

Robust Handwriting Extraction From Lecture Video

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Motivation

- New education paradigms bridge technology and traditional teaching.
- Many utilize lecture videos.
- Efficiently processing videos with white/blackboards can improve contrast, readability, reduce memory requirements...

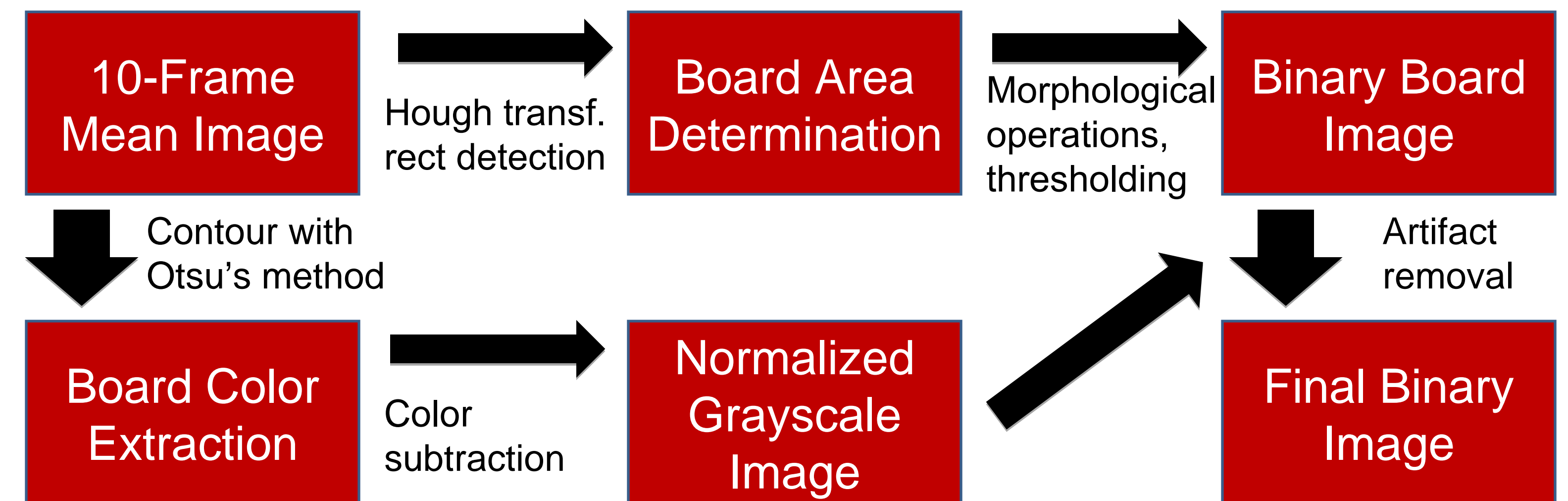
Objective: Develop a robust algorithm for efficient extraction of writing from lectures involving blackboard/whiteboard interaction



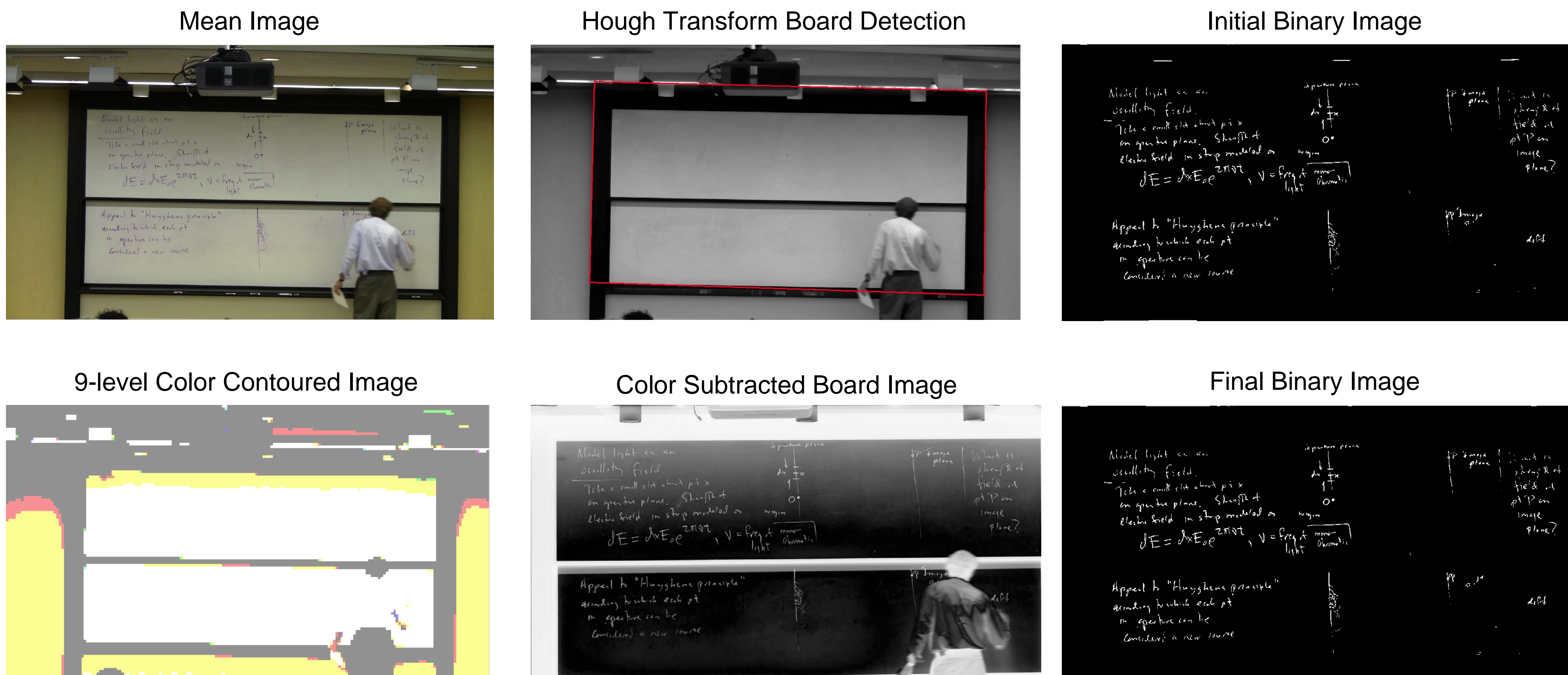
Assumptions

- Fixed camera: no zoom, no panning
- Entire board captured in screen
- Color information of text ignored
- Not too distorted: $80 < \theta < 100$

Handwriting Extraction Algorithm



Experimental Results



Conclusions

- ### Algorithm Performance
- Hough transform and board determination fairly fast (< 2 sec in MATLAB)
 - Algorithm weakens against low-contrast images, uneven lighting, and board smearing.
 - Artifact removal very slow due to high number of morphological and pixel-wise operations.

- ### Future Work
- Remove frame-to-frame redundancies by examining areas (blocks) of change over time.
 - Characterize specific actions - writing, erasing, board moving).
 - Faster artifact removal
 - Rectangle detection for image stabilization (moving camera)

References

- L.W. He and Z. Zhang, "Real-Time Whiteboard Capture and Processing Using a Video Camera for Remote Collaboration," IEEE Transactions on Multimedia, Vol. 9, No. 1 (2007).
- M. Wienecke, G.A. Fink, and G. Sagerer, "Video-based on-line handwriting recognition," Proceedings of International Conference on Document Analysis and Recognition ('01).
- J. Illingworth and J. Kittler, "A Survey of the Hough Transform," J.Computer Vision, Graphics, and Image Processing C44, 87-116 (1988).
- V.F. Leavers and J.F. Boyce, "The Radon transform and its application to shape parameterization in machine vision," Image and Vision Computing Vol. 5, Issue 2 (1987).