DIGITAL TAPESTRY FOR CONTEMPORARY TEXTILE ENGINEERING

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***Abstract*:** This paper addresses the novel problem of automatically synthesizing an output image for contemporary digital tapestry from a large collection of different input images. The synthesized contemporary digital tapestry image, called a digital tapestry can be viewed as a visual summary or a virtual 'thumbnail' of all the images in the input collection. The problem of creating the tapestry is cast as a multi-class labeling problem such that each region in the tapestry is constructed from input image blocks that are salient and such that neighboring blocks satisfy spatial compatibility. The proposed framework was tested on several consumer photograph collections, and the results are presented.

Keywords: Tapestry, Engineering, Algorithm

1.Introduction

For all spheres of human cultural activity, the creativity and innovation are priorities, communications and presentations. They are permanent objective, strategy, tools and resources created and-or use a variety of visual forms, images, pictures, compositions.

The study of cultural heritage can be used as part of a strategy for planning and management. It also can be a development tool, which:

- demonstrate the development of folk art, practices and elements;
- It offers new opportunities for public awareness of local heritage;
- inform the tourism industry;
- promotes business development.

In general the studies of cultural heritage can be divided into two types: cognitive and in-depth investigation.

The in-depth study should provide detailed information on folk elements and motifs of an ethnographic area and create a detailed file for each of them. This type of research requires time, significant financial resources and highly qualified personnel.

The cognitive research refers to find general information about the objects, while deeper than general information about the elements of folklore, includes detailed information about their characteristics, their environment and their development over the years.

The goal of cognitive research is to quickly identify potential significant resources from a given folklore. Usually held in order to help identify the parameters of in-depth study to define its scope. The weakness of this method of research is that it is based on

visual characteristics of the studied folk elements. If the importance of the resource lies in characteristics such as connectivity historical event or person – then the work can not be identified as significant for the human cultural activity through this method. This research always requires a detailed study of folklore heritage thereafter.

The object of our cognitive study are Egyptian tapestries and the way of their transfer in the contemporary textile by engineering methods.

The history of tapestries indicates clearly that a tapestry well-hanging in our home brings not just interior beauty but also a sense of history. European weavers have produced these textiles for centuries, including medieval, renaissance and Arts and Crafts periods. This traces a history of tapestries from the ancient Egyptians to today. Tapestry is one of the oldest forms of woven textiles. The techniques used have remained the same for centuries. Remnants of tapestries woven in ancient Egypt have been dated as far back as 3000BC. In the Middle Ages master weavers' studios designed and wove great, colorful tapestries for wealthy clients. This is the technique used most frequently for the flat woven rugs and hangings called kilims. Slit tapestry is also used for bags, pictorial tapestries, and other articles. The fabrics are usually weft-faced, meaning that the warp is covered completely; the surface is ribbed in a vertical direction [7].

Warp yarns are those that were affixed to the loom; weft yarns are those that were interlaced with the warps. In all of the photos here, the fabrics are oriented as they were on the loom-with the warps running vertically.

Tapestry is a form of textile art, traditionally woven on a vertical loom. Tapestry is weft-faced weaving, in which all the warp threads are hidden in the completed work, unlike cloth weaving where both the warp and the weft threads may be visible. In tapestry weaving, weft yarns are typically discontinuous; the artisan interlaces each colored weft back and forth in its own small pattern area. It is a plain weft-faced weave having weft threads of different colors worked over portions of the warp to form the design [4].

In the Renaissance artists such as Raphael , (Raffaello Sanzio da Urbino) known as Raphael, was an Italian painter and architect of the High Renaissance. His work is admired for its clarity of form, ease of composition, and visual achievement of the Neoplatonic ideal of human grandeur. Together with Michelangelo and Leonardo da Vinci, he forms the traditional trinity of great masters of that period [6].

Tapestry artists entered the 21st century disgruntled about the competition created by newly accessible computer-aided weaving options and other "quick" systems for producing artwork. Also, young artists were not attracted to tapestry. Surprisingly, at the same time that weaving seemed out of favor, fibers had become one of the two most popular majors for art students. Educators like Jane Kidd were witnessing an increase in students in fibers classes but those interested in tapestry had decreased notably. (Kidd, Jane, Checking the Pulse: Reflecting on the 'American Tapestry Biennial 4' in an Expanded Field. ATA Educational Articles) Computer savvy young artists expected speedy results and these emerging artists also questioned the notion that art must be made by hand. They embraced interdisciplinary input and appropriated imagery [2,8].

2. Engineering approaches

In the “design-led” approach (figure 1) by Professor Mike Ashby developed and applied over 20 years with colleagues at Cambridge and collaborating universities [1,3]. The motivation to establish this route at is to involve right from the beginning with the question ‘What is the objective of the design? The investigation start with a strong practical motive and critically discuss of materials, properties, alternative materials and processes as well as the underlying physics and chemistry.

In the conventional “science-led” approach begins with the physics and chemistry of materials. It progresses from the atomistic through the microstructure to the macroscopic properties. As a consequence the motivation by the challenges of the design is often lost. Still, it is necessary to understand the theory, but the goal should be to make of things [9]. It is developing of a perspective on how the fundamental science translates to real engineering applications. The work begins with a design challenge.

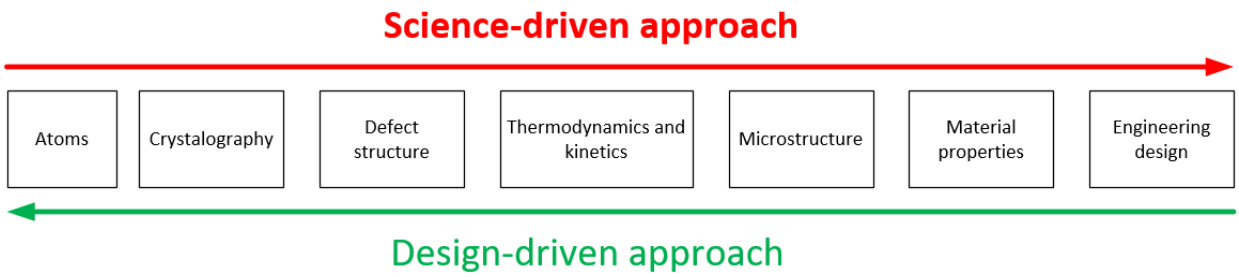


Fig. 1. „Science-led-approach“ and „Design-led-approach“ [9]

The observation of these small objects induced to enter into a second research step, devoted to the investigation of the concept of design. In the land of “middle earth”, design has been used as the connection between the cultural domain and the world of innovation. Either considering it from an aesthetical point of view or identifying it as the driver of a process of sense making, design is able to connect the world of culture to the world of business, adding unexpected values and new meanings to the product. This is evident in both the design-based approaches previously identified [11].

From this perspective, design derives its value from the cultural and artistic domain, transferring it into design solutions, which are incorporated in the product. In other words, design “exploits” culture to add value to the product [5].

Discussion

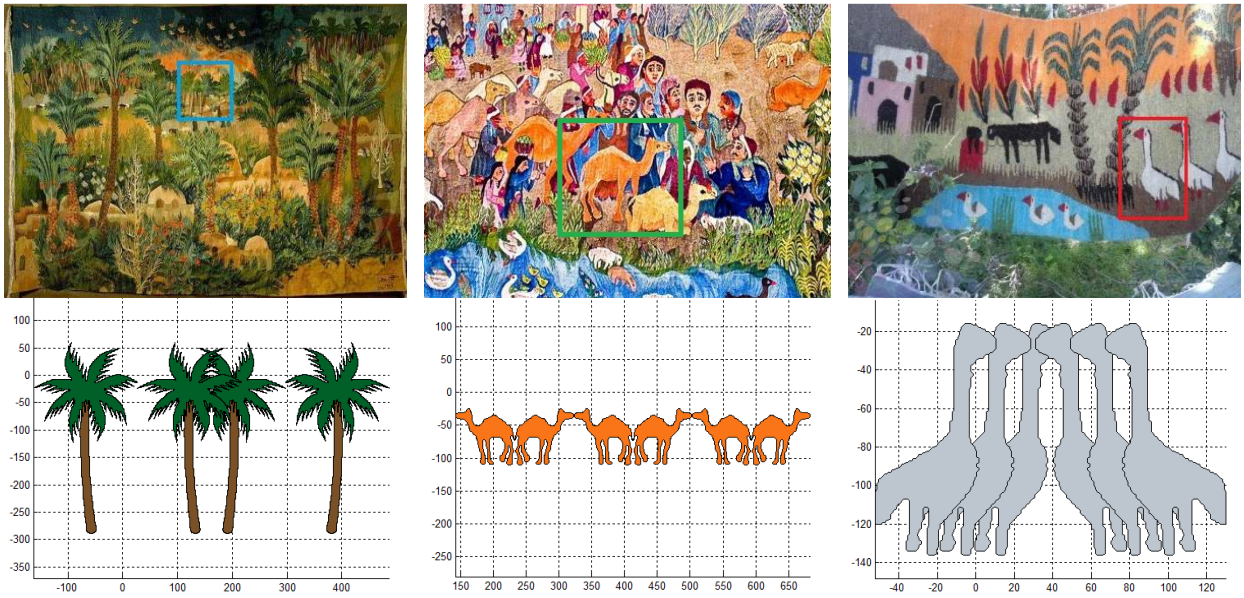
Tapestry Design in as a piece of woven fabric and imagine turning it over, with top and bottom positions maintained, to see the reverse side represented design. Turning the fabric over reverses the order of the columns in the original design. Also, because warp threads that show on the face of the fabric are hidden under weft threads on the reverse (and vice versa), the colors must be exchanged. To achieve this \reverse side" directly, the weaver threads warp yarns through the harnesses in reverse order and lift, for each weft yarn, only the warp threads that were not lifted in the original draft.

The various drafts are classified as follows: Straight; Pointed; Skip and sateen; Broken; Divided; Grouped; Curved; Combination.

Broken draft almost resembles the pointed draft. However the pointed effect is broken. This type of draft is suitable for tapestry weaves such as herringbone twills. These drafts are employed for the production of stripe and check designs, in which the stripes have different weaves or their combinations. This draft is used for producing the fabric with two different stripes. The repeat of the draft is determined by the number of stripes and the number of threads in each stripe. The number of shafts in the draft depends upon the number of stripes and the warp repeat of weave of each stripe. Various methods of drawing in can be combined in one draft for producing a certain type of tapestry fabric. Two or more drafts described above can be applied simultaneously, for example, straight and skip or sateen, grouped and curved, and so on. Combined draft is the most complicated and can be chosen only if there are some technological or economic reasons. The designer having a great experience can do it properly. The construction of any woven tapestry fabric depends upon the design, draft and the lifting plan and these are very closely dependent upon one another. A thorough knowledge of this interdependence is very valuable to the designer upon whose skill several mechanical limitations of the loom may be imposed. In many cases it is only his innate acquaintance with the drafting systems and the possibilities of manipulating the lifting orders which enables him to introduce variety into apparently rigid mechanical systems of operation. In normal practice the designer has to produce a range of tapestry designs for looms with a known pattern scope. This usually involves the draft and the lifting plan construction. A similar procedure is adopted when the designer is asked to reproduce a specific design from a sample. The weave in the sample is analyzed and a suitable draft and lifting plan is derived.

The fauna and flora motifs are “woven as drawn in” which means the pattern is created by using the same tapestry sequence for the weft threads as the threading sequence for the warp threads. In other words, the tapestry draft is obtained from the threading draft. For example in Figure 14 the tapestry draft for the ancient Egyptian motif is obtained from the profile threading draft. To read the profile threading draft, ancient Egyptian motif from the right. The threading or warp draft is two units. The tapestry draft is exactly the same with two units, the pattern is “squared” and “woven as drawn in” because starting at the upper right corner of the drawdown the warp threads for block woven with the treadle to create the pattern.

On figure 2 are presented flora and fauna elements from Egyptian tapestry. The analysis of recently published studies in identification and determination of the tapestry shows that the use of image processing systems is important priority direction for the automatic determination of their specific characteristics. Explain that the systems for image processing to obtain initial information about the quality of tapestries, the main advantages that are distinguished are: non-destructive testing, easy technical realization, high performance, large informative, selectivity, good efficiency, sensitivity, technological compatibility and the remote control.



a) Floral element – palm b) Fauna element – camel c) Fauna element – duck

Fig.2. Flora and fauna elements extracted from Egyptian tapestry

As major trends are emerging use of video cameras to detect external defects and use of hyper-spectral vision systems in the diagnosis of internal defects of tapestry products.

The algorithms for determining the similarity in assessing the form of elements are based on coefficients that describe it. More commonly used in practice coefficients [11] are those of the form, eccentricity, ovality and circularity, presented in table 1.

Table 1.

Coefficients for description of form

Coefficient	Formula	Description
Coefficient of the form k_f	$k_f = \frac{P_e^2}{A_e}$	P_e – the perimeter of the element; A_e – area of the element;
Coefficient of eccentricity k_e	$k_e = \frac{D}{d}.100,\%$	D – the long axis of the element; d – short axis of the element;
Coefficient of ovality k_o	$k_o = \frac{P_e^2}{4\pi A_e}$	
Coefficient of circularity k_c	$k_c = \frac{1}{k_o}$	k_o is the coefficient of ovality

Another important aspect of using the tapestry motifs is in the making of collages. The collage might be most familiar as a fine arts practice, its epistemological underpinnings suggest its potential as a method for research and through the arts [10]. Here are explained by briefly discussing collage art.

a) Motif in the left side of collage b) Motif in center of collage

Fig.3. Tapestry motifs in collages

The first group was made by Prof. Dr. Aleksandr Smirnov, while attended and participation in Egypt. These techniques have one very basic thing in common. They move color vertically up the warps in specific ways and at the same time create bridges or third colors in their simplest forms. They can also travel across the fell line. When viewed from a distance, these techniques optically blend the colored shapes and lines into another color, or they optically blend by creating small bars and dots of color or small triangular areas.

On figure 3 are presented examples of these collages with tapestry motif located in the left side of collage and second example – the same motif located in the center of the collage.

Conclusion

This paper addresses the novel problem of automatically synthesizing an output image for contemporary digital tapestry from a large collection of different input images.

The problem of creating the tapestry is cast as a multi-class labeling problem such that each region in the tapestry is constructed from input image blocks that are salient and such that neighboring blocks satisfy spatial compatibility.

Expected inspiration from nature to contribute to the improvement of technology and its impact and be felt in all spheres of life. Some designs may seem impossible performance today, but more improving human understanding of nature and improve skills so that in future all designs to be realized.

Learning from nature inspire the designers and limitless their creatives and this can be used as solution to difficulties encountered with fashion design. That nature flora and fauna elements are used in the tapestry. These tapestry elements can be digitalized by techniques of image processing. The resulting ornaments, their elements, shapes, colors and proportions between them are a basis for creation of modern textile.

An important aspect of using the tapestry motifs is in the making of collages. The collage might be most familiar as a fine arts practice, its epistemological underpinnings suggest its potential as a method for research and through the arts.

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