

Handwritten Document Image Binarization Competition (H-DIBCO 2014)

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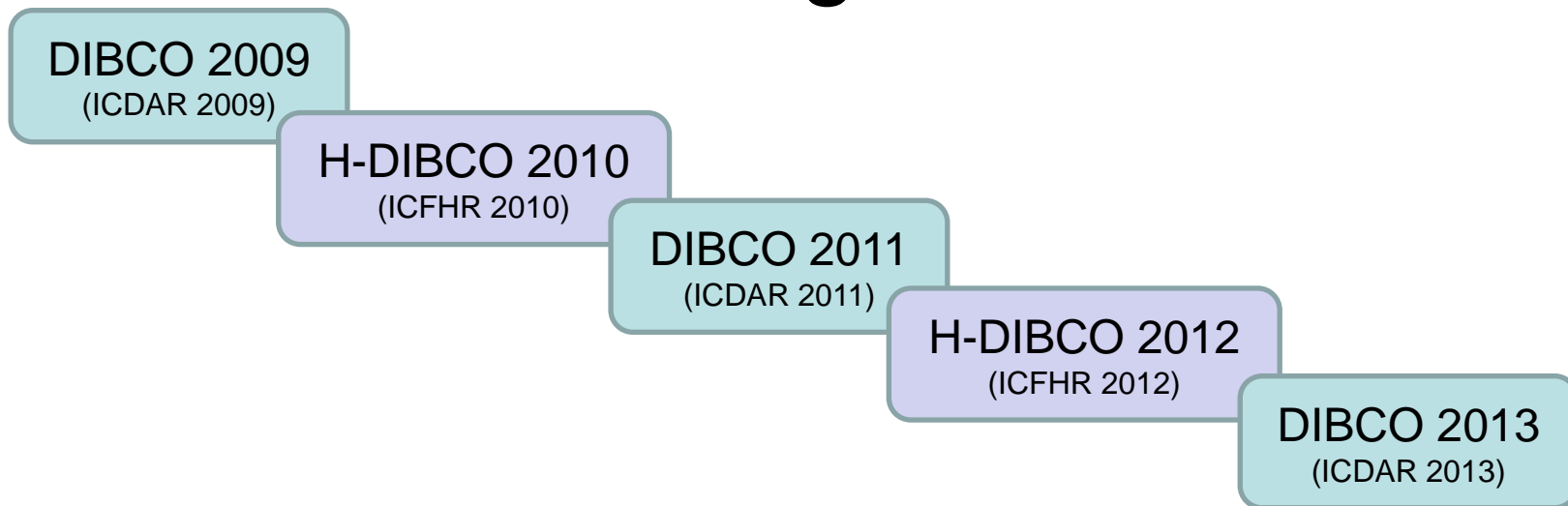


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Department of Electrical and Computer Engineering
Xanthi, GREECE

H-DIBCO 2014
Crete Island, Greece

Background

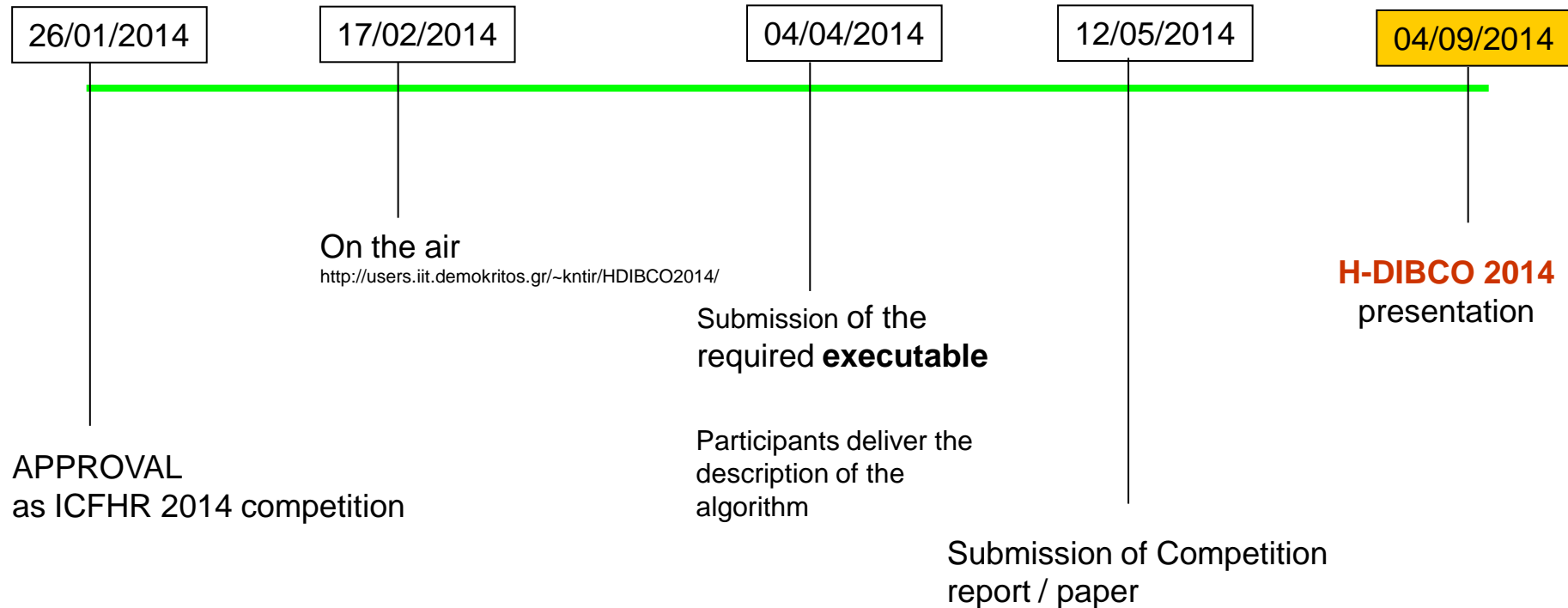


Aim

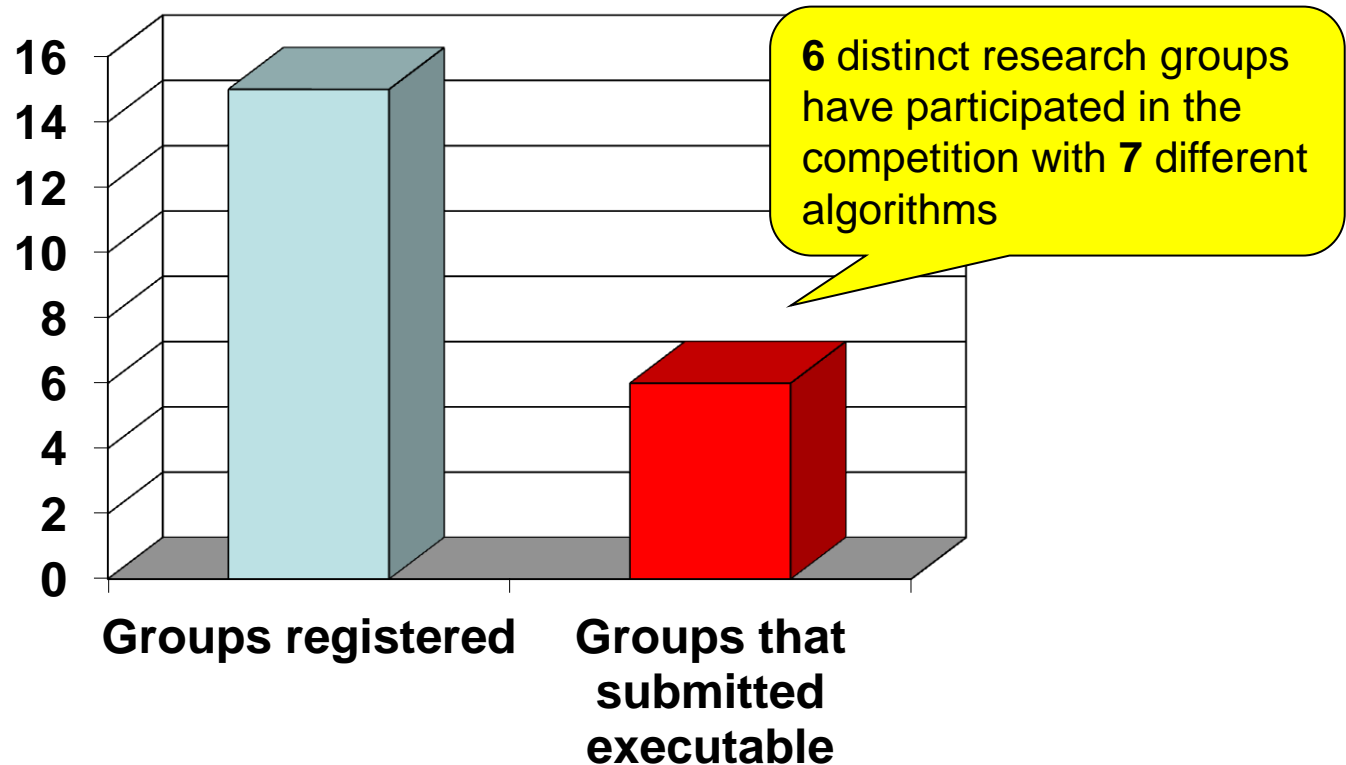
To record recent advances in handwritten document image binarization using

- a benchmarking dataset that is representative of the potential problems which are challenging in the binarization process of handwritten documents
- concrete evaluation performance measures.

Timeline



Participants in numbers





Synchromedia Lab, École de technologie supérieure de University of Québec, Montreal, Quebec, Canada (Hossein Ziaei Nafchi and Reza Farrahi Moghaddam and Mohamed Cheriet)



Smith College, Department of Computer Science, Northampton (MA), USA (Nicholas R. Howe)



Centro de Informática, Universidade Federal de Pernambuco, Brazil (Rafael Galvão Mesquita, Carlos Alexandre Barros de Mello, Ricardo Martins de Abreu Silva, Péricles Barbosa Cunha de Miranda)



Image Processing and Multimedia Laboratory, Dept. of Electrical and Computer Engineering, Democritus University of Thrace, Greece (Nikolaos Mitianoudis and Nikolaos Papamarkos)



Golestan University, Gorgan, Iran (Majid Ziaratban and Fatemeh Bagheri)



Dept. of CSE, University of Kalyani and CVPR Unit, Indian Statistical Institute, India (Chandranath Adak and Bidyut B. Chaudhuri)



Dataset

H-DIBCO 2014 testing dataset consists of **10** document images for which the **associated ground truth** was built for the evaluation.

<http://users.iit.demokritos.gr/~bgat/HDIBCO2014/benchmark>

we created the binary image ground truth following a semi-automatic procedure based on the work in :

K. Ntirogiannis, B. Gatos and I. Pratikakis, “An Objective Evaluation Methodology for Document Image Binarization Techniques”, In *Proc. of the 8th International Workshop on Document Analysis Systems (DAS'08)*, Nara, Japan, September 2008, pp.217-224

Dataset

H-DIBCO 2014 dataset originates from the collections of the TranScriptorium project (<http://transcriptorium.eu/>)

The selection of the images in the current dataset was made so that should contain representative degradations which appear frequently in handwritten documents (e.g. variable background intensity, faint characters, smudge, low contrast, bleed-through)

Handwritten document Image + GT

Linaria Otiris quorundam. 782. 773. 774. } 775.
Linaria . 1^a Pannoniae Clusij. 790 *Linariae tertium genus.*
Linaria tertia Styriae Clusij. 795 *Trago. —*
Linaria Moravica. quarta *Linariae diuersae. de Colon*
Clusij. 797. *Linaria caerulea Apula*
traphilla Colonnae. —

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Handwritten document Image + GT

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Evaluation measures

- F-Measure

$$FM = \frac{2 \times \text{Recall} \times \text{Precision}}{\text{Recall} + \text{Precision}}$$

$$\text{Recall} = \frac{TP}{TP + FN}$$

$$\text{Precision} = \frac{TP}{TP + FP}$$

a measure of how close is an image to another

- PSNR

$$PSNR = 10 \log \left(\frac{C^2}{MSE} \right)$$

$$MSE = \frac{\sum_{x=1}^M \sum_{y=1}^N (I(x, y) - I'(x, y))^2}{MN}$$

measures the visual distortion in binary document images

- Distance Reciprocal Distortion Metric (DRD)

$$DRD = \frac{\sum_{k=1}^S DRD_k}{NUBN}$$

$$DRD_k = \sum_{i=-2}^2 \sum_{j=-2}^2 |GT_k(i, j) - B_k(x, y)| \times W_{Nm}(i, j)$$

- Pseudo (weighted) F-Measure

$$F_{ps} = \frac{2 \cdot R_{ps} \cdot P_{ps}}{R_{ps} + P_{ps}}$$

use distance weights with respect to the contour of the ground-truth

K. Ntirogiannis, B. Gatos and I. Pratikakis, "Performance Evaluation Methodology for Historical Document Image Binarization", IEEE Trans. on Image Proc., vol. 22, no.2, pp. 595-609, Feb. 2013.

Evaluation Results

For the sake of clarity, the complete set of binarization results of each participating binarization method can be found in the following link:

<http://users.iit.demokritos.gr/~bgat/HDIBCO2014/results>

The final ranking was calculated:

- By firstly, sorting the accumulated ranking value for all measures for each test image.
- The summation of all accumulated ranking values for all test images denote the final score

Evaluation Results

Rank	Method	Score	FM (%)	F_{ps} (%)	PSNR	DRD	Time (sec)
1	6	65	96.88	97.65	22.66	0.902	17.43
2	2	70	96.63	97.46	22.40	1.001	7.23
3	5	143	93.35	96.05	19.45	2.194	16.20
4	1	173	89.24	90.71	18.49	4.502	21.19
5	4	189	89.77	90.98	18.46	4.227	14.84
6	3.b	215	86.24	91.46	17.43	5.011	4.65
7	3.a	265	79.54	88.25	15.87	6.639	4.61
-	Otsu	-	91.78	95.74	18.72	2.647	-
-	Sauvola	-	86.83	91.80	17.63	4.896	-



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SMITH
COLLEGE

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ÉTS École de
technologie
supérieure

Synchromedia Lab, École de technologie
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Evaluation Results

Combination of a method that simulates the way the human visual system perceives distant objects and Howe's binarization method.

This algorithm finds the binarization that minimizes a global energy function based upon the image Laplacian, with a smoothness term that incorporates knowledge of the Canny edge locations.



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And the winner is.....

Rafael Galvão Mesquita, Carlos Alexandre Barros de Mello, Ricardo Martins de Abreu Silva, Péricles Barbosa Cunha de Miranda

affiliated to

the Centro de Informática, Universidade Federal de Pernambuco, Brazil

