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# Detection of Line Scratch in Video

Ms. Jare Dipali Y[1], Ms. Khadse Shweta S[2], Ms. Sawant Kalyani M[3],
Ms. Sayyed Sumaiya S[4], Prof. R. V. Panchal[5]
(Department of Computer Engineering, VPCOE,Baramati,PuneUniversity)

## Abstract:

Most common defects are flicker, dirt, dust and line scratches.Here we consider line scratch detection.Line scratches appear as thin bright or dark line.This line are usually straight and vertical.The restoration of old videos is based on primary interest because of great quantity of old film records. But manual digital restoration of videos is time consuming process. To detect the scratch in films or video is very difficult task because of the various characteristics of the detected defects. There are main problems created during line scratch detection like sensitivity to noise and texture or some time wrong detection due to thin structure related to scene. In this method, robust and automatic algorithm for frame scratch detection in videos and an temporal algorithm for filtering wrong detection is applied. Hence in this, there is relax some of the techniques used for detection which causes more number of scratches are detected. In this way effectiveness and lack of some external parameters are acquire by combining of a contrario methodology as well as local statistical estimation. In this way ,scratch detection in textures is reduced fast.The filtering algorithm eliminates wrong detection due to vertical structure by exploiting the coherence of motion in videos.

*Keywords* — **Film Restoration,Line Scratches,Adaptive Detection,A Contrario Methods,Affne Motion Estimation.**

## I. INTRODUCTION

To detect the scratch in films or video is very difficult task because of the various characteristics of the detected defects. There are main problems created during line scratch detection like sensitivity to noise and texture or some time wrong detection due to thin structure related to scene. Inthis method, robust and automatic algorithm for frame scratch detection in videos and an temporal algorithm for filtering wrong detection is applied.

## II. MOTIVATION

1.2.1 Multidirectional detection of scratches in digitized images is also having some disadvantages. These disadvantages are as follows:

(a) No temporal information can be used for detection.

(b) This method can detect line scratch regardless of their orientation.

(c) This method label the pixels that belong to scratch.

1.2.2. Scratch detection via under damped harmonic motion is also one of the method for detection of line scratch But it also has some problem .

(a) This method uses second order differential equation.

(b) But it is not clear thats why second order differential equation is necessary.

(c) False alarm rejection problem is not addressed.

1.2.3. Generalized model for scratch detection is the adaptive threshold for detection. But problem with this method is that detection rate worse than previous methods.

4. These are some algorithms which are not good to detect the line scratch in video.

5.Spatial line scratch detection algorithm and temporal filtering algorithm to detect the line scratch in video is good method.

6. Temporal filtering algorithm is used for filtering wrong detection in video.

## III. LITERATURE SURVEY

1. Robust Automatic Line Scratch Detection in Films is the base paper which gives a solution for scratch detection and how to avoid false detection from video. This paper also proposed Frame-By-Frame scratch detection algorithm which detects scratches and temporal filtering algorithm which removes scratches from videos.[1]

2. Automatic Line Scratch Detection and Removal in Digitized Film Sequence is another paper which mainly focuses on increasing quality of a video by using techniques for scratch detection and removing those scratches from videos. Pixel scratch detection technique is used for scratch detection. From the detected scratch pixel we can identify the shape and using that we remove false detections. Then by comparing motion of object, we can remove false alarm And finally pixel filling technique is used to remove the detected scratches.[2]

3. Temporal algorithm discussed in Film line scratch removal using Kalman filtering and Bayesian restoration is another paper to validate the detections while detection of scratches. This paper proposed the proper process for detection and removal of line scratches . Detection of the scratch is two step process , firstly determine candidate line scratches . Then these candidate line scratches are tracked using Kalman filter to avoid false scratches. Disadvantage of this system is that if there is any change made in initial step of kalman filtering algorithm and if any problem occur in it then whole system may suffer at the end of algorithm. [3]

4. Automatic scratch detection and removal of scratches for archive sequences is discussed inScratch detection via temporal coherency analysis and removal using edge priority based interpolation. Temporal coherency technique is proposed to get scratch positions. When restoration of particular video is in progress spatial and temporal information is considered.[4]

5. Median filtering technique is discussed inA method of scratch removal from old movie film using variant window by Hough transform for removal of scratches after detecting it. But during removal of scratches there may be sometime deformation of the unexpected area is happened ,so to avoid this median filter is used and also window technique is used for interpolation of signal with variable. For detecting straight line element around the scratch Hough transform is used. Median filtering is performed after definite line element. So film scratches are effectively removed by the combination of detection and filtering technique.[5]

6. Advances in Automated Restoration of Archived Material. proposed idea for line scratch detection in which it considers spatial detailed information by considering frame-by- frame analysis. And for betterment of result it also considers motion information.[6]

7. Detection and removal of line scratches in degraded motion picture sequencesgives the basic idea of model for line scratch detection. This method is proposed bye Kokaram. Problem with this system is that:
(a) Unclear how the cross section is obtained.
(b) Statistical step may be long.
(c) Unclear how scene feature are rejected, rejection is based on line brightness only, which does not differentiate line features from line scratches.

8. Multidirectional detection of scratches in digitized images is also having some disadvantages.
This disadvantages are follows:
(a) No temporal information can be used for detection.
(b) This method can detect line scratch regardless of their orientation.
(c) This method label the pixels that belong to scratch.

9. Scratch detection via underdamped harmonic motion. is also one of the method for detection of line scratch. But it also has some problem.
(a) This method uses second order differential equation.
(b) But it is not clear that why second order differential equation is necessary.
(c) False alarm rejection problem is not addressed.

10. Generalized model for scratch detection is the adaptive threshold for detection. But problem with this method is that detection rate worse than previous methods.

**2.1. Mathematical Formulation ::** There must be a be a system that help user to identify the scratch in the black and white as well as color videos. User should have facility to remove scratches from the video. These scratches must be vertical one. Hence proposed system should detect as well as remove vertical scratch from videos. The proposed algorithm is composed of two steps.First step is a pixel-wise scratch detection step, where method decide whether each pixel is potentially part of a line scratch. After this, secomd step is method use a contrario methods to group the scratch pixels into visually significant scratch segments. The resulting grouping procedure is both automatic and adaptive and could be applied to different detection tasks.

**2.1.1. Detection of line scratch Pixel-wise**

First of all, this technique introduce a test to distinguish potential scratch points from other pixel The method presented here is a variant of the classical test used by Kokaram [14],
which thresholds the following difference :
$e(x;y) = Gs(x;y)-Ms(x;y)$;
where , $Gs(x; y)$
Is a vertically sub sampled version of the input image, and $Ms(x; y)q$ is a horizontally median filtered version of $Gs(x; y)$. This criterion determines whether the considered pixel is visibly out of sync with its horizontal surroundings. this technique change this difference slightly, by taking the median value of a local horizontal neighborhood without the value of the pixel in question. This avoids the pixel having any influence on the median value. Also, technique prefer to use a 3x3 Gaussian filter for noise reduction rather than vertical sub sampling, in order to retain as much information about the scratch as possible. While this step induces some loss in precision, it is
necessary due to the high amounts of noise and film grain in old films. Unfortunately, this criterion alone may detect unwanted edges.

To avoid this, another criterion concerning the average grey level values either side of the scratch is used. this method stipulate that these averages must be coherent to a certain extent, to avoid detecting intensity fronts. A visual illustration of our pixel wise detection criteria may be seen in The previous criteria may be expressed as follows.
Let $Ig(x; y)$ be the Gaussian filtered grey level image. Let $Im(x; y)$ denote the median value over a local horizontal neighborhood of pixel (x;y), and $Il(x; y)$ and $Ir(x; y)$ be the left and right horizontal averages. The two Boolean criteria are
$c1(x;y) : |Ig(x;y)-Im(x;y)| > Smed$
$c2(x;y) : |Il(x;y)-Ir(x;y)| < Savg$
where, smed and savg are grey-level thresholds. technique therefore define the
binary image as
$IB(x;y) = f10$
$1 = c1(x;y) and c2(x;y)$
$0 = Otherwise$
In the present algorithm, the median filter has a width of 5 pixels and the value of smed is set to 3. These values appeared to us to be good empirical choices. The left and right averages are each taken over 3 pixels on either side of the 5 central pixels,
and savg has been experimentally set to 20. Once this binary detection image is obtained. In this white points are detected as potential scratch pixels whereas the black points are not. Once such a detection image is obtained, the points must be grouped into significant scratch segments.

**2.1.2.Grouping and validation by scratch point :**

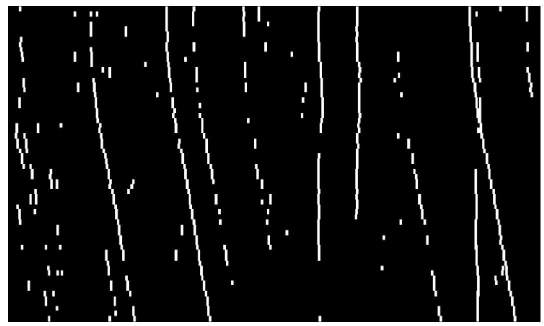

fig (1)(a) Original detections (IT )

fig (1)(b) Realigned detections (I'T )

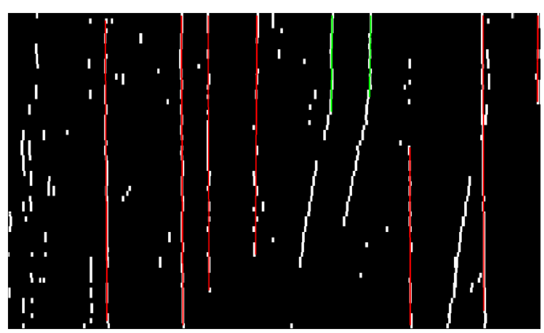

fig (1)(c) Detected trajectories. In red false alarms, in green true scratches.

fig(1)(d) Final filtered detections

Because of false detections due to noise and texture, a robust approach is needed to group the pixels into segments. One may do this by using the Hough transform. Unfortunately this method has some serious drawbacks Due to false discoveries because of noise and texture, an amazingly vigorous methodology is expected to grouping the pixels into segments.

A well-known methods in the most extraordinary systems for recognizing unmistakable lines in binary images is the Hough transform, and this is utilized for the grouping of scratch identifications. Unfortunately, this methodology contains edges which need to be tuned from succession to grouping, and does not offer an exact spatial localisation of line segments. With a specific end goal to grouping the pixelwise location, this technique swing to a more complex arrangement of strategies known as a contrario method, utilized for alignment detection.In a word, the contrario methodology is a generic approach to thresholds distinguish visual objects in digital images. Detection are situated keeping in mind the end goal to control the quantity of false location in white noise image, or all the more by and large under a background model. This model as a rule depends on a freedom assumption on the essential elements to be grouped for the detection. A group is approved when it is impossible that this grouping has been produced by the background model. That is, groupings are identified when they are impossible under the theory that essential components are independent. Most importantly, this method show the a contrarious approach as it is utilized to recognize line fragments. For this situation, the basic elements to be grouped are pixels, and segments are identified as groups of pixels whose gradients are perpendicular to provided direction. Given a line segment made of l pixels, a variable $x_i$ is related to every pixel. The variable $x_i$ is equivalent to 1 if the pixel is aligned to the fragment and 0 generally. Aligned pixels are those whose gradient orientation is orthogonal to the segment orientation, up to some angular precision p radians with

p [0, 1]. Let $s = x_1 + \ldots + x_l$ be the number of aligned pixels. This is the amount of the identification of portions is based. Bigger estimations of s are related to more important line segments. Presently, the discovery of segments set thresholds that rely on upon l and p and are in this manner non-inconsequentially set. The point of the contrario methodology is decisively to situated these limits. The identification depends on the probability distribution of s under some background model. On account of line portions as portrayed in, the background model indicates that all angle introductions are autonomous and take after a uniform appropriation in [0,2]. This is the situation, for instance, in a in a Gaussian white noise image. As above, we consider a fragment made of l pixels In the Locally Adaptive Grouping for Line Scratch

Detection now depend on the same standards to grouping pixels that have been identified by the pixel-wise technique. The introduction grouping, the background model relates to a picture where the direction of the gradients is randomly and uniformly distributed. This critical theory represents circumstances in which dont wish to recognize alignments. On account of maximality, the past recognition methodology, numerous excess portions are recognized. This is on the grounds that an exceptionally significant fragment frequently contains, and is contained by different sections which are -important. So as to keep just the best discovery for such cases, we utilize the idea of maximality. A fragment is maximal significant on the off chance that it neither contains, nor is contained, by a section which is more important. In

this way, we just acknowledge sections which have this property. Along these lines the computational expense, is significantly lessened. This outcome depends on the properties of the binomial law. In Exclusion Principle, since scratches have a width of a few pixels, distinctive sections may relate to the same scratch. Since for restoration purposes we would like as exact a representation of the scratches as could be expected under the circumstances, we utilize a prohibition standard as characterized, which expresses that a pixel may have a place with one scratch just. On the off chance that a pixel s is contained by a few fragments, then the most significant portion holds s. Every other fragment which contains s has this pixel removed. Those that are no more -significant are discarded. This standard can be connected not just to pixels which have a place with a few portions, additionally to those which are at a separation of x from more than one fragment. In our examinations, we set x to three pixels. Temporal Filtering Algorithm: Despite the fact that the past calculation identifies line scratches with great spatial exactness and is vigorous to commotion and composition, it doesn't manage the issue of false alerts because of slight vertical structures that are a piece of the caught scene. On a frame-by frame basis, these nearly look like line scratches. In a few circumstances, it is basically difficult to separate the two without former learning concerning the scene structure. Unfortunately this kind of learning is hard to get and utilization. One other approach to recognize genuine and false scratches is to utilize use temporal information contained in the image sequence. Since scratches are brought on by physical harm to the real film, their movement is totally autonomous of that of the scene. In this way, any detections displaying motion which is coherent with the scene should related to false discoveries.

Thus, this technique dismiss any scratch discoveries having a direction which adjusts to the predominant scene movement. technique shall refer to this criterion as the movement coherence criterion. This standard does not manage scratches which move with the scene, or are totally still in a static scene. However, such circumstances are difficult to determine without earlier learning on the way of scratches. The real challenge when utilizing motion information for scratch filtering is deciding the directions of genuine and/or false discoveries. This is an exceptionally troublesome assignment on account of genuine scratches because of the generic nature of the directions of line scratches. Rather, we might attempt to focus the directions of false detections. In all that follows, assume that a scratch locator gives the beginning identifications. In this work, regularly utilize the detection scheme; however it should be noticed that it is conceivable to utilize any spatial detection scheme in the writing, in spite of the fact that the outcomes may be more terrible if pixel accuracy discoveries are not given. For temporal filtering purposes, here speak to a scratch location by its normal segment position and the list of the frame in which it is found. Give it a chance to be the xt paired location guide of the identified scratches. For a sample of this representation, Let S speak to an initial scratch detection . We refer to this as a segment.. Let x(S) and y(S) be the average column and row indices of the segment and t (S) denote the frame in which the segment was detected. The main step of the proposed temporal filtering is to focus the trajectories of the false recognitions, a non-inconsequential undertaking given the abnormality of the detection map. As opposed to deciding the directions in IT, make another binary map in which the positions of the segments are realigned as for an expected global scene motion. Let call this new detection map IT. Before expressly characterizing the new detection map, let us watch that the positions of false identifications will show up as straight vertical lines, because of the movement cognizance theory. For a sample of IT , The issue of identifying straight, vertical lines in picture is significantly more compelled than taking after non generic trajectories, and thusly simpler to explain. This movement estimation is completed between every frame to frame pair of all through the image succession. The identification likewise ensures an exact and interesting portrayal of the directions, utilizing the maximality and exclusion principles defined. The maximality standard infers that trajectories with temporal holes may be grouped together, furthermore that the starting and end purposes of the trajectories can be identified heartily. By utilizing the exclusion principle, just the best representation inside a certain neighborhood will be picked, which abstains from needing to make troublesome choices if directions are excessively near to one another. A median filter is effective for removing isolated noises. Suppose that and the area of an image with a black vertical scratch is given as shown in Fig. 1(a). Here the image area is enlarged to show the details and each small square corresponds to an image pixel. If a one-dimensional horizontal median filter is applied, the vertical black line can be removed as shown in (b) and the image is restored completely. Here, the window size of the median filter is supposed to be larger than or equal to 2M+1, where he width of the scratch is M. However, if the image area contains an object as shown in Fig.1(c) and scratch is added as (d), the median filter distorts the object as shown in (e). Here the picture territory is

expanded to demonstrate the subtle elements and every little square compares to a picture pixel. The median filter will just replaces the
pixel esteem with the mean of neighbouring pixel values; it replaces it with the median of those qualities. The median is figured by first sorting all the pixel values from the encompassing neighborhood into numerical request and after that then replacing the pixel being considered with the middle pixel value .(On the off chance that the neighborhood under thought contains a significantly number of pixels, the normal of the two centre pixel qualitys utilized.) This method first detects scratches, and then interpolates the pixels on scratch with a one dimensional median filter. The direction
of the filter window is obtained by Hough transform, so that the median window contains a straight line element crossing the detected scratch. If a line element is not detected on the scratch, usual one dimensional median filter with a horizontal

## IV. CONCLUSION

To conclude, we still lose object details when it is moving very fast, yet for old time motion pictures the original frame is also very blurry too, so perhaps a high quality rendering for such kind of situation is hard to achieve anyway. As for near-static scenes or those with slow camera panning or zooming, which is typically applied photographing skills in the old days, the results is very satisfactory. Frequently appearing blotches that flicker around the scene almost disappear and as a by product of temporal median filtering the whole scene is denoised in general and instability of scene illumination, which is another annoying artifact of digitized BW motion pictures, is also alleviated to some extent. In terms of computational cost, the block matching full search is obviously bottleneck of the system. However our joint motion/noise detection stage helped to reduce
the number of needed motion estimation by a factor of ?? for static scene and ?? in general. One further saving might be achieved by using log search methods or apply the redundancy between forward and backward motion vector fields and predict from each other, or by applying iterative OFE methods with the prediction as an initial guess. It should also be pointed out that the block-matching method still seem to yield inaccurate motion estimation result and thus affect the recovery of distortions by temporal median filtering. One way to improve it is to try half-pixel accuracy motion vector values, which shall cost more computation or another way is to apply original frame pixels directly on positions where distortion occur. I have tried joint edge detection of the difference frame between original and filtered version as well as the difference between temporally adjacent frames and then imposing original pixel values on the median filtered ones at detected regions. Initial results have better recovery of the blurring effect but quality of the processed video rely heavily on the performance of edge detection. Further research might be conducted to find better edge detection and maybe try with a combination method again to reduce the distortion.

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