Virtual document restoration

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- Why virtual?
- Secure management of documents and artworks
- Specialized image capture
- Typical degradations in ancient photographs
- Digital tools for image restoration

Digital management of historical archives

- Safeguard and security
- Scholarship
- Public access

Tools

- Capture and digitization
- Digital enhancement and restoration
- Extration of information
- Indexation
- Translation into machine-readable form
- Archival

Specialized image capture and restoration

Specialized image capture

- Extract information from non-visible bands
- Exploit different probing modalities
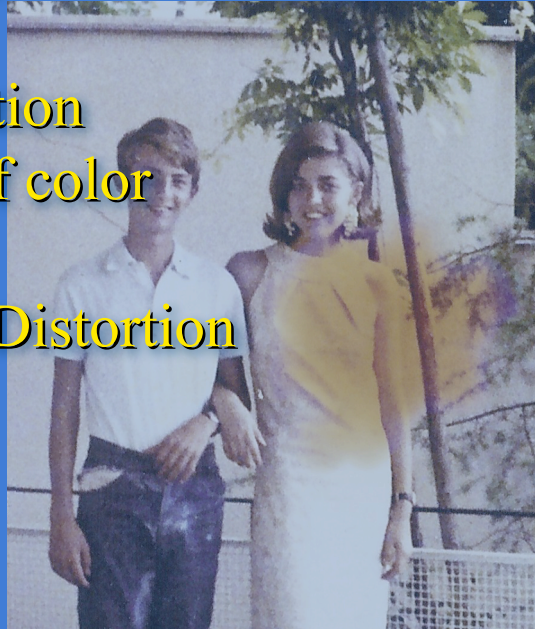- Exploit diversity data
- Select the best set of data "channels"

Digital restoration

- Recover the original appearance of the document
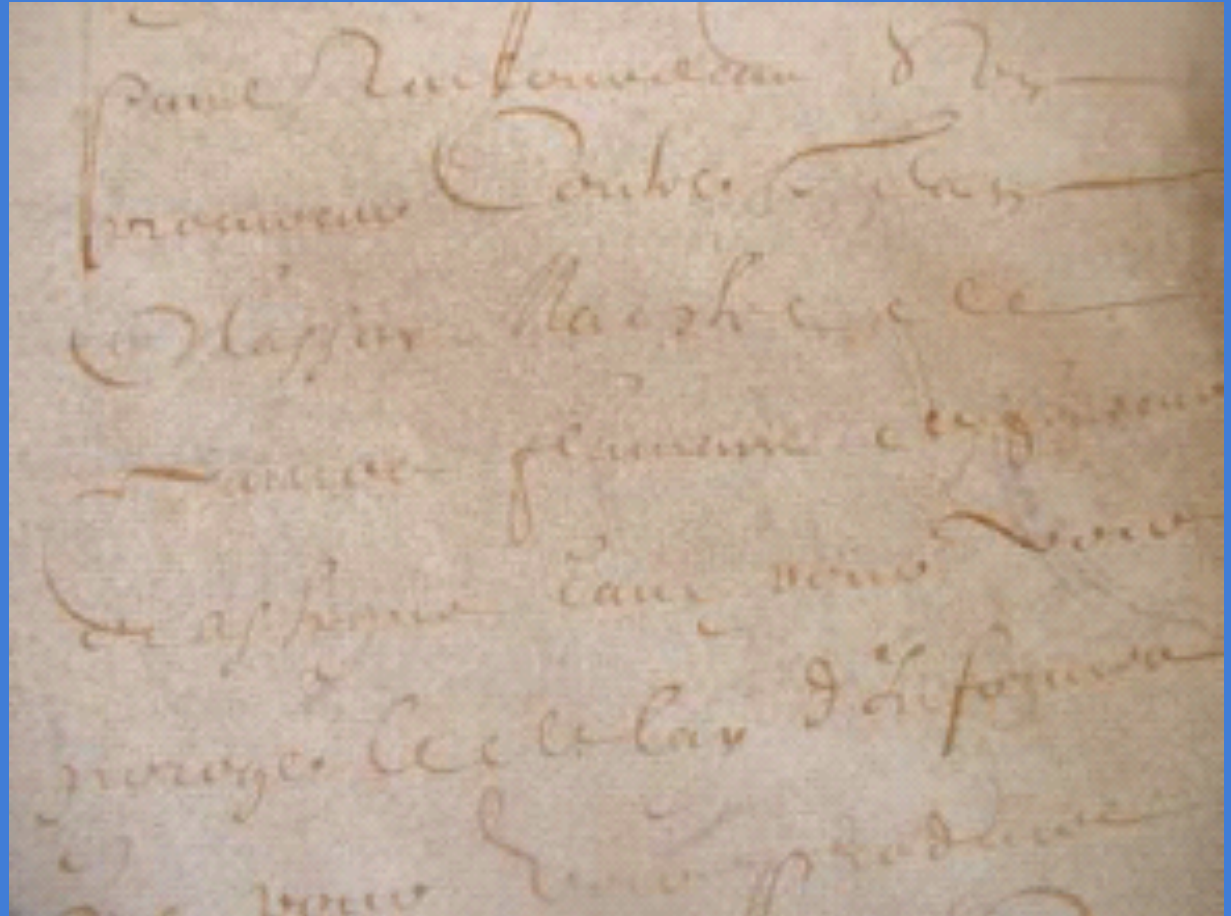- Extract hidden information (stamps, watermarks)

Typical degradations in ancient photographs

- Loss of density
- Fading
- Loss of resolution
- Degradation of color
- Blotches
- Interference - Distortion

Hidden information

- Stamps
- Watermarks
- Texts
- …

Digital tools for image restoration

Goals

- Denoising
- Contrast enhancement - Sharpening
- Color reconstruction
- Deblotching
- Separation of sources

Tools

- Histogram equalization
- Projection onto color spaces
- Multiresolution analysis
- Inpainting
- Selective smoothing
- Statistical processing

Color reconstruction: Contrast enhancement

- Just aesthetic improvements
- Manual, trial-and-error, procedure

This means

- No guarantee of fidelity
- No possibility of mass processing

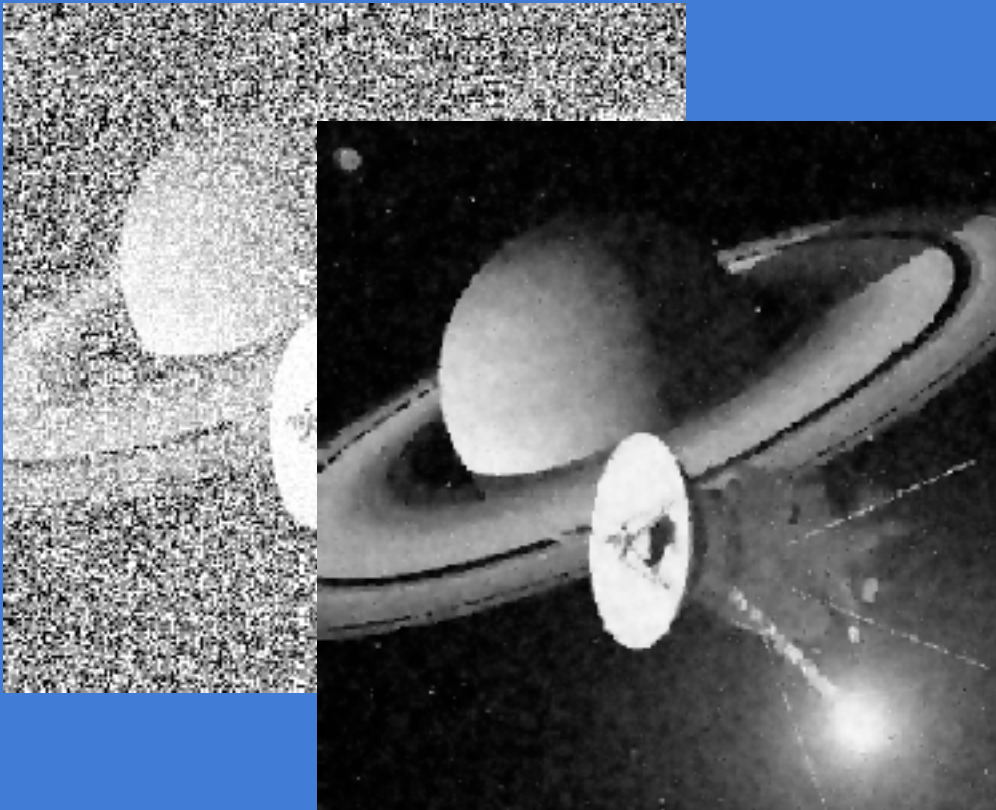A useful virtual restoration must often rely on automatic and repeatable procedures

Examples

Despeckling: median filter

Filling gaps - inpainting: statistical processing

- The procedure can only be automatic
- The results depend strongly on the statistical features of the image and of the missing samples

This means
- Any automatic inpainting procedure must be adaptive
- This normally requires lengthy processing

Examples

Deblurring: Bayesian approach

- Digitization and virtual restoration can help managing large image archives by:
  - Improving the security of the originals
  - Helping maintenance and physical restoration
  - Innovating accessibility and scholarship by:
    - Extracting visual and contextual information
    - Improving the documentation techniques
    - Making documents available online
    - Integrating local and remote documentation