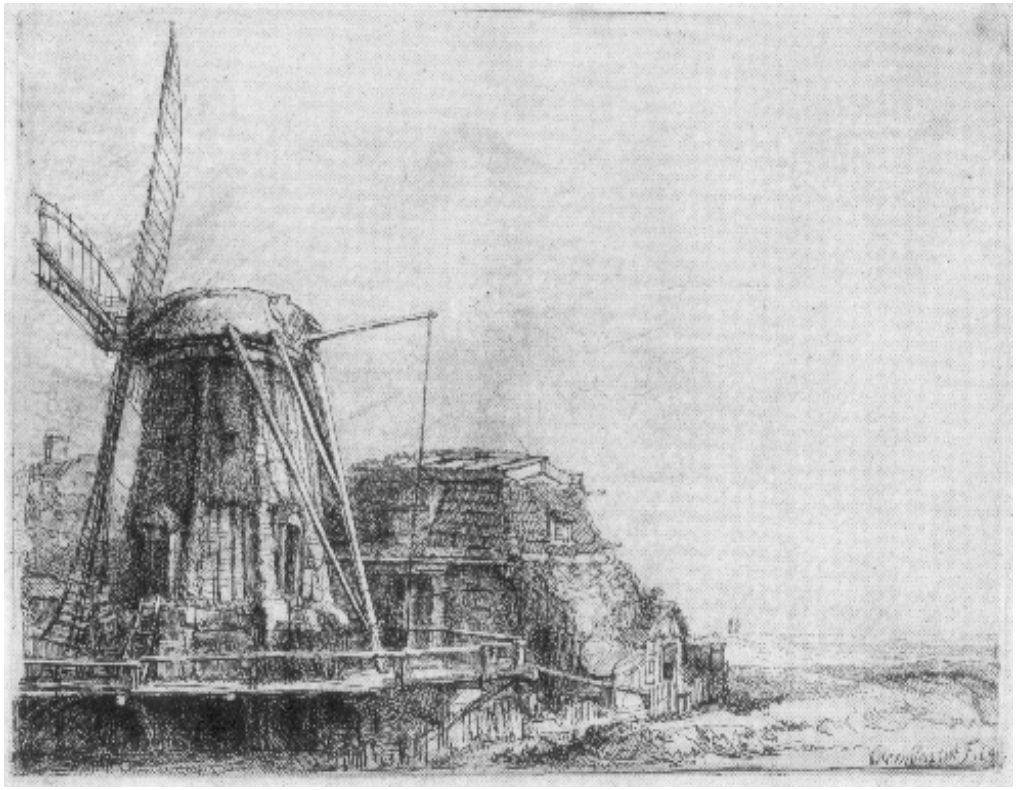
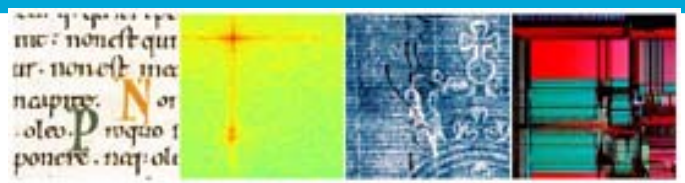
PAPER FEATURE EXTRACTION AND PAPER RETRIEVAL



July 13, 2007

Jan C.A. Van der Lubbe



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DUT Image Processing Tasks

According to Bernstein Vienna Meeting, January 17, 2007

- **Numerical paper description standards**
  July 2007
- **Sieve feature measurements in binary images**
  July 2007
- **Sieve feature measurements in grayscale images**
  March 2008
- Sieve segmentation in grayscale images
  June 2008
- **Watermark imaging by backlight subtraction**
  April 2008
- Identical watermarks identification
  January 2008

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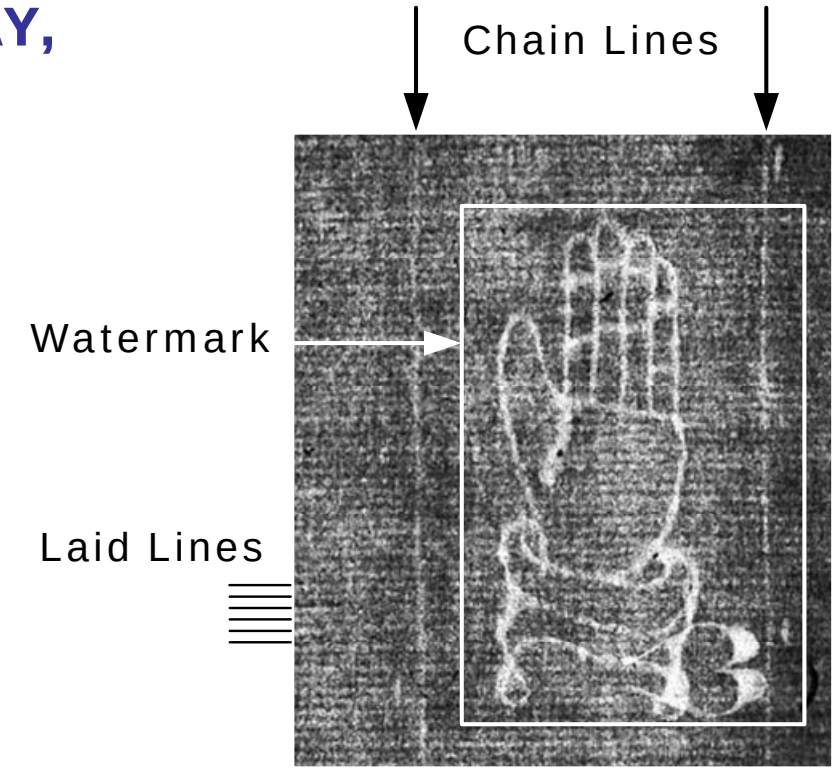
CHALLENGES

- **SIEVE FEATURE MEASUREMENTS IN GRAYSCALE IMAGERY (X-RAY, β-RADIOGRAPHY, BACKLIGHT)**
- **MATCHING**
- **AUTOMATIC FEATURE EXTRACTION AND MATCHING**



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AUTOMATIC PAPER FEATURE MEASUREMENTS IN GRAYSCALE IMAGERY

- LAID LINE MEASUREMENTS
  - laid line density matrix
  - average laid line density
- CHAIN LINE MEASUREMENTS
  - chain line distance matrix
  - average chain line distance
- MATCHING ON THE BASIS OF LAID AND CHAIN LINES

- AUTOMATIC METHODS FOR BACKLIGHT IMAGERY

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AUTOMATIC WATERMARK DETECTION IN GRAYSCALE IMAGERY

- Line Properties

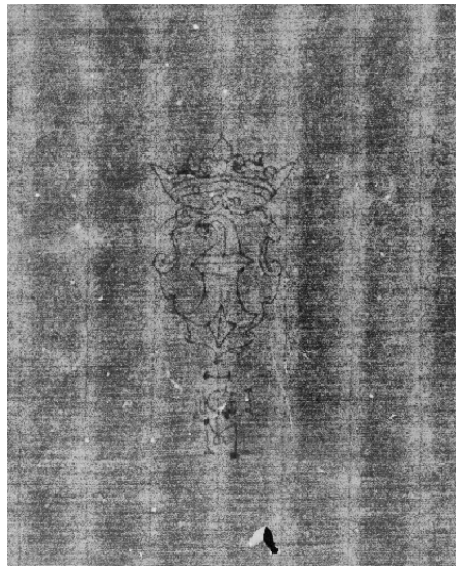
Profile

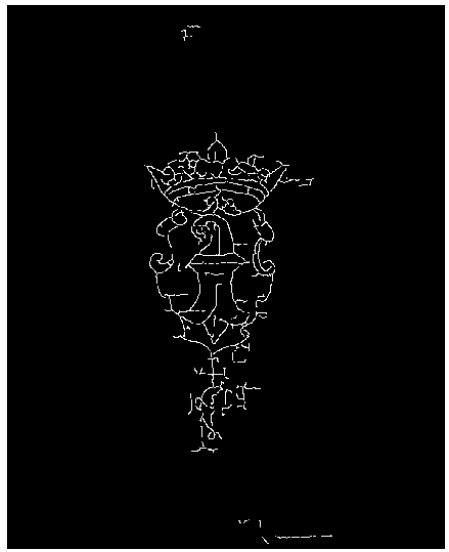
Contrast

Width

Connectivity

Length





	Test set error	Training set error
Moreu, vStaalduinen	0,0154	0,0153
Riley, Edwards, Eakins	0,0405	0,0413

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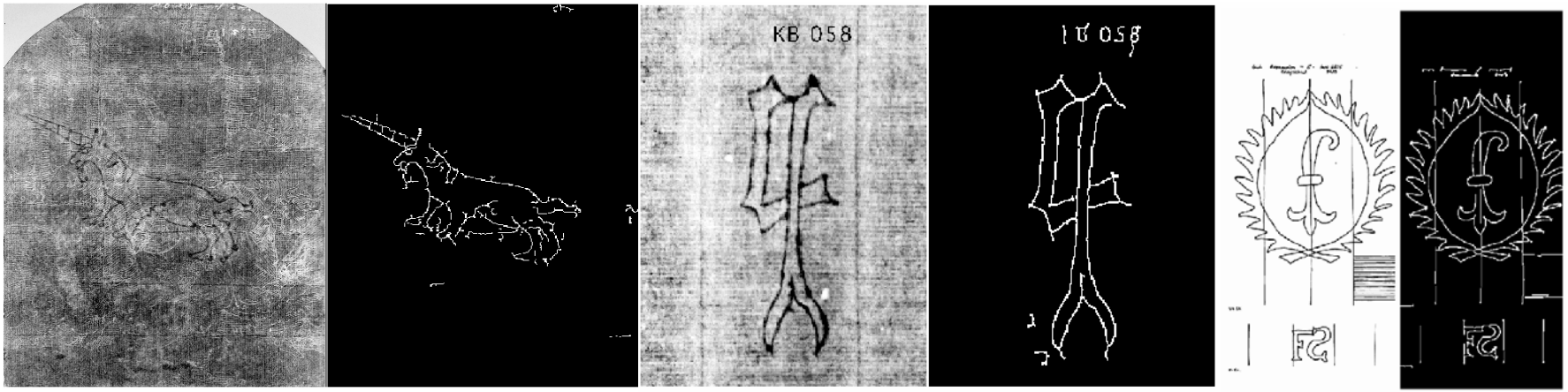

- **ALTHOUGH RESULTS ARE BETTER THAN KNOWN UNTIL NOW, ALL KNOWN METHODS FOR WATERMARK DETECTION ARE TOO OPTIMISTIC OR APPLIED TO EASY CASES (compare Wenger et al. ICHIM 01)**

- **SUITABLE IN CASE OF SIMPLE IMAGERY, BINARY IMAGES (PICARD)**

- **AUTOMATIC DETECTION NOT SUITABLE FOR CATALOGUE GENERATION. FOR MATCHING?**

- **SEMI-AUTOMATIC DETECTION METHODS**

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THE WATERMARK PARADOX

	HUMAN BEING	COMPUTER
CHAIN AND LAID LINES	-	+ +
WATERMARK DETECTION	+ +	-
MATCHING	-	+

In the field of watermark research one forgets sometimes that the watermark itself is not of interest, but only the metadata

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THE NEXT STEPS

- **Automatic detection of chain and laid lines and their properties has been solved. The same w.r.t. retrieval on basis of chain and laid lines**

To be done:

- **Semi-automatic watermark detection in gray scale imagery**
- **Automatic watermark detection in binary imagery (e.g. Picard)**
- **Watermark feature extraction (height, width)**
- **Watermark retrieval strategies**
  - **hierarchical search strategies**
  - **feature-based (shape, landmarks)**
  - **context-based (together with paper features)**

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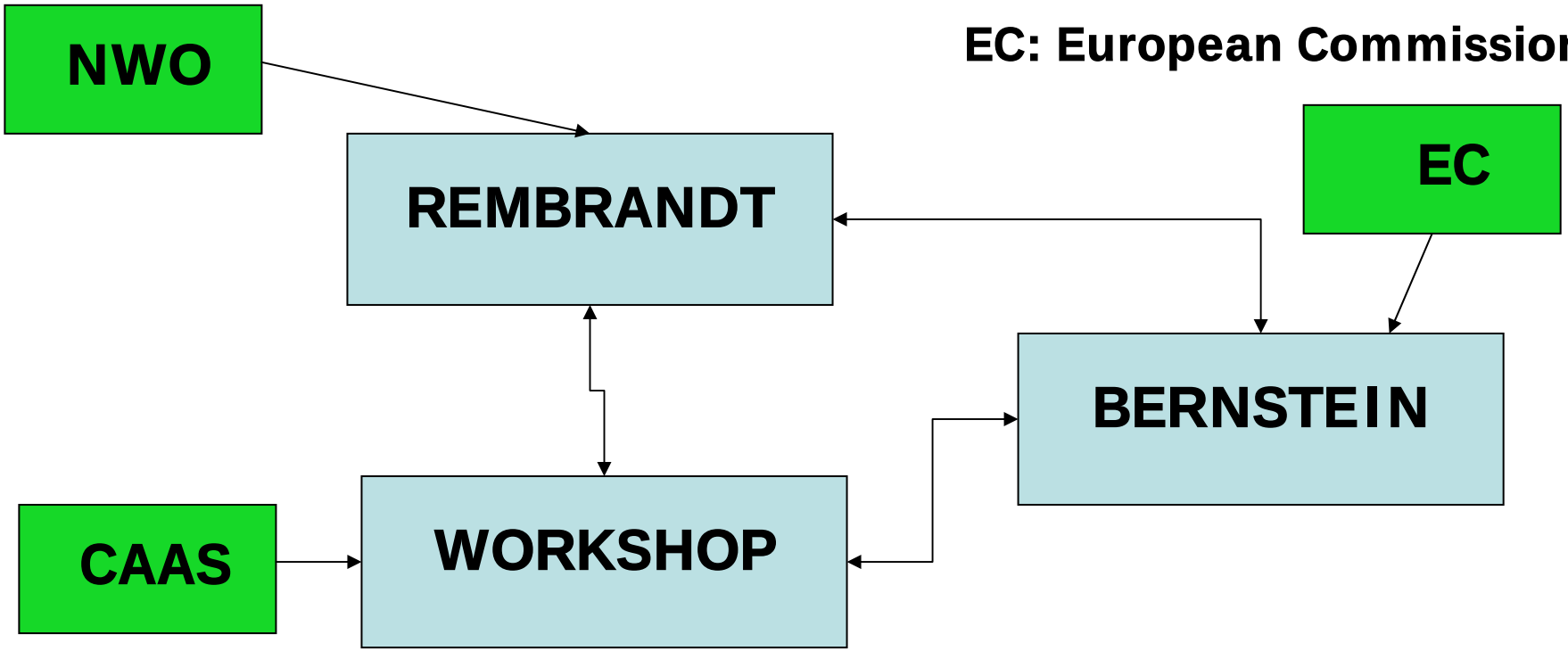
COOPERATION ON PAPER RESEARCH

NWO: Netherlands Council for Scientific Research

EC: European Commission



CAAS: Centre of Art and Archaeological Sciences

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- Jan C.A. van der Lubbe
  J.C.A.vanderLubbe@tudelft.nl
- CAAS Vacancy (from Nov. 1)