Using fuzzy logic for movie enhancement

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Abstract

It is not a secret the great importance of film as one of the most known , common way for documentation in scientific, cultural, social, literary, and all fields of life. Hence the protecting these films by safe storing and repairing damaged parts of them or in case when the film not clear (have noise) take a great importance in researches. In this research, fuzzy logic technique is used to repair the distortion parts of tested film one after the other by convert the affected scene to a group of cascadedframes that constituent the scene, and then each frame is taken and analyzed into their basic components, to be working on the data components of the image after putting them in matrix-(two dimensional) then apply the fuzzy logic equations on this matrix to get new matrix, then return this new matrix to its previous origin state (image) to notice that points representing noise are removed. Process is applied to all frames of the scene to get the scene enhanced and free of unclear areas (affected).applying this process to all damaged scenes in documentary film to get an enhanced film by using (fuzzy logic).

الخلاصة

لايكاد يخفى على أحد الأهمية الكبيرة للأفلام كأهم وسيلة من وسائل التوثيق في المجالات العلمية, الثقافية, الأجتماعية, الأدبية, وفي كل مجالات الحياة. من هنا تأتي أهمية المحافظةعلى هذه الأفلام وحمايتها من التلف من خلال اصلاح الأجزاء التالفة منها أوفي حالة انه الفيلم أصلا غير واضح نتيجة تعرضه الى أضرار. فيهذا البحث تم استخدام تقنية المنطق المضبب لأصلاح الأجزاء (المشاهد) التالفة من الفيلم جزء بعد الاخر حيث يتم أولا تحويل المشهد المتضرر الى مجموعة من الصور المتتالية المكوّنة للمشهد ثم تم أخذ كل صورة وفصلها الى مكوناتها الأساسية ليتم العمل على البيانات المكونة للصورة بعد وضعها في مصفوفة ذات بعدين ثم تطبيق المعادلات الخاصة بالمنطق المضبب على هذه المصفوفة للحصول على مصفوفة جديدة , ثم يتم ارجاع هذه المصفوفة الجديدة الى حالتها السابقة (صورة) لنلاحظ بأن النقاط الممثلة للضوضاء قد أزيلت. يتم اعادة هذه العملية على جميع الصور المكونة للمشهد لنحصل على مشهد محسّن خالي من المناطق غيرالواضحة (المتضررة). تكرر هذه العملية على جميع المشاهد التالفة للفيلم لنحصل على فيلم محسّن باستخدام المنطق المضبب.

Introduction

Transmitting, digitizing, scanning, storing, and many other operations, will convert an image from one form to another, so degradation occurs at the output image hence, the output image. Has to undergo a process called image enhancement. Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved.

The application of fuzzy techniques in image processing is a promising research field [1]. Fuzzy Logic was initiated in 1965 [2], by Lotfi A. Zadeh , professor for computer science at the University of California in Berkeley. Basically, Fuzzy Logic (FL) is a multi valued logic that allows intermediate values to be defined between conventional evaluations like true / false, yes/no, high / low, etc. In fuzzy logic, the truth of any

statement becomes a matter of degree. Notions like rather tall or very fast can be formulated mathematically and processed by computers, in order to apply a more human-like way of thinking in the programming of computers [3].

Digital Image Processing

An image may be defined as a two-dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image. The field of digital image processing refers to processing digital images by means of a digital computer. Note that a digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements, and pixels. Pixel is the term most widely used to denote the elements of a digital image [4].

Image Enhancement

The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. Image Enhancement (IE)transforms images to provide better representation of the subtle details. It is an indispensable tool for researchers in a wide variety of fields including medical imaging, art studies, forensics and atmospheric sciences. It is application specific: an (IE) technique suitable for one problem might be inadequate for another. For example forensic images or videos employ techniques that resolve the problem of low resolution and motion blur while medical imaging benefits more from increased contrast and sharpness. To cater for such an ever increasing demand of digital imaging, software companies have released commercial softwares for users who want to edit and visually enhance the images. Is the process of manipulating an image so that the result is more suitable than original for a specific application? The word specific is important here, because it establishes at the outset that enhancement techniques are problem oriented. Thus, for example, a method that is quite useful for enhancing X-ray images may not be the best approach for enhancing satellite images taken in the infrared band of the electromagnetic spectrum [4].

There is no general ―theory of image enhancement. When an image is processed for visual interpretation, the viewer is the ultimate judge of how well a particular method works.

Image Enhancement Techniques

The Image enhancement techniques can be divided into three broad categories:

1. **Spatial domain methods**, which operate directly on pixels.
2. **Frequency domain methods**, which operate on the Fourier transform of an image.
3. **Fuzzy domain**

Fuzzy image enhancement is based on gray level mapping into a fuzzy plane, using a membership transformation function. The aim is to generate an image of higher contrast than the original image by giving a larger weight to the gray levels that are closer to the mean gray level of the image than to those that are farther from the mean. An image I of size M x N and L gray level scan be considered as an array of fuzzy singletons, each having a value of membership denoting its degree of brightness relative to some brightness levels.

Why use fuzzy logic

- Fuzzy logic is conceptually easy to understand. It is natural.
- Fuzzy logic is flexible. It is easy to change without starting from scratch.
- Fuzzy logic is tolerant of imprecise data. this is built into the process ,rather than added onto the end.
- Fuzzy logic can be built on top of the experience of people who already understand the system.
- Fuzzy logic is based on natural language, that which is used by ordinary people on a daily basis and which is convenient and efficient. the basis for fuzzy logic is the basis for human communication. As a result, it is easy to use.

Experimental work

Following are the Algorithm steps for this work:

Input: distortion film.

Output: enhanced film.

1. Determine start and end points for first destroyed scene in the taken film.
2. Convert the scene to set of sequence images.
3. Implement fuzzy logic equations to each image in step 2.
4. Collect images to get the enhanced scene.
5. Repeat step 1 to 4 to every destroyed scene in the taken film.
6. Display the enhanced film.

Results and Discussion

In this research we deal with film as it is group of scenes and these scenes are a group of subsequence images. In fact, there is 24-30 images displayed continuously in every one mint which appear to person as one film. Taken the film, converting it to a group of scenes by using assistant systems used in montage operation ,in this research we use Absolute Video Converter system. As shown in figure (1).
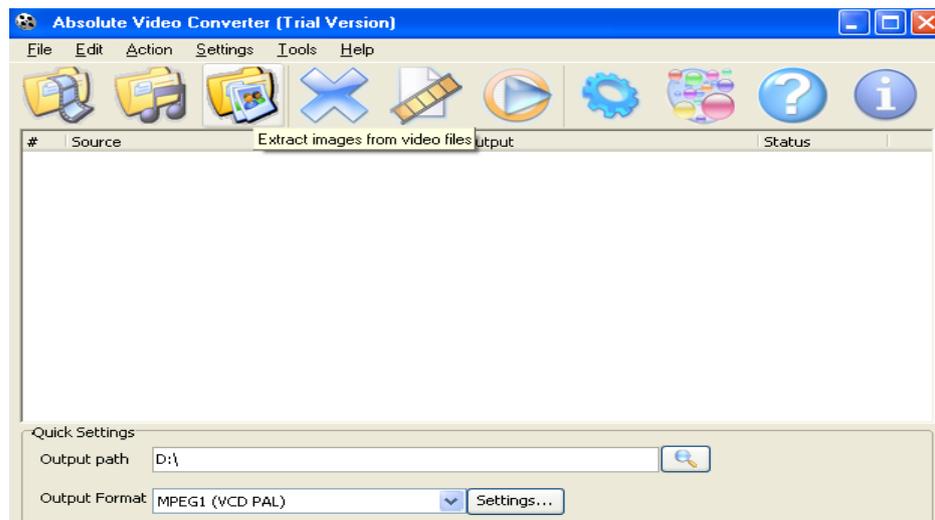
Figure(1): Absolute Video Converter system

The convert instruction ,convert the scene to a set of sequence images of a particular scene, as shown in figure(2).every image is processed alone by split it to (header, pallet and data).
The work is done to the data part by convert it to a two dimensional array that represent the image value.

(1)   (2)   (3)   (4)

Figure (2): sequence images for particular distortion scene.

1. A (3x3) mask is implemented in this work for every point in this array by convert the array from two dimension to one dimension ,find the maximum and minimum value, then implement the fuzzy logic equation:

$$\text{Val}(x) = \begin{cases} 0 & \text{if num(x)}<0 \\ \frac{num(x)-min}{max-min} & if\ 0 \leq num(x) \leq 1 \\ 1 & \text{if num (x)}>1 \end{cases}$$

After implementing this equation, first position in the new array is found. moving the mask to the next position in the array, the previous operation is repeated to get the second position , and so until the last value of the array.figure(3) shows the enhanced cascade images for a particular scene after implementing the fuzzy logic equation .

(1)   (2)   (3)   (4)

Figure (3):sequence images for the enhanced scene.

2. Using the (ulead system), the sequence enhanced images will be converted to scene again .
3. This work is done to every damaged scene in the taken film to get an enhanced film.

Conclusion

Fuzzy technique provides promising result in image-processing tasks that cope with some drawbacks of classical techniques. Fuzzy filter is capable of dealing with uncertain information. It is required to recover a heavily noise corrupted image where a lot of uncertainties are present. Each pixel in the image is represented by fuzzy rules that consider the neighborhood information to removes the noise. The proposed technique used fuzzy if – then rules that represent bridge between human knowledge on the one side and the numerical framework of the computers on the other side, simple and easy to understand, to achieve a higher level of image quality considering the opinion of the human observers.

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