Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

An improved motion-compensated restoration method for damaged color motion picture films

Msc Interim Presentation

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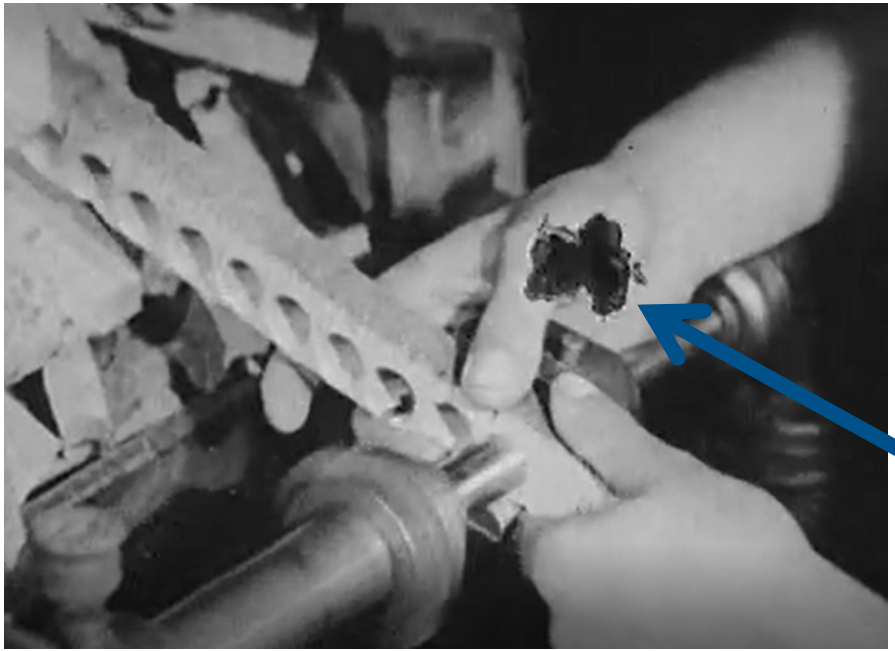
Introduction

This is an old video clip

Restored the Old Films

What is Blotch ？



This is one frame of the video

Blotch

Progress of My Project

1.Reference Reading ✓

2.Motion Estimation Matlab Code(integer-pixel,Half-pixel) ✓

3.The Previous Method in Blotch Detector(SDI,SROD Matlab Code) ✓

4. Fix the image by My method ✓

5.Improve the Algorithm by using the Compressed Information

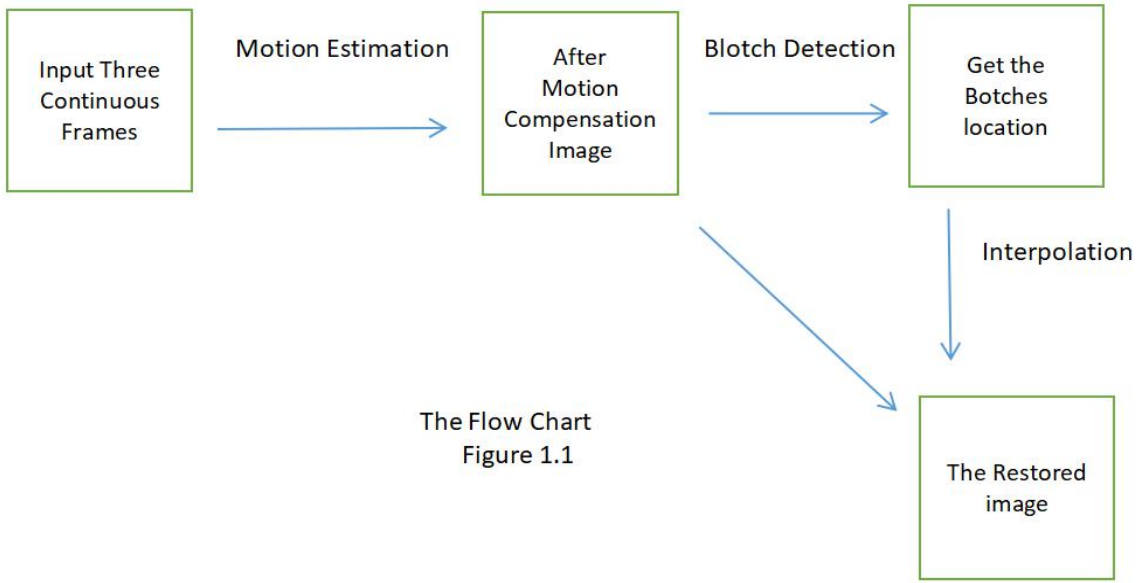
6.Evaluate the Performance of Blotch Detector

7.Write up

Two Main Part Of Work

Finding Blotches

Deblotching



The Flow Chart
Figure 1.1

Block Matching Algorithm

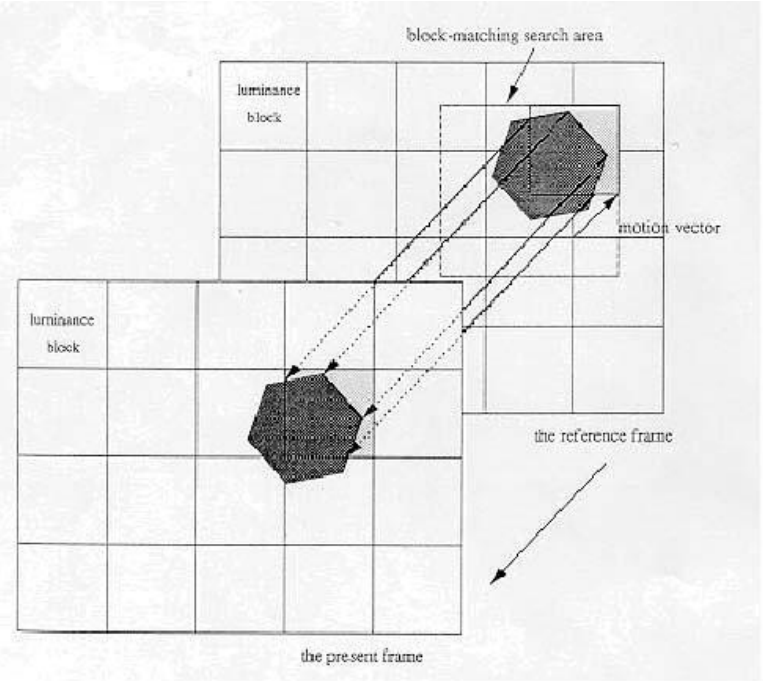
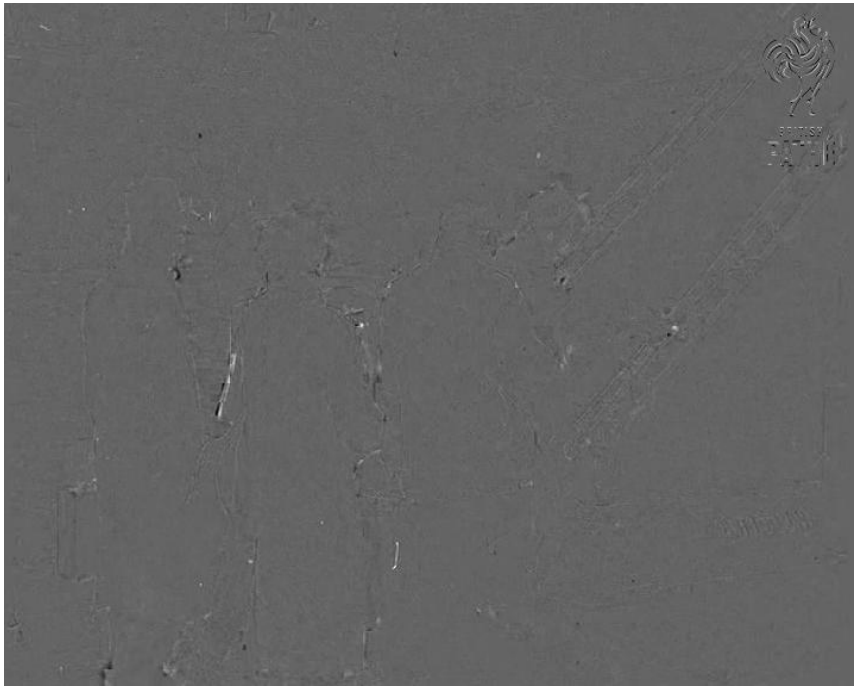


Figure 1.1

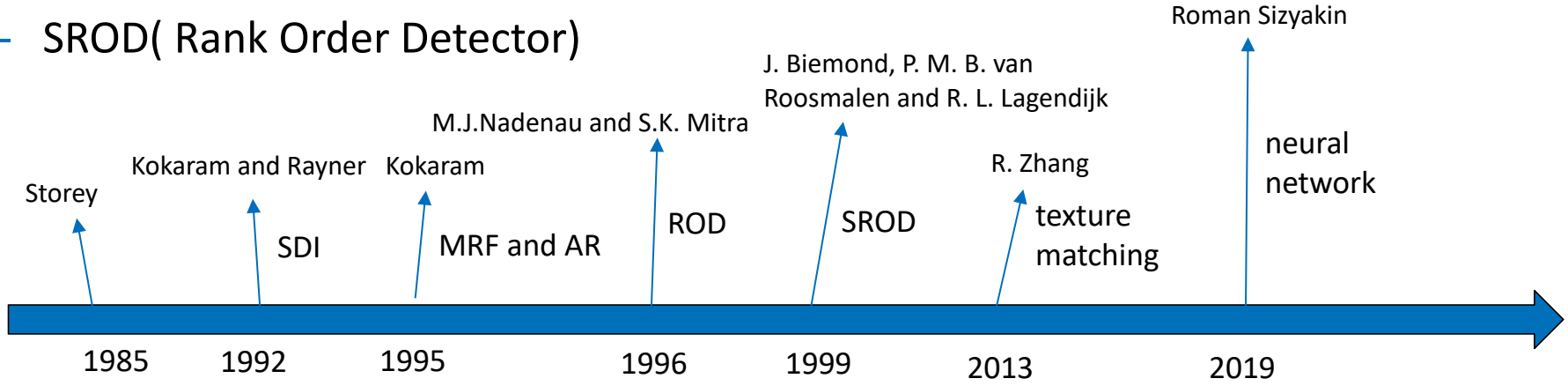
$$\text{Mean Absolute Difference (MAD)} = \frac{1}{N^2}\sum_{i=0}^{n-1}\sum_{j=0}^{n-1}|C_{ij} - R_{ij}|$$

The Motion Vector and Error Image

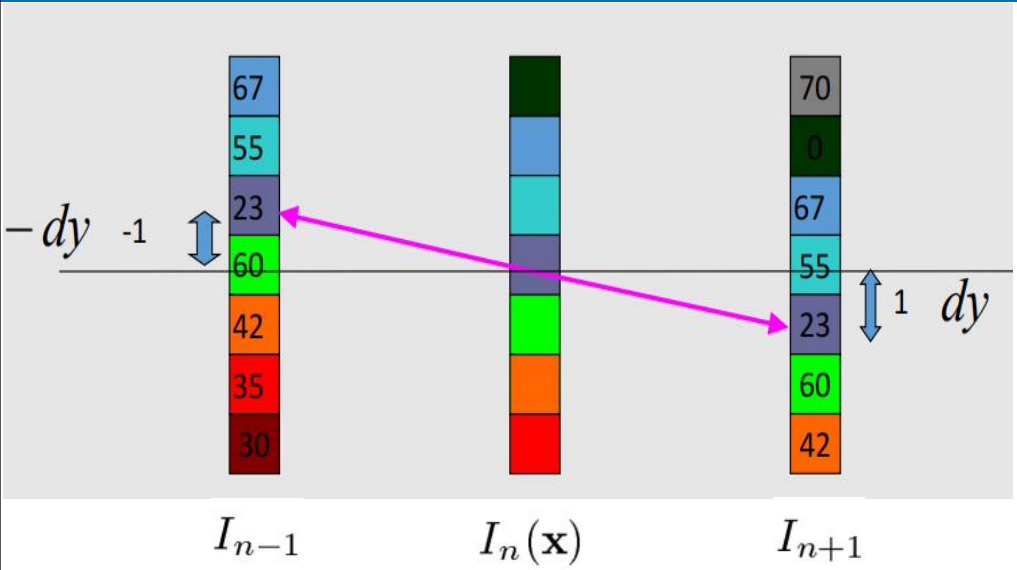


Blotch Detection(Previous Work)

- SDI(Spike-Detector Index)
- SROD(Rank Order Detector)



SDI (Spike-Detector Index)

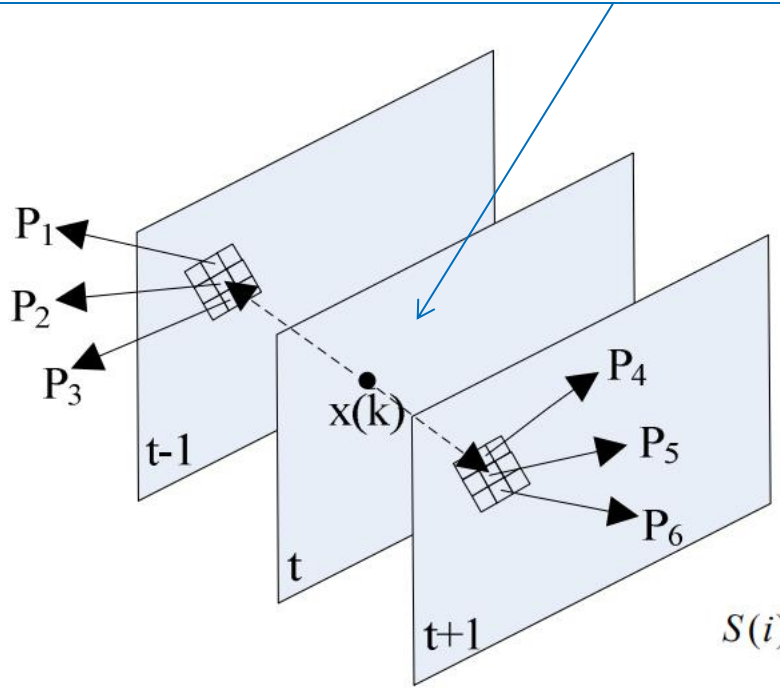


$$b_{\mathrm{SDIa}}(\mathbf{x}) = \begin{cases} 1 & \text{for } (|E_b| > E_t) \text{ AND } (|E_f| > E_t) \\ 0 & \text{otherwise} \end{cases}$$

$$E_b = I_n(\mathbf{x}) - I_{n-1}(\mathbf{x} + \mathbf{d}_{n,n-1}(\mathbf{x}))$$

$$E_f = I_n(\mathbf{x}) - I_{n+1}(\mathbf{x} + \mathbf{d}_{n,n+1}(\mathbf{x}))$$

SROD (Rank Order Detector)



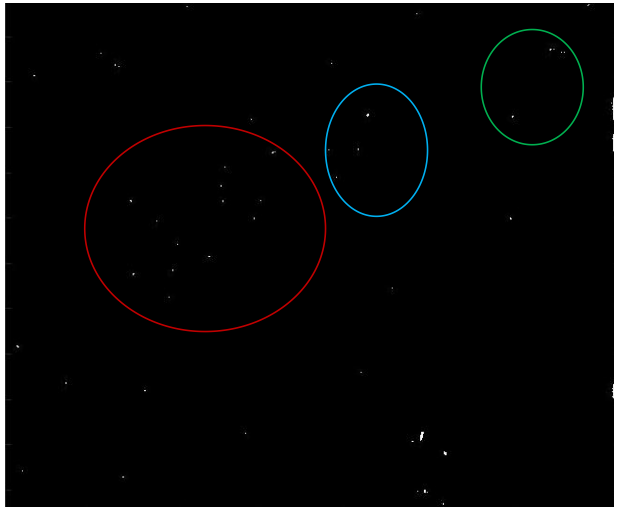
$$
\begin{aligned}
p_1 &= I_{n-1}(\mathbf{x} + \mathbf{d}_{n,n-1}(\mathbf{x}) + [0\ 0]) \\
p_2 &= I_{n-1}(\mathbf{x} + \mathbf{d}_{n,n-1}(\mathbf{x}) + [0\ 1]) \\
p_3 &= I_{n-1}(\mathbf{x} + \mathbf{d}_{n,n-1}(\mathbf{x}) + [0\ -1]) \\
p_4 &= I_{n+1}(\mathbf{x} + \mathbf{d}_{n,n+1}(\mathbf{x}) + [0\ 0]) \\
p_5 &= I_{n+1}(\mathbf{x} + \mathbf{d}_{n,n+1}(\mathbf{x}) + [0\ 1]) \\
p_6 &= I_{n+1}(\mathbf{x} + \mathbf{d}_{n,n+1}(\mathbf{x}) + [0\ -1])
\end{aligned}
$$

$$
S(i) = \begin{cases} 1 & if\ \left|Z(i) - \min(p_k)\right| > T_1\ \ and\ \ \left|\max(p_k) - Z(i)\right| > T_1 \\ 0 & otherwise \end{cases}
$$

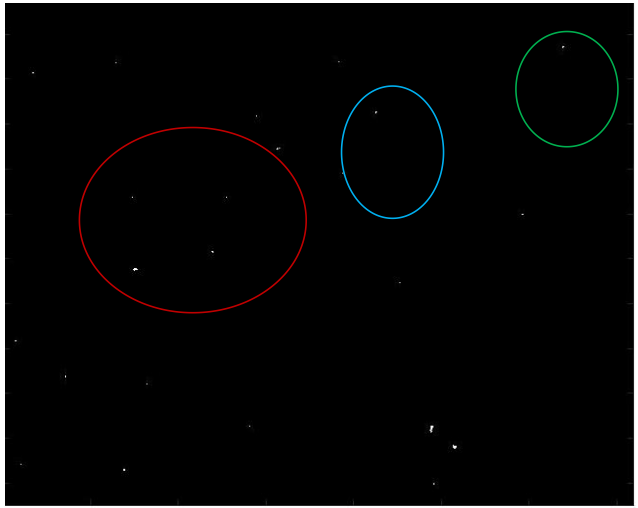
Fig. 1 The selection of reference pixels p_k

The Result

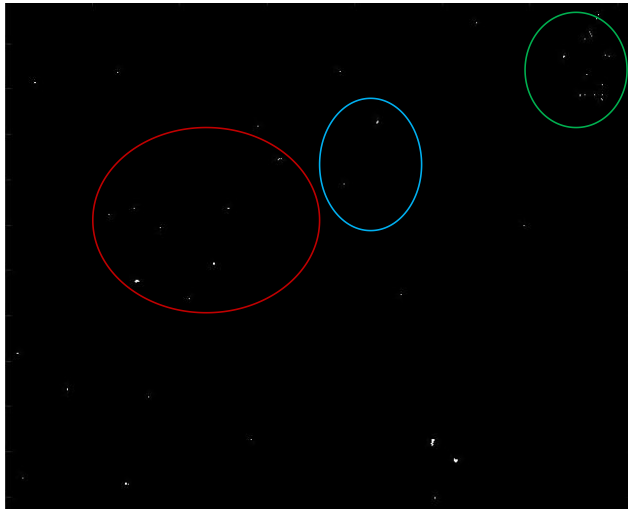
All Based On The Exhaustive Block Matching Algorithm



SDI Method



SROD Method



SROD Method
Half-pel

The Difference

Based On Exhaustive Block Matching Algorithm

Current Frame

Fixed Frame

Reference

1.R.Storey - Electronic detection and concealment of film dirt. Smpte Journal. pp.642-647. 1985

2.Kokaram AC, Rayner PJW. - A system for the removal of the implusive noise in image sequences.1992

3.GangalA，KayikciogluT，DizdarogluB. An improved motion compensated restoration method for damaged color motion picture films. 2004

4. A. C. Kokaram, R. D. Morris, W. J. Fitzgerald and P. J. W. Rayner, "Detection of missing data in image sequences," in IEEE Transactions on Image Processing, vol. 4, no. 11, pp. 1496-1508, Nov. 1995.

5. A. Buadès, J. Delon, Y. Gousseau and S. Masnou, "Adaptive blotches detection for film restoration," 2010 IEEE International Conference on Image Processing, Hong Kong, 2010, pp. 3317-3320.

6. X. Li, R. Zhang and Y. Zhang, "The detection of blotches in old movies," 2013 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference, Kaohsiung, 2013, pp. 1-7.

7. Roman Sizyakin , Viacheslav Voronin, Nikolay Gapon , Marina Pismenskova , Alexey Nadykto , "A blotch detection method for archive video restoration using a neural network," Proc. SPIE 11041, Eleventh International Conference on Machine Vision (ICMV 2018), 110410W (15 March 2019); https://doi.org/10.1117/12.2522807

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Thank You