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All the Colours of a Film: a study on the Chromatic Variation of Movies

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ABSTRACT

In this work, we discuss and present different techniques for film colour summarization together with a preliminary colorimetric study. The aim of this project is to combine the frames of different videos, reducing them to just one image of chromatic significance.

This elaboration is made through two different methods: the *movie barcodes* and *long exposure images*. Due to their nature, those concise images have not only an artistic aim, but are movies chromatic synthesis that can eventually be used for colour checks and for identification of dominances.

At first, we applied those methods on two videos from the Pixar Animation Studios' short animation movies. Then, as preliminary test, we present an application on the frames of a homemade video altered in different ways together with the relative visual and numerical results.

Keywords: *Colour movies, Colour histogram, Video Analysis, Image Analysis, Image Processing*

INTRODUCTION

Since its origin, cinema has tried to use colours to give movies a powerful and meaningful relevance [4,6]. In this work, we propose two different representations of entire movies in a single image.

At first, we show these methods applied to two videos from the *Pixar Animation Studios'* short animation movies, then we apply the same method on a short homemade video which colour has been altered in three different ways.

In the first method, the *movie barcodes* allow to follow the main chromatic content along the whole film, and the *long exposure images* permit to create an impressionistic image as a kind of average colour spatial histogram.

A possible use of these methods, is to help in having a visual global idea of potential colour dominants.

STATE OF THE ART

Colour palettes and colour barcodes aren't a new idea: they can easily be found in literature and some of them can be downloaded from the web. Many of these generators, though, tend to just randomly pick colours or to reduce the whole frame into a one-pixel column averaging the pixels colours.

Two of the many websites that shares movie barcodes are: a Tumblr blog called *Moviebarcode* [7] and *The Colors of Motion* developed and created by Charlie Clark [2]. In Clark's work the movie is reduced in one image computing the average colour of an image and creating a line of pixels of this colour.

Different works were made by Martin Bellander [1] and Jason Salavon [5]. The first did something similar to a movie barcode but developing a code to analyse the use of colours in paintings over history, while Jason Salavon used a software of his own design to generate different types of images. Like Bellander, Salavon analysed paintings and created some sort of barcodes of MTV's music videos, but the most interesting work for us is his third project called *Amalgamation work*, in which he presents a synthesis and unification of pictures or movie frames. Salavon's *Amalgamations* remind of the photographer Jason Shulman's works, *Photographs of Films* in which photographs the entire movie using ultra-long exposures, obtaining a single image that captures the entire length of a film.

In 2013, Theodore Gray, the Co-founder of Wolfram Research [9], spent almost a year to develop an iPad app in partnership with Walt Disney Animated Studio. He and his team used the Mathematica software to create a feature they called *Colour Maps*, to extract the colour script out of a final animated movie. Theodore Gray's work was the one that inspired us to try and develop our own code to create different and representative images of movies, to produce a fast-visual colour analysis.

The selected short films

The movies from *Pixar Animation Studios'* are two: "La Luna" and "Presto". "La Luna" (2011) is directed and written by Enrico Casarosa. The short premiered on 6th June 2011 at the *Annecy International Animated Film Festival* in France, and it was paired with Pixar's *Brave* for its theatrical release on 22th June 2012, being shown before the film's beginning. The analysed frames are: 9840. The second selected short movie is "Presto" (2008), directed and written by Dough Sweetland. The short was release the 10th June 2008 at *Annecy Animation Film Festival* and it was paired with WALL-E the 27th June 2008. The analysed frames are: 7486.

For the second type of analysis we shoot a short video of Matera landscape and then we altered it in different ways. The video has been modified through the software *DaVinci Resolve* decreasing the values of one of the three channels. In this way we obtained three videos, one with just R and G channels, one with just G and B channels and one with just R and B channels. The analysed frames are 700 for each version.

MOVIE BARCODES



Figure 1 Workflow of the "Movie Barcode" algorithm.

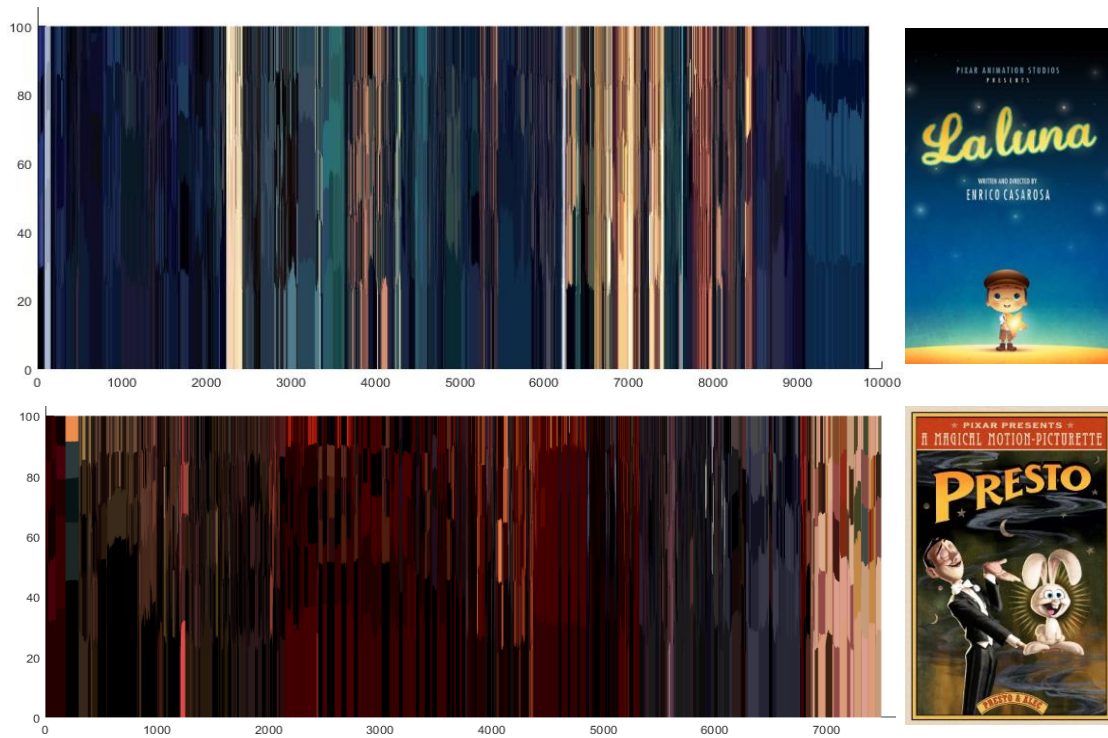


Figure 2 Movie Barcode palettes of "La Luna" (top) and "Presto" (bottom).

Here the steps for Movies Barcodes. The algorithm considers every single frame, divided in a R, G and B channels; the first step is the posterization of the image. In this part the algorithm computes the number of colours present in the image and then, this value is divided by a defined arbitrary number. For this experiment we selected a value of 100. So, for each RGB channel the values of colours (starting from 255) are divided by 100 and rounded to the lower value. This colour reduction permit to obtain a posterization of the image as is visible in FIG. 1. Then we rank the most used colour bins. Those operations are done for each frame and to plot the final images the algorithm built an image composed by a line of pixels of height 100 for each frame, in which the most frequent colour bins are

reported in percentage.

With this method we obtained the images in FIG. 2 that show the 5 most present colour bins in each frame for both the analysed movies.

MOVIE LONG EXPOSURE IMAGES

For the realization of long exposure images, we created a simple code that sum and average all the frames of the movies.

The results of our movies long exposure images are visible in FIG.3.

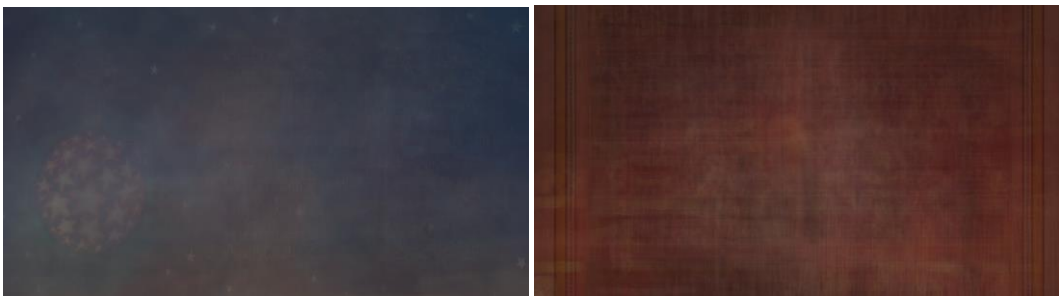


Figure 3 Long exposure images of "La Luna" (left) and "Presto" (right).

RESULTS AND DISCUSSION

FIG. 2 and 3 shown the two methods applied to the short movies "La Luna" and "Presto" and those syntheses provide information about the mood of the film and about the sequence of the different scenes. The first movie has a strong dominant of blue and light blue colours, that suggest calm and relax, despite the second that has a strong red dominance, that suggest action and movement.



Figure 4 Same Frame of the modified video of Matera. The first is the original one, then we have the result of the reduction of each RGB channel.

Then, we applied the *Movie Barcode* method to a homemade video of the city of Matera and to 3 versions modified compressing each time a different RGB channel. A frame of the different videos is reported in FIG. 4.

In FIG. 5 we have a representation of the movie barcodes of the original video and of the altered ones. Here the different colour casts are visible.

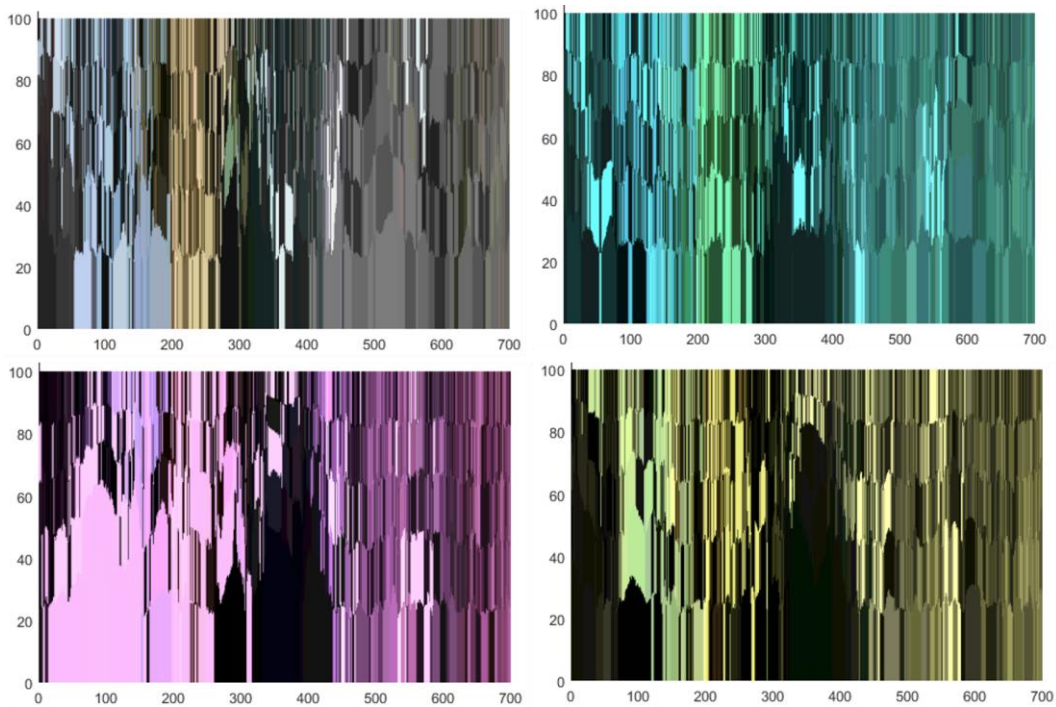


Figure 5 Movie Barcode Palettes of the original video of Matera (top, left) and the same video modified reducing one RGB channel.

	Mean			Difference from Original		
	R	G	B	ΔR	ΔG	ΔB
Original	170	171	170			
RG	163	165	147	-7	-6	-23
RB	188	167	187	18	-4	17
GB	149	182	177	-21	11	7

Table 1 The first chart indicates the RGB mean values of the movie Barcodes of the Matera's video. The second chart shows the value of RGB difference from the original video.

CONCLUSIONS

In this work we have presented two methods for the summarization of movie colours: *Movie Barcodes* and *Long Exposure Images*. With those methods is possible to visualize in a compress and alternative way the colours present in a movie.

We have presented these methods applied to short Pixar movies and *Movie Barcodes* to a homemade movie with altered colour, in order to test its capabilities of colour cast visualization.

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