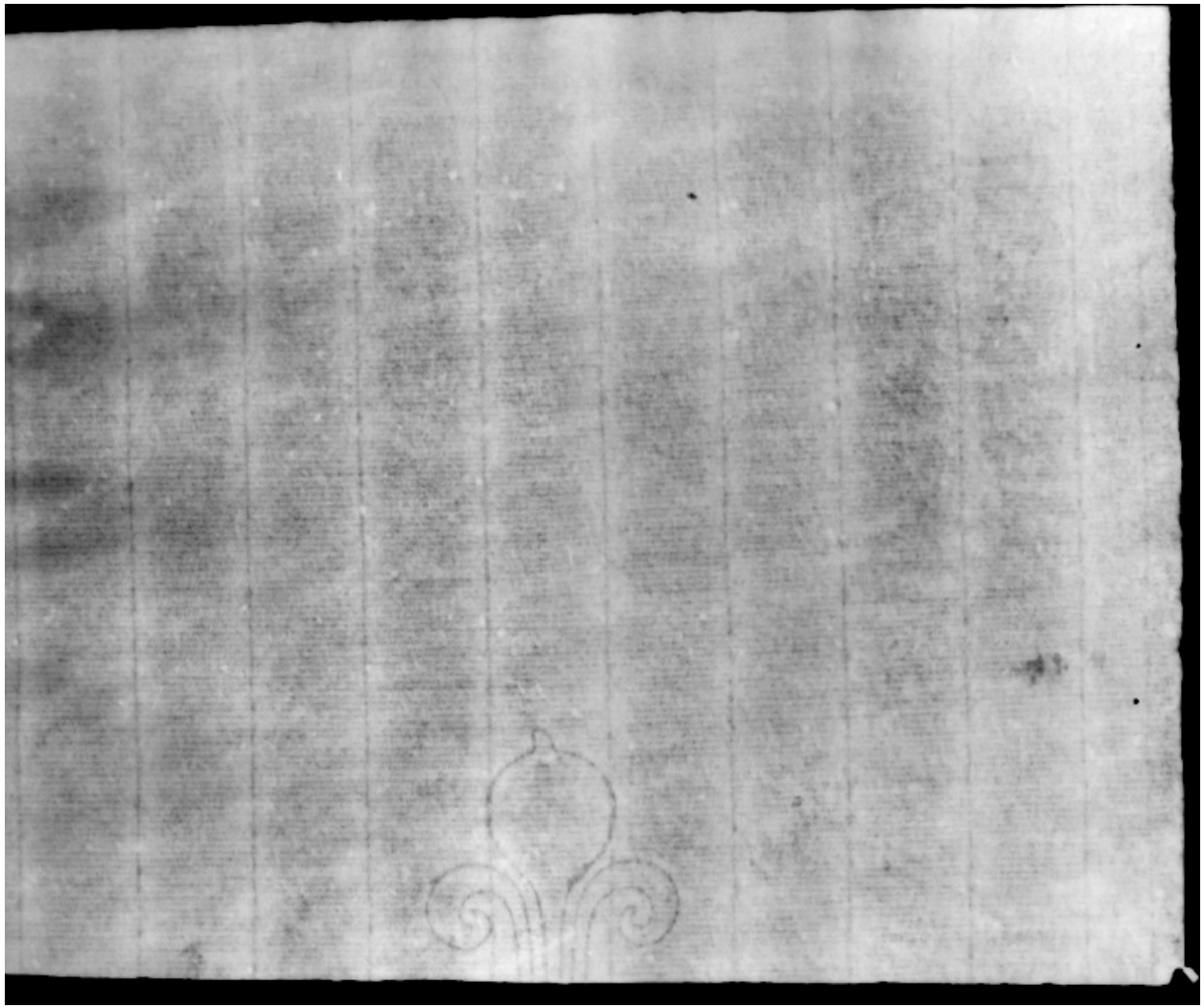




Combined Page



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- Eventually, more reference points can be used for differently scaling both axes
- Different (non-linear) registration methods will be tried to correct wrinkles
- Process is slow, optimization seems very difficult due to many local minima/maxima

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Why Full Page?

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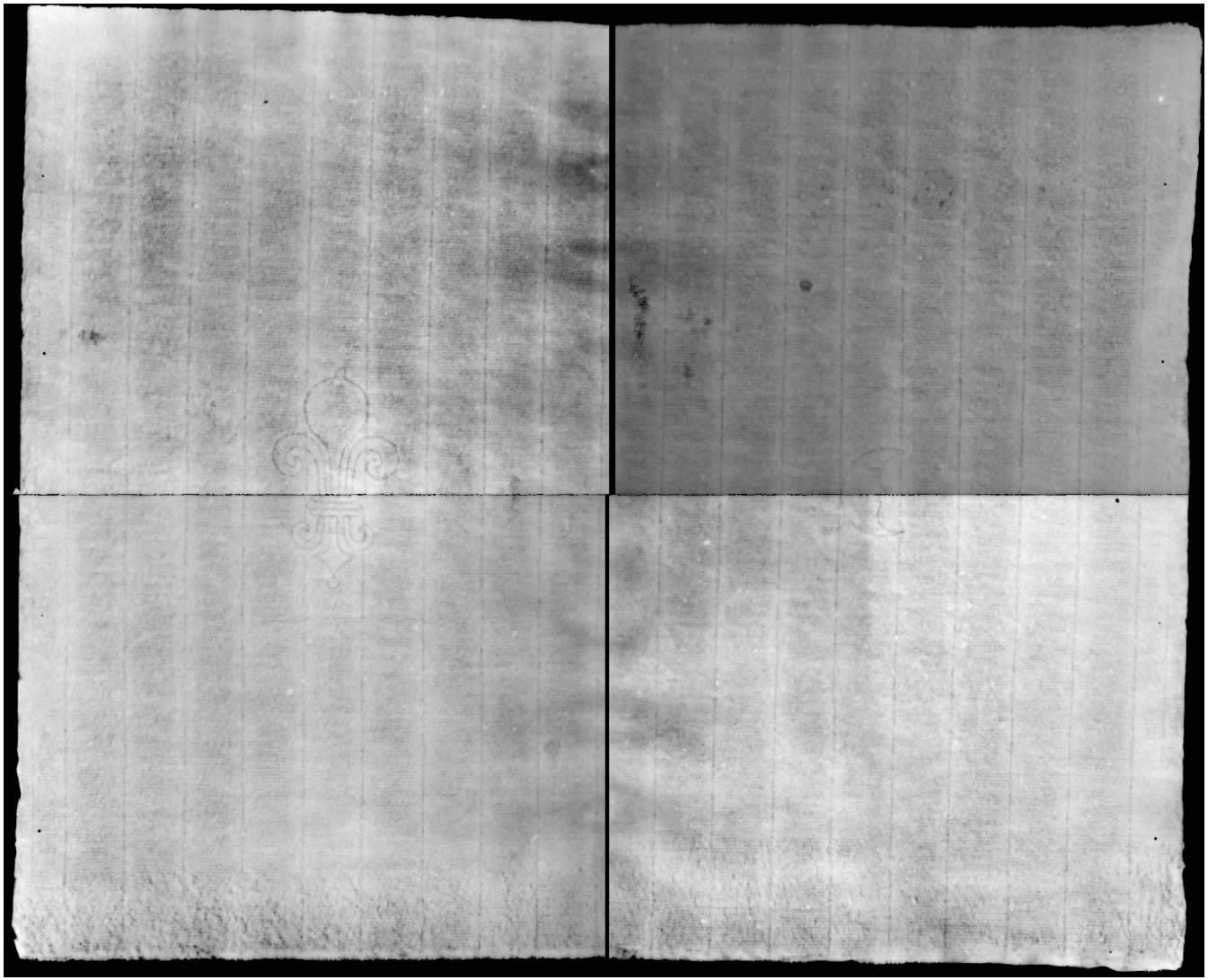

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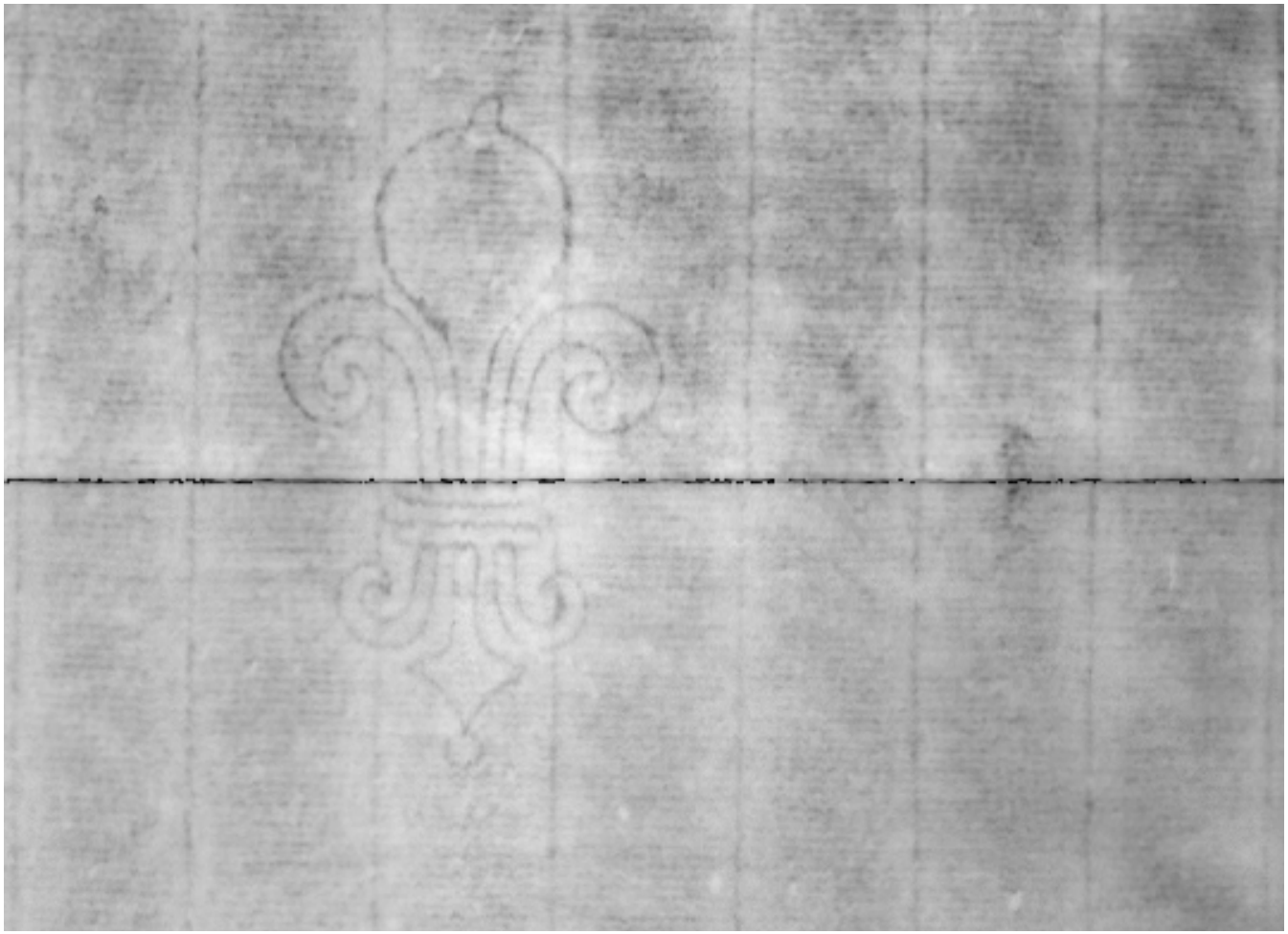

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Outlook

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- What does the community want? Which data should we provide?