

Transition Based on Histogram Properties

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Abstract: - Shot transition in a video refers to how the shot changes. Shot transition is classified as abrupt and gradual transitions. To detect these transitions, various methods have been proposed, which are discussed in the literature survey. This paper deals only with gradual transition, i.e. Dissolve, Fade & Wipe. With the help of Histogram properties like mean, contrast, entropy, skewness, kurtosis and visibility, the authors try to individuate each gradual transition.

Key words: - Shot transition, Shot detection, Histogram properties.

I. INTRODUCTION

Video is a sequence of interlinked images. A shot in a digital video sequence is defined as a set of images (frames) from a single camera i.e. a shot is a result of uninterrupted camera work. Shot change detection also known as shot transition is the procedure for identifying changes in the scene content of a video sequence. There are mainly two transitions between shots, abrupt shot cut, and gradual transition. Gradual transitions are Fade, Wipe, and Dissolve.

An image histogram is the graphical representation of frequency count of the pixels in a digital image. Based on the graphical representation certain properties called statistical properties/histogram properties are derived. These properties are used to individuate the gradual transitions, fade, wipe and dissolve.

II. LITERATURE SURVEY

Salim Chavan, Sadik Fanan, Dr. Sudhir Akojwar [1] in their *Wipe Transition Detection Algorithms*, they have given a detailed survey of wipe detection algorithms along with their advantages and disadvantages.

Adnan M. Alattar in their *Detecting and Compressing Dissolve Regions in Video Sequences with a DVI Multimedia Image Compression Algorithm* [2] have proposed a dissolve detector and dissolve handling mechanism. The dissolve detector exploits the parabolic behavior of the variances of the frames in a dissolve region to differentiate it from the rest of the group.

Miss. Mikhal Rakshaskar, Prof. Salim Chavan [3] in their *Comparative Study of Various Algorithms for Detection of Fades in Video Sequences* have done a survey on various fade detection algorithms.

Chong-Wah Ngo, Ting-Chuen Pong, and Roland T. Chin [4] have presented a novel approach for video shot detection, based on the analysis of temporal slices which are extracted from the video by slicing through the sequence of video frames and collecting temporal signatures.

Jordi Mas and Gabriel Fernandez [5] have presented a method for video shot boundary detection based on color histogram differences in *Video Shot Boundary Detection Bases on Color Histogram*. It provides a simple and fast growing algorithms in real time.

Li Yufeng, Yang Yinghua, Li Guiju [6] have proposed a Wavelet Transform Method in which wipe transition was considered as vital mode of gradual transition. In the intended idea, each frame of color sub-image and edge sub-image are decomposed with the aid of Db-4 wavelet transition.

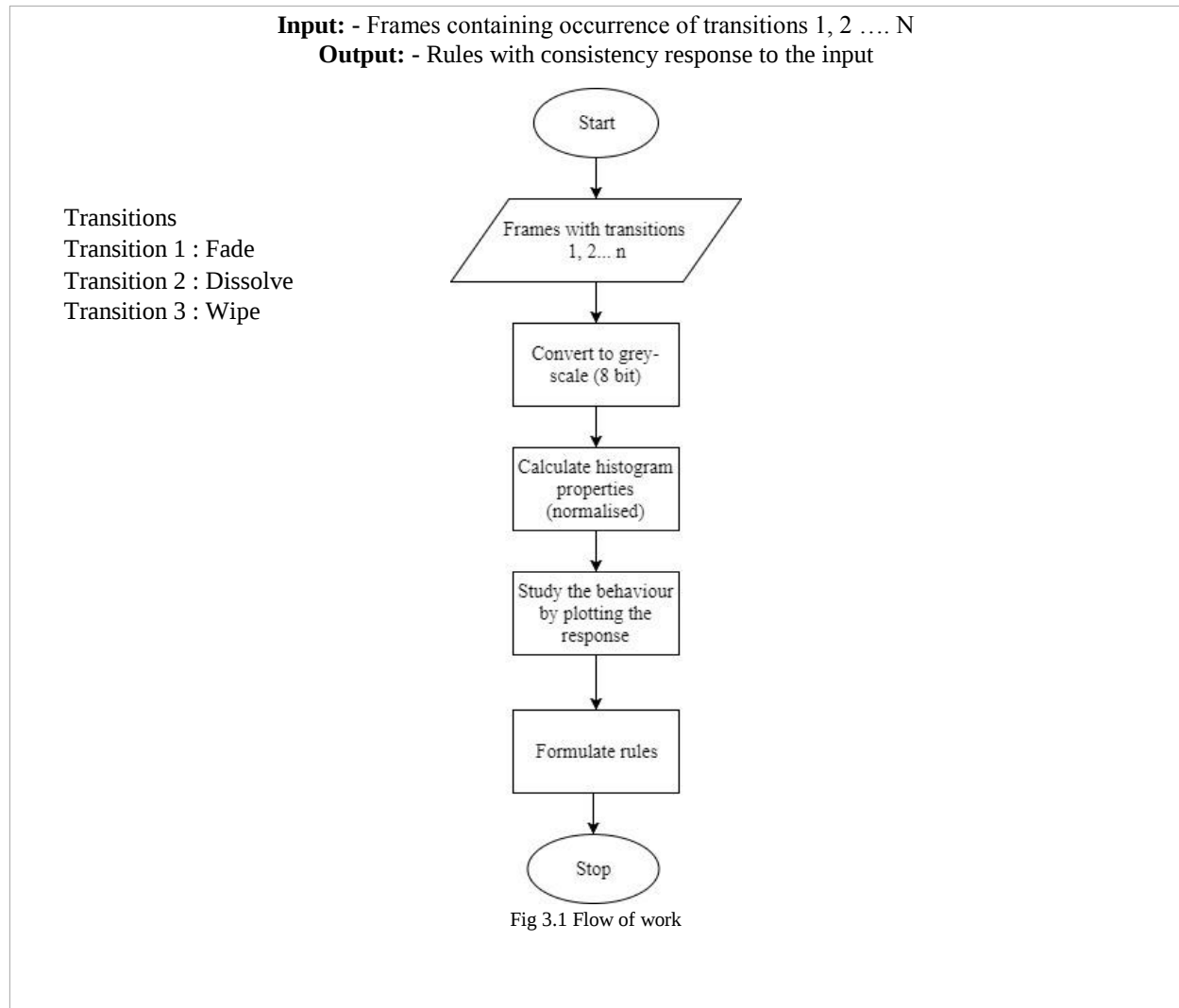
Sarah Porter, Majid Mirmehdi & Barry Thomas [7] have used the Average Inter-Frame Correlation Coefficient and Block-Based Motion Estimation to track image blocks through the video sequence and to distinguish changes caused by shot transitions from those caused by camera and object motion.

III. OBJECTIVE OF THE WORK

The main objective of this paper is to build a model that will find different gradual transitions namely fade, dissolve and wipe. For hard-cut, a large number of methods have been proposed. However research work on finding gradual transition are comparatively less [1] [2] [3] [4] [5] [6] [7]. Flow of work (3.1) show flow of entire proposed work.

3.1 Flow of work

A representation about the flow of work is shown in figure 3.1. Input that is to be given to this system, is video (frames) with gradual transitions. Input frames are converted to grey-scale. For the grey-scaled frames histogram properties, discussed in section 3.3, are calculated. These properties are then normalized



(range 0 - 1) to understand their behavior. The normalized values are plotted with x axis (frame no) being independent of y axis (value). The characteristic behavior of the graphs are studied, based on which certain rules are formulated, which will be unique to the gradual transitions.

3.2 Type of shot transition

Shot transition is characterized into two categories, hard cut and gradual transition. In gradual transition, there are three kinds; Fade, Dissolve & Wipe.

i) Hard cut: - The change from one shot to another without any transition effects in between is hard cut. It is also called as abrupt change. (Fig 3.2 a)

ii) Fade: - In a fade video sequence, a shot turns gradually into a single color, usually black. Fade-in occurs when the transition is between a constant image and a scene. Fade-out is between a scene and a constant image. (Fig 3.2 b)

iii) Dissolve: - Dissolve is a combination of fade-in and fade-out. It occurs when one shot changes to another shot gradually. A new frame fades-in to the sequence bringing out dissolve. (Fig 3.2 c)

iv) Wipe: - Of the gradual transitions, wipe is dynamic. When one shot is replaced by another shot, where the replacing frame occurs from one side of the frame being replaces, wipe is said to have occurred. (Fig 3.2 d)

3.3 Methodology

The following characteristic properties are derived from histogram of an image.

i) Mean / Brightness: Brightness is the perception elicited by the luminance of a visual target.

$$B(I) = \frac{1}{MN} \sum_{i=0}^{N-1} \sum_{j=0}^{M-1} I(i, j)$$

ii) Contrast: The contrast of an image is the amount to which different objects in the image can be visually distinguished from one another.

$$C(I) = \sqrt{\frac{1}{MN} \sum_{i=0}^{N-1} \sum_{j=0}^{M-1} (I_{ij} - B)^2}$$

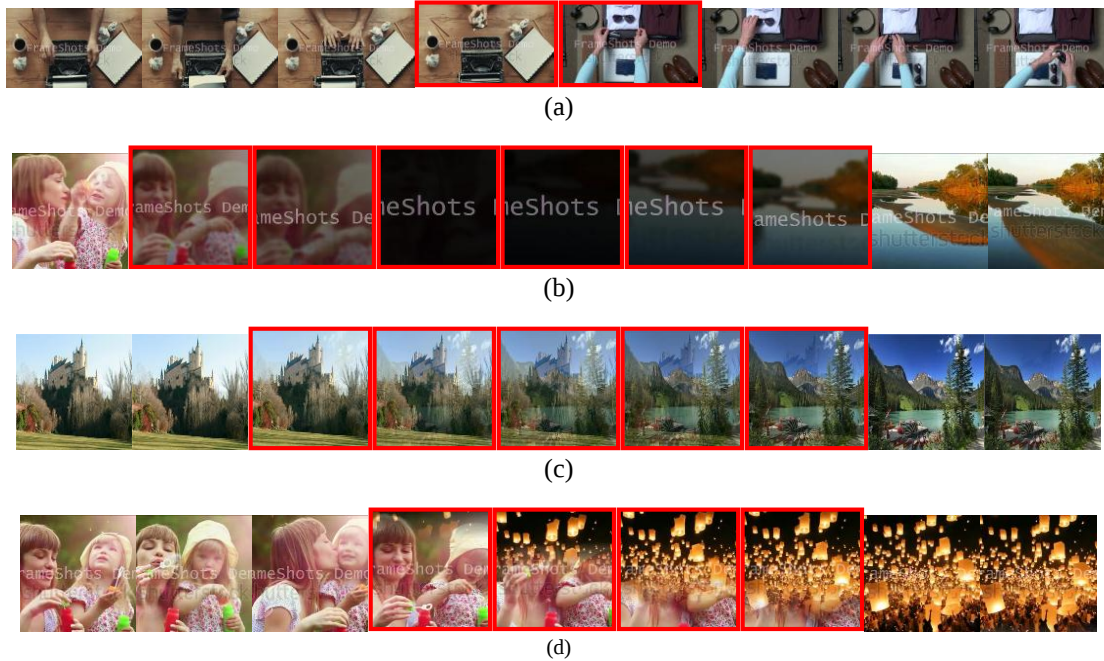


Figure 3.2: - (a) Hard-cut (b) Fade (c) Dissolve (d) Wipe

iii) Entropy: The measure of the amount of information that can be derived from the image.

$$E = - \sum_{i=0}^{255} p_i (\log_2 p_i)$$

iv) One Dimensional Moment: An image moment is a certain particular weighted average of the image pixels' intensities.

$$\mu_n = \sum_{i=0}^{255} (i - B)^n P(i)$$

v) Skewness: A measure of the degree of asymmetry of the histogram. $\gamma_1 = \sqrt{\mu_3 / \mu_2^3}$

vi) Kurtosis: It is the measure of the degree of peakness of a histogram and is represented by k.

$$K = \sqrt{\mu_4 / \mu_2^4} - 3$$

vii) Spatial Frequency: SF is computed as

$$SF = \sqrt{RF^2 + CF^2}$$

$$RF = \sqrt{\frac{\sum_{m=1}^M \sum_{n=2}^N (F(m,n) - F(m,n-1))^2}{MN}} \quad \text{Row Frequency}$$

$$CF = \sqrt{\frac{\sum_{n=1}^N \sum_{m=2}^M (F(m,n) - F(m-1,n))^2}{MN}} \quad \text{Column Frequency}$$

$$\text{viii) Visibility: } V = \frac{\sum_{v=1}^h \sum_{u=1}^w |I(u,v) - B|}{B^\alpha}$$

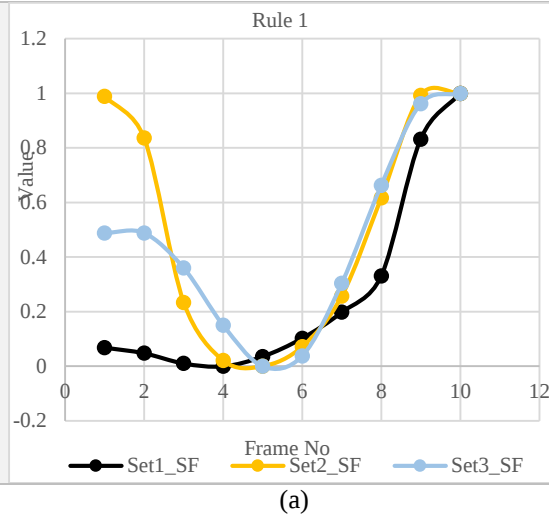
IV. RESULTS

In order to demonstrate different video transitions, using the properties derived from histogram a number of input video (24 sets), natural scenery is chosen. Video data set contain gradual transitions; fade (8 sets), dissolve (8 sets), wipe (8 sets). Behavior of the histogram properties are observed to frame the rules, wherever applicable. Among the different statistical properties mentioned, it is seen that entropy (E), skewness (SK), kurtosis (K), spatial frequency (SF) & contrast (C) depicts notable change during the transition. Rules were formulated only for Fade & Dissolve transition. For Wipe transition there were no common behavior of the properties.

Experiments are conducted first on Dissolve transition, followed by Fade and Wipe. For every rule, three sets (Set 1 – black, Set2 – orange, Set 3 – blue) are shown in the graph.

i) Video transition: - Dissolve

Table 5.1: - Dissolve

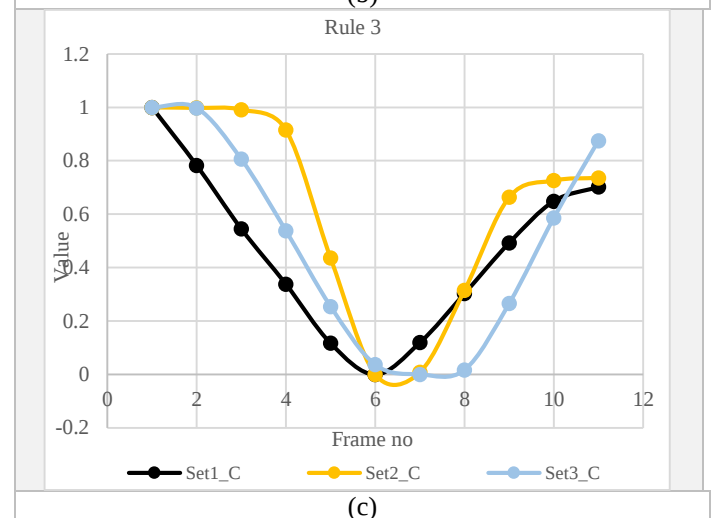
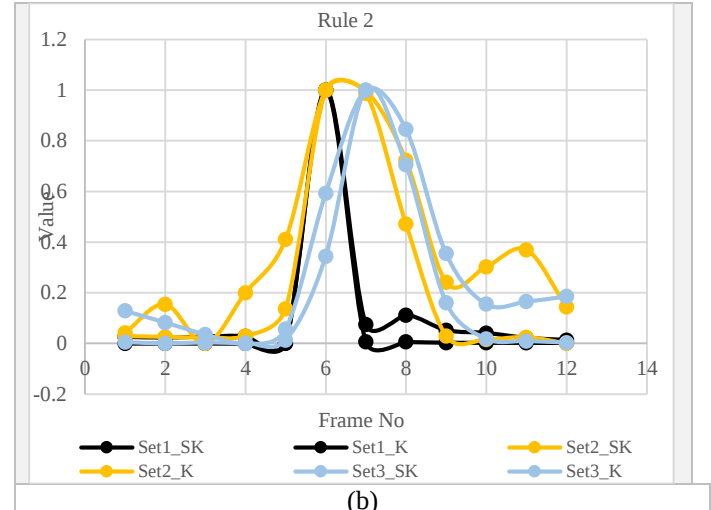
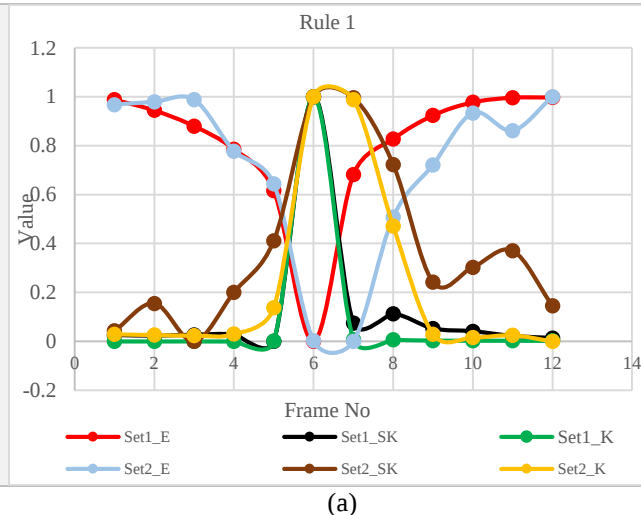


In graph 5.1 (a), SF - Spatial frequency is seen to have to fall and rise in its value during the transition (Set-1). Similar characteristic behavior of the histogram property is observed in other sets. As the input video, dissolve, passes through, values of spatial frequency decreases gradually and reaches zero, during the transition. Later on it increases and the value remains constant after transition is over.

ii) Video Transition: - Fade

In graph 5.2 (a), two sets are shown. Set 1 has three properties, (E – red, SK – black, K – green) and Set2 has three properties, (E – light blue, SK – brown, K – yellow).

Table 5.2: - Fade

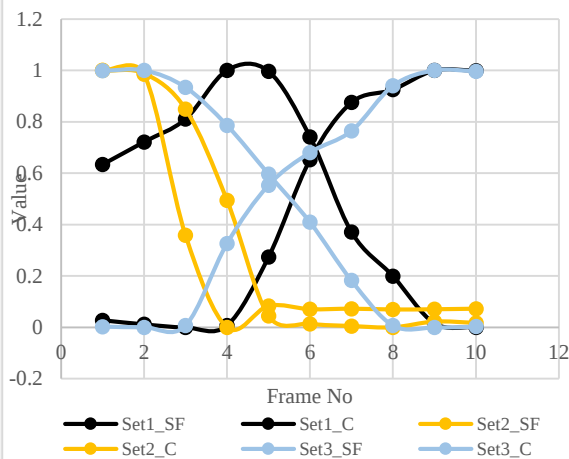


Graphs 5.2 (a), (b) and (c) show the comparison results. It is seen that, entropy (E), skewness (SK), kurtosis (K) and contrast (C), derived from the histogram of the each input frame, of fade videos, shows characteristic behavior during the transition. In graph 5.2 (a), entropy (E) inverts skewness (SK) and kurtosis (K) during the transition, rule – 1. As the input video, fade passes through, with an increase in the value of entropy (E), there would be a decrease in skewness (SK) and kurtosis (K) values, and vice versa. In graph 5.2 (b) Skewness (SK) and kurtosis (K) follow each other during the transition, rule – 2. The input video, fade, when passes through, behavior found in skewness (SK) is also found in kurtosis (K), i.e. they increase and decrease at the same time. In graph 5.2 (c) the value of contrast (C) decreases, reaches zero during the transition and then increases, rule – 3.

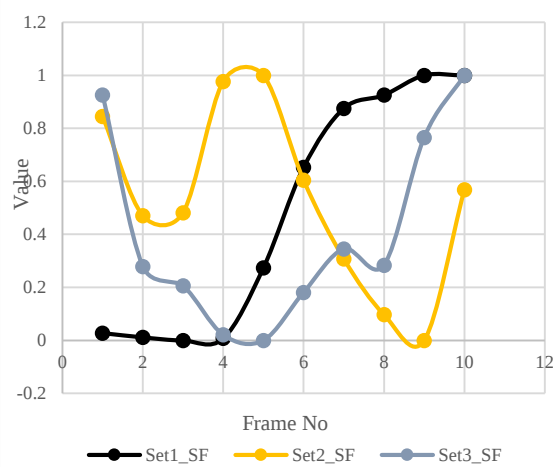
iii) Video transition: - Wipe

The histogram properties do not show any common characteristic behavior. Following graphs 5.3 (a) & (b) show notable changes in the behavior of the properties.

Table 5.3: - Wipe



(a)



(b)

Graphs 5.3 (a) & (b) show the comparison results. In graph 5.3 (a), it can be seen that spatial frequency (SF) and contrast (C) in sets-1 and set-3 invert each other. But in set- 2, they are seen following each other. No common behavior can be formulated from this result.

Similarly consider graph 5.3 (b), in set-1 and set-3, there is an increase in spatial frequency (SF) value. In set-2, spatial frequency (SF) curve is seen to have a decrease in its value during the transition. There are some notable changes in the behavior of histogram properties.

Therefore it is not possible to differentiate wipe transition from the rest of the group, making use of histogram properties alone.

Rule set

Sl.no	Rule
Dissolve	
1	Gradual rise of spatial frequency.
Fade	
1	Entropy inverts skewness and kurtosis.
2	Skewness follows kurtosis.
3	Gradual rise of contrast

V. CONCLUSION

Histogram properties can individuate Dissolve and Fade transitions alone. Wipe transition doesn't not exhibit any common characteristic. So this method cannot be used to differentiate gradual transition as a whole. In our next work, we have made use of textural methods like GLCM (Grey-Level-Co-occurrence Matrix), Run-Length Matrix Method, Statistical Method and Laws Texture Method integrated with histogram properties, to detect gradual transitions in the video.

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