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2D-Clothing Shape Design Using Spline Curve

Hoang Tra Linh
National Taiwan University of Science and Technology, Taiwan
tralinhoang@gmail.com

Chuan-Kai Yang
National Taiwan University of Science and Technology, Taiwan
ckyang@cs.ntust.edu.tw

ABSTRACT

Fashion design expresses modernness, reflects changes in a society, economy, politics and culture. As a result, fashion also changes very fast and distinctively, and for that reason the improvement and creativity are indispensable. Nowadays, there are numerous fashion design systems/tools. However, they are more about making the clothes software, therefore the provided shape is limited and the way of rendering is stiff since it does not take the shape of the body into account. Tools like Telesia Creator Fashion Design CAD software provides more freedom in the way of representing the clothing shape. However, it adopts a quite unintuitive way to change the shape of a curve. Consequently, we propose the idea of a 2D clothes design system which allows a designer not only to manually create clothes but also to semi-automatically extract a clothes Spline shape from the input image. In other words, our system is able to provide the reference shape for a designer, as well as allows a designer to create his/her work by integrating some provided shape together or even directly modifying the reference shape to create a new one.

Keywords: 2D Clothes, Spline, Interpolation Curve.

1 INTRODUCTION

In the world of fashion, ideas are foundations of every creative task. Coming up with a new idea is always encouraging and necessary especially when the fashion trend changes dramatically. Moreover, since computer has become more and more popular, clothing design software has been used not only for professional purpose, but also for personal interests. It has inspired us to propose a 2D clothing shape design system which can be served as a supporting tool to make the clothing design process easier for both professional and amateur designers. In the fashion field, clothing design includes many steps that range from marketing research, creativity to sketching and fabric selection; and fashion designers work in different ways. Some sketch their ideas on a piece paper, while others drape fabric on a dress form. The proposed system is designed to be suitable for the first type of designers. It is different from the software that gives the finished garment or so-called a pattern marker. It helps a user easily create a new clothing shape from sketch or by modifying an existing design.

Nowadays, there is plenty of different fashion design software, such as: Virtual Fashion, Dress Assistant, Poser and Kaledo by Lectra, etc. For those 2D fashion design software, most of them use lines or simple arcs to render clothes which might limit the shape creation. Besides, common software like Photoshop or other drawing tools might be more flexible by allowing a user to create random shapes using an approximate spline. However, using an approximate curve means the target curve doesn't go through control points (points used to define the shape of the curve) and therefore, the created shape will be modified by approximately controlling those points not necessarily on the shape. Some people may find it difficult to manipulate such a shape and therefore need time to get used to this process. Understanding the situation, our system provides a better way for designing a clothing shape by using the interpolating *Natural Cubic Spline Curve*, or *NCSC* for short. This kind of curves also allows us to create complex clothing shapes; moreover, it allows a user to design the shape in an intuitive way. It's because the interpolating NCSC has its curves go through control points. In this way, when a user wants to modify the shape of clothes, he/she only needs to directly manipulate the control points near that desired region.

Furthermore, our system can be used in the case users want to create a clothing shape which is similar to the shape within some kind of fashion image. Our system allows a semi-automatic creation of the clothing Spline shape which is specified in the input image provided by a user. This way, the designing task becomes faster and doable for people who do not draw well. On the other hand, this system is more about giving an idea for creating a clothes rather than making a clothes. And since the trend is not what it used to be, many people now follow their own fashion rules, inspired by what they see on the fashion-animated streets, or the Internet. Hence, together with the blooming of Internet, this system is suitable for anyone with interest in fashion and

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is able to access the Internet to get his/her own source of clothes. This system will allow a user to extract the shape that he/she wants from an image. As a result, the system helps catch the clothing shape, as well as the current trend, and then allows a user to modify shapes according to his/her taste.

2 RELATED WORK

Several prior works have used B-spline as a curve representation due to its compactness, continuity, and local shape control. Cohen et al. [2] uses *B-splines* curves for independently matching 2D objects of any affine transformations. Similarity, Mongkolnam et al. [5] uses B-spline curves to approximate the boundary of each segmented shape with finer details. Our work is mostly similar to Tseng et al.'s work [8] in a way of sampling a number of control points from the edge elements on the shape. Our system also uses B-spline curves which are more suitable to represent complex shapes in comparison with a higher degree Bezier curve due to its local control property. However, we, instead of using an approximate curve, we use an interpolation curve NCSC as an image contour representation. We think NCSC has an advantage of providing an intuitive way for design since NCSC allows a user to directly manipulate the shape by controlling the points on the curve.

For clothing shape design, over the last few decades, several image segmentation approaches have been proposed, for example, the work by Wu et al. [9], Friedland et al. [3], Mortensen et al. [6], Chuang et al. [1], and Rother et al. [7].

3 PROPOSED SYSTEM

The purpose of this system is to let a user create a new shape by modifying an existing shape. Therefore the outline of a shape is a primary concern. In order to have this outline, we need an image including the target shape which we wish to extract. Then the system will do all the works to give the user a modifiable version of his/her desired shape in the input image. The flow chart of the whole system is shown in Figure 1. We firstly choose the Natural Cubic Spline Curve (NCSC) to be our basic tool of rendering shapes which can be manipulated in the system. Then for clothes design modification of a shape-boundary retrieval approach we do the following stages: 1) Shape extraction, 2) Boundary extraction, 3) Spline-boundary creation. Our shape extraction uses SIOX, which needs some simple interaction from a user, to extract the desired object. After that, the boundary extraction can be divided into two steps: the first step uses the thresholding method to create a binary image; and the second step uses an image morphology method to extract the boundary of that binary shape; the third step is to recreate the boundary of the extracted shape under the form of a spline curve which makes use of the data information including: Harris corner detection and boundary chasing algorithm. Finally, our system allows a user to show the shape with different textures or pattern provided in the library in order to give the clothing shape result a fruitful look.

4 EXPERIMENTS AND RESULTS

4.1 Experiments

Our implemented system runs on an Intel Core i7-2600 CPU at 3.4 GHz with a 32-bit Operating System. The algorithm is written in Java, using NetBeans IDE 8.0.1.

Though most clothing worn for everyday wear falls within a narrow range of conventional styles, unusual garments are usually sought for special occasions such as evening wear or party dresses. We observe that a neckline or a collar and sleeves with cuffs of clothes are the most distinguishable parts that make them different from one other. They are more complex and sophisticated. Other parts like a body of clothes or pants are easier to manipulate. The body part usually covers most of the upper human between neck and waistline. The variety in shape of this area is not much. For example, the length of this area can be either mid-torso or mid-thigh. Or, it can be loose or tight around the bust or waist. Pants are also not too various in style and therefore, are simple to modify. Hence, in our library, we provide templates of different type of neck/collar, several types of sleeves and hemlines. Figure 2 shows an example of template library provided by our system. These templates were used to create all the results shown in Figure 3.

Our system is designed for designers who would like to sketch their ideas on a piece paper or electronic device to create a new clothes shape from sketch or modify an existing design. In order to understand more about the contribution of our system, we want to make a comparison between our system and others that are available in the market. Nowadays, in the market there are various kinds of design software. In general, we divide them into two main categories of design software: one is an image processing tool bundling with multiple design functions, for instance Photoshop; the other type serves for specific professional design purposes, for example: CAD for precise and technical drawing; logo and poster design likes CorelDraw; or artistic fashion illustration likes KaledoV4R1 of Lectra.

For the first type of software described above, we choose Adobe Photoshop CC as the candidate. Since Photoshop published by Adobe Systems is a very popular bitmap graphics editor that not only allows users to create and edit images, but also features even more creative possibilities with new tools for design. Moreover, at the time of writing this thesis, Adobe Photoshop CC is the latest version in the Photoshop series. Meanwhile, for the professional design software that serves

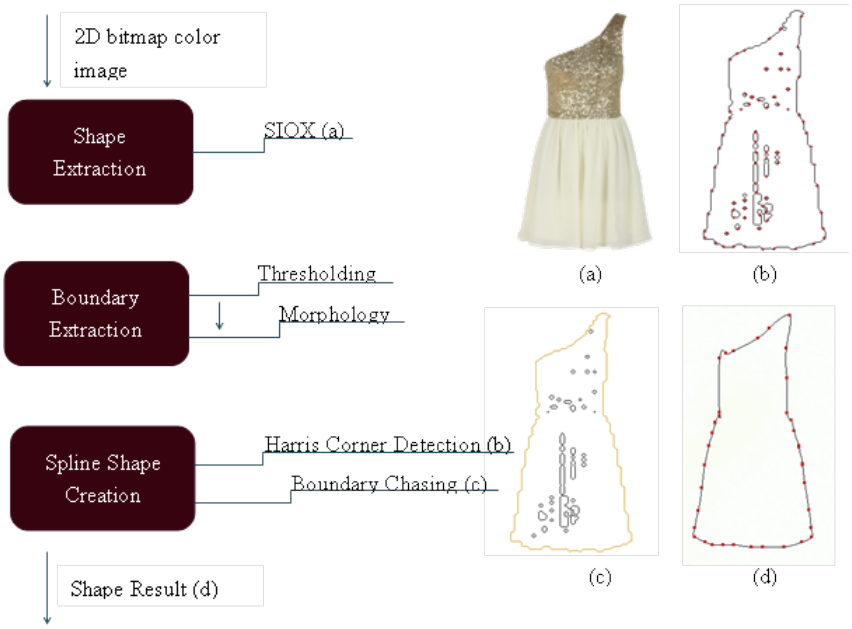

Figure 1: Flow chart and results in each step (a) SIOX extracted result; (b) Harris corner points on the extracted shape; (c) Yellow shape boundary being chased; (d) Final result represented in NCSC.

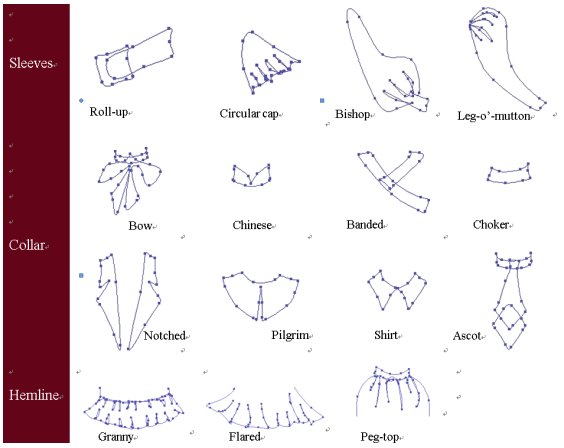

Figure 2: Template library.

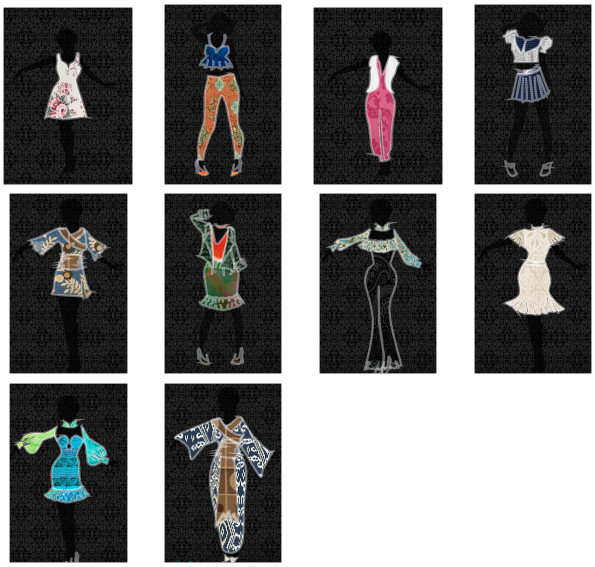

Figure 3: Results.

for specific purpose we choose KaledoV4R1 of Lectra [4] since it is more relevant to our system when it comes to clothing design. Lectra is a well-known company that provides technology solutions & associated services for industries using fabrics, leather, technical textiles & composite materials. Kaledo, professional software for clothing design, is one of the most famous creations of Lectra. It has all the necessary elements and features that are ideal for creating designer clothing meant for the catwalk, end even for a clothing business. KaledoV4R1 is the latest 2D release of Lectra on June 24, 2014.

Table 1 shows the comparison features among three different systems: Adobe Photoshop CC, Kaledo by Lectra and our system.

Currently our system only works well with the image that satisfies the three requirements listed as follows. First, the clothes from the input image should not be covered by the body part or hair (for woman garments). Second, the extracted clothes should not appear more than one time in the input image. Third, the target shape has to be fitted well inside the image, which means the shape cannot be cut by the image margin.

Finally, some results generated by our system are shown in Figure 3.

5 CONCLUSION AND FUTURE WORK

Fashion design systems have been used more and more by not only professional but also amateur designers.

System / Feature	Adobe Photoshop	Kaledo	Our System
Drawing Tools:			
Curve Tools	approximating curve	approximating curve	interpolating curve
Smart Fill Tool	✓	✓	✓
Design Assets:			
Customizable Clothing Template	✗	✓	✓
Semi-automatic Spline Shape Creation	✗	✗	✓
Design Rendering:			
Real Fabric Rendering	✓	✓	✓
Textile Design	✓	✓	✗

Table 1: System Comparison Matrix.

Considering that, we propose a new and easier way of doing clothing design which allows for rapidly acquiring a clothing shape and rendering it in a way that makes the designing task more intuitive. The whole procedure consists of three steps: 1) obtain the silhouette of an object chosen by a user using SIOX; 2) apply Harris corner detection to extract a feature points from the silhouette; 3) sort the feature points and present the shape clothes using NCSC. Compared with other systems, ours provides the functionalities of semi-automatic creating a clothes Spline shape from an input image and a reference which helps to save users a lot of time. Besides, it is different from the previous works which use the approximation curve to do the shape creation. Here we change the way of curve manipulation from approximation to direct control. As a result, it is intuitive and more convenient for a user. Moreover, our system can be used as a useful tool to complement the existing design tool, such as Photoshop or Kaledo of Lectra. The ability of using an arbitrarily provided image enables the user to get more interesting results.

From our experiments, we observed some limitations of our system, and the improvement over which leads to directions for our future works. Firstly, the inaccurate shape extraction (parts missing or incorrectly classified foreground) when it comes to extract the clothes from real-life photos or if background and foreground share many identical shades of similar colors. It is because SIOX is color dependent. Using a better method for shape extraction may significantly improve the results. Secondly, texture removal is also an important step which needs to be considered before doing the shape extraction. It helps to improve the result of shape boundary creation. Next, our current system only provides the 2D texture which makes the garment look flat and therefore deteriorates the liveliness of the design. For that reason, instead of using 2D B-Spline, we could use Non Uniform Rational B-Spline(NURB) surface which allows a user to modify the surface of the clothes to create folds of the garment, thus being able to apply and render textures in a 3D form. Lastly, the speed of the system decreases while working with more clothing shapes, and this is also a concern and needs to be improved in the future.

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