METHODS OF IDENTIKITS DRAWING

Milan KOVÁČ, Peter SCHREIBER

Authors: ***Milan Kováč, MSc. Eng., Peter Schreiber, Assoc. Professor, PhD.***
Workplace: ***Institute of Applied Informatics, Automation and Mathematics, Faculty of Materials Science and Technology in Trnava, Slovak University of Technology Bratislava***
Address: ***Hajdóczyho 1, 917 24 Trnava***
Email: ***milan.kovac@stuba.sk, peter.schreiber@stuba.sk***

Abstract

If we want to identify somebody, his face is our primary target. Description of somebody means mainly the description of his face, too. With the computers, we have new possibilities how to make facial composites. There are more ways how to draw a face. The article describes the present-day methods and offers new ways, how to solve main problems.

Key words

face, composite, foil, stripes, folds, witness, genetic algorithms

Introduction

The face is the basic part of a human body, which plays a dominant role in identification and in description of people.

To remember someone means to remember his face. That is the reason why photos capture the face and not other parts of the body. If we want to remember someone, primarily we observe his face. If we are not able to reconstruct the face of a person, the person becomes a shadow. If we remember the name, but not the face, the man ceases to be a real person. If someone wants to hide his identity, he especially hides his face.

We try to get the man's face in the process of identification. The facial composite (identikit) is a tool for it. [1]

The composite is a common thing. It is used by police, by secret services; often it is made and used in the films. Facial composite can be characterized as a graphical presentation of an eyewitness's memory of a face. We can determine the identity of the sought person in this way.

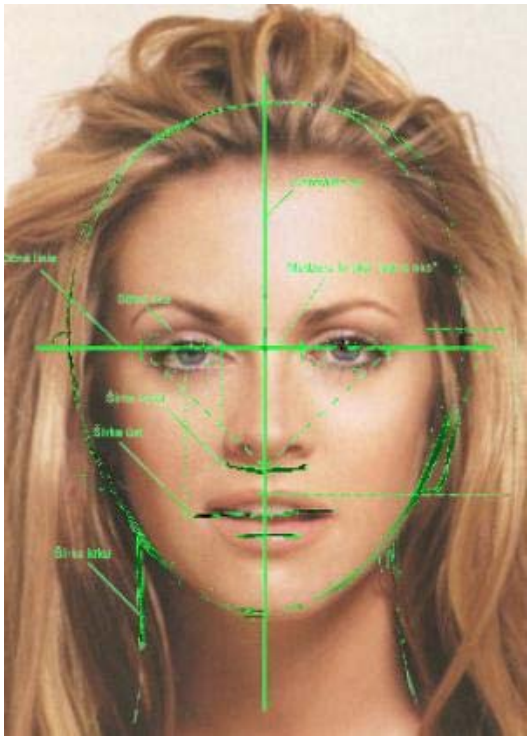

Fig. 1 *Face features* [2]

The construction of the composite was originally performed by a trained artist in consultation with a witness. This method is still used today and it is considered to be the best One. Seeing that a drawer is not the most common occupation, different templates of separate facial features came into using. A final face is given by their linking. There may be various forms, whether overlapping transparent foils or image cut into strips. More recently, computer imaging systems have been developed, such as most popular FACES and CompuSketch, Mac-a-mug and SuspectID in the United States. The systems E-FIT and more recently PRO-FIT has been widely used in the United Kingdom. [3].

There are more ways of identikits applications: In addition to a witness description there are used for posters, for additional evidence or in the television and newspapers, when the public assistance is needed. Many times this method can be the only way how to identify a missing person.

From facts mentioned above it is clear that the formation of the composite bases on two fundamental pillars. The first one is the witness. People generally have a good ability to recognize and remember faces, but it is worse if they have to describe it. In addition, several complications may arise. A man remembers the face on the whole, not by individual parts. If the face is described by individual parts, the result may not be accurate. Conversely, if there are too many options for the witness, he can be in a maze. Some people have no memory for faces, or there may be various "mind tricks". The known example is when several witnesses describe the same man completely differently and each of them was convinced of the correctness of his description. The time also plays the important role: the longer it is, the greater is the probability that the result will be not precise. The result can also be induced by the actual artist (program). Probably no composite can be absolutely accurate, but it should be precise enough to identify a real man. [4]

Display Methods

In general, all facial composite programs work on the same principle: folding individual parts of the face into the final image. Exceptions are, of course, 3d programs, which work on different principle. They model a face. It is possible to achieve exact likeness with some effort by these 3d programs, but it is questionable how much such programs are suitable for composites design when you need to rely on witness memory. These modeling programs are used mainly when we have a model (pattern), which we need to convert into 3d. Mainly some older people are not able to use this option. Also the realism of the resulting face depends on the program.

Many people consider classic drawing as the best way of composites making, so it is not necessary for good programs to be 3d. From now on we will talk about "ordinary" programs. In principle, they work by the same way, each of them composites the face from various individual parts. The displaying can be done by many ways and it can not be said that one of them is strictly better than another one.

The witness should work with a face as with a single entity, or he should be perceived so at least; he should not be forced to work with different parts of the face particularly. One of the problems, which are probably unavoidable, is overloading of the witness with possibilities. When he suddenly sees many similar faces, he may become "lost" in his own thoughts and not be able to remember correctly. Therefore, the folding process is split into steps to avoid the witness congestion with possibilities. Several display methods are mentioned below. [5]

Foils

This approach is probably the best known method. It works like classic foils. There are various parts of the face such as eyes, nose, etc. on individual sheets. The resulting face is given by their overlaying. Various types of noses, mouths, eyes are stored in a database. The chosen parts are inserted into the resulting image. The final face is done step by step by this way. The face is assembled from several parts, respectively layers.

The witness has many available options, and he must choose the correct parts. He compiles the resulting face from them.

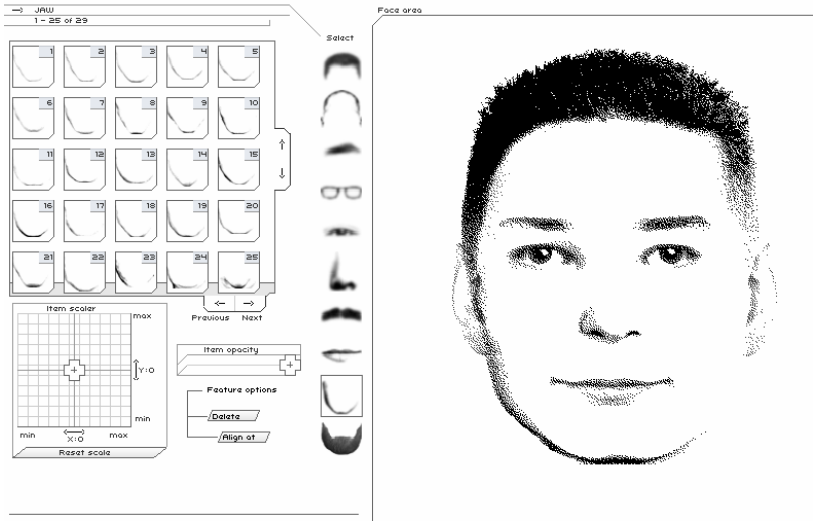

Fig. 2 *Flashface* [6]

The simple program Flashface, which is available free on the internet, is given in the Figure 2. It allows the assembling of the face by overlapping parts. There is a menu of individual parts of the face in the left side. The parts are marked by user and after that they are used for the face image in the right side. Individual parts are black and white, and by their overlapping we get the final face, so the composite creating looks like the work with foils. The individual parts (Fig.3) are divided into categories. It is not possible to work with the whole face, but the overlapping gives an illusion of one unit. The face is simple; we can see just basic features, so the witness is not bothered with useless features.

Fig. 3 *Individual parts* [6]

Strips

Another way for faces displaying is using of so-called stripes. Individual faces are horizontally split into several parts (eyes, nose, mouth...). These strips are horizontally close, so they put together an overall face (Fig.4). For example, if we want to change eyes, we change only the strip with eyes and the other strips will remain in place, so they are still in sight. The witness can see the whole adjusted face by this way. The final face is not the result of overlaying multiple images, but the individual parts of the face are just put side by side and they are perceived as a whole.

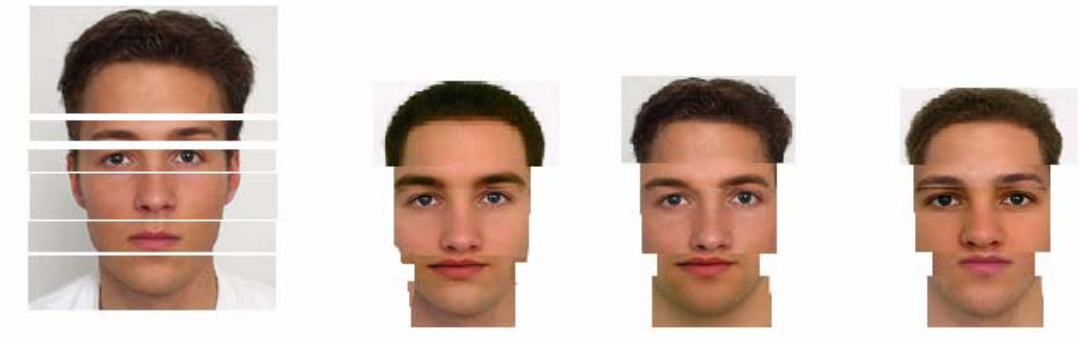

Fig. 4 *Individual strips* [7]

The picture on the left side shows the original face, which is cut into strips. The three faces on the right side show how they would look if they are the mixture of several parts. By this way we can change the individual strips and we still see other parts unchanged in the same time.

Folding

This method is actually a sort of mixture between the foils and the strips. It uses overlapping and also assembling. The principle is simple; we have a background image with the face. However, it is just a "blank" face; there are not eyes, nose or other parts. These are stored separately and moved into this blank face. Therefore we see the background and the individual parts (Fig.5). The parts overlap the face like in the case of foils, while the parts are handled similarly to the strips.

Fig. 5 *Blank face with parts* [8]

The figure 5 shows a blank face in the right and the parts in the left side respectively. The resulting face is given by inserting the components to the background.

Fig. 6 *Complete face* [8]

The result is therefore an overlapping of different parts with the background; such outcome may be quite credible (Fig.6). A witness sees it as a whole; unlike the foil we see the whole face and not just its contours.

Possible solution – genetic algorithms

As we can see, we have more possibilities. In general, all methods are similar. We work with parts of faces, putting them together to get a result. It is like a puzzle game with one great difference – we do not know how the image should look. We just try to create a result from all of its parts, which will be good enough to fulfill requirements.

There is no ideal approach in the faces drawing. Each method has its own pros and cons. The determining element is the witness. He must be sure which face is correct, where are differences, what is necessary to change… In reality, many of them are not able to do this, or are not certain – we can say they are just guessing.

To improve this process and avoid main problems, we suggest a new solution. The using of genetic algorithms or neural networks can be ideal.

We can avoid the main problem with the witness by genetic algorithms. Our suggested approach is this one: At the beginning, the program will create several faces from the faces elements from a database. The witness will choose one face, which will be the most similar to the real one. Now the genetic algorithm will take this face as primary one and will create another generation of faces, similar to the chosen one. Now again, the witness will choose one face, etc. This way, the witness must just remember the real face. He is not forced to describe it or say what is wrong. Also, he is not overloaded with many facial parts. He sees complete faces, he just chooses from them. This is easier and less stressful. After several steps, we will get to the final face. This is more efficient way than just creating a facial composite. With the combination of genetic algorithm and facial composite, we will get better results and the entire process will be simpler.

Conclusion

There are many ways how to draw a face in the process of making the facial composite. Although drawing by artists is regarded as the best solution, this method is not always possible. Therefore foils began to be used. The new opportunities started with the arrival of computers.

The used methods are similar to each other and fulfill the same function. It cannot be said that one way is better or worse than others. The programs should have certain properties, such as offering different options and giving witness choices without giving too many options at once for witness to keep a clean head.

Neither method can be called ideal. Each one has some limitations resulting from the method of folding. Foils offer only basic contours. Strips do not offer a credible result and some parts give wrong combination with other parts, which do not create an illusion of a single face like in the case of foils.

Regardless of method the key element is the witness. Even if he manages the face creating, he may be not able to describe it. After rendering the face by his description he could also say that this is not correct, something is different, but he is unable to say what exactly. So irrespective of the used program, the human factor is still questionable.

It is necessary to find a way how to eliminate this problem, at least partially. The asked solution could be the application of neural networks or genetic algorithms. With their utilization we could obtain better and more accurate results. The witness describes a face by the best way he could. Next, by using of genetic algorithms, the program would offer a number of similar faces and the witness should select the most accurate option. He identifies the face without requirement to describe it. The program self offers more options. The witness must only choose one of the faces, closest to reality. By this way we would get a good outcome and the problem, where the witness claims that there is something wrong, is eliminated. The choosing from the offered options is much easier than to create them. Therefore the whole process is easier and offers better results.

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