# FACIAL RECOGNITION

One of the remaining incompletely solved problems in the area of digital analysis is how one can instantaneously recognize via electronic computer a particular human face from a set of millions of others. Although numerous facial recognition computer programs exist most will fail, especially when the subject is in disguise or has made changes in hairstyle, age, and or facial orientation. This inability stands in stark contrast to what our brains are able to do and it suggests that a more detailed understanding of how humans are able to accomplish such a task should eventually lead to a breakthrough in perfect computer recognition. I started thinking more about this process recently stimulated by a chance viewing of the television program 60 Minutes concerning a small subgroup of individuals who are incapable of distinguishing between individual faces including such extremes such as a mother not being able recognize her daughter. When the woman was asked by the interviewer what she sees in the photograph of the daughter her answer was that she recognizes obvious facial features such as eyes, nose , and mouth but is unable to connect these with her memory to allow recognition. This fact suggests to me that facial recognition relies on small subtle difference between the individual to be recognized and some kind of a norm stored in the brain and that those few individuals incapable of facial recognition are suffering from an inability to compare the small differences between an individual and a normal facial pattern.

Following this line of reasoning I have begun to first look for a facial norm. This can be gotten by computer morphing as explained at http://www.faceresearch.org . In my examination I have taken from their list of some two hundred or so photos of college age students a list of fifty young caucasian female and male subjects and averaged their photos. The result is the following-

COMPUTER MORPHING OF A LIST OF FIFTY RANDOMLY CHOSEN FEMALES AND MALES
SHOWING THE AVERAGE CHARACTERISTICS OF THE HUMAN FACE

(Data Source: http://www.faceresearch.org)
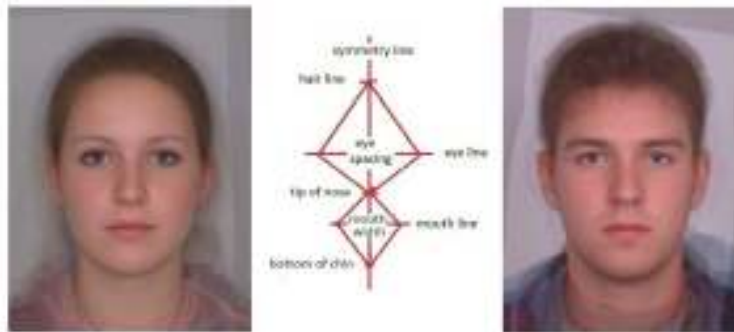
There are several things quite interesting about this result. First of all one notices the two morphed images show two relatively attractive individuals created from a randomly selected group of individuals ranging from highly attractive to highly unattractive. This suggests that our brains are programmed, on a genetic basis, to be attracted to something close to an averaged human face and that large departures from this are probably undesirable . Furthermore, when measuring the dimensions of the two morphed images, it becomes clear that these have a unique double kite structure as indicated by the red line pattern. The configuration is about the same for the morphed female and male image although the eyebrow shape and chin length differ slightly. Excellent bilateral symmetry is also present in both cases.

It seems to me that one probably distinguishes an individual's face from a large collection of others by noting the subtle differences between it and the above normal averaged face. The amount of processing required for such a comparison should be considerably less than a brute force scan of the entire face. The fact that the normal human brain is able to accomplish facial recognition in a split second strongly supports such an approach. Those parts of the face showing the largest departure from the norm will be the ones likely to be first called up to compare with stored memory making for a rapid identification. For example, very easy recognition will be achieved for individuals such as Barbara Streisand, Bernadette Peters , Reese Witherspoon, Julia Roberts, and Jackie Kennedy among many others. Their facial features have obvious departures in certain areas from the norm which will be instantly recognizable by most viewers. The most difficult recognition can be expected to occur when an individual is a close match to the norm such as Elvis Presley. In that case a much more detailed and higher pixel image will be required for the recognition process and other factors such as clothing style and body shape will have to enter the analysis. Notice that the facelift industry essentially attempts to change facial features of individuals to more closely approach the above facial norm. The best disguises would appear to be ones close to the facial norm shown above. Large variations from the norm including facial asymmetries produce factors of unattractiveness. This fact is

taken advantage of by horror movie producers. Think of the monsters portrayed by Charles Laughton in the" Hunchback of Notre Dame" , Lon Chenney in "Phantom of the Opera", or Margeret Hamilton as the wicked witch of the west in the"Wizard of Oz".

I remember in my early twenties that I was quite intrigued by the Italian actress Gina Lollobrigida. It is difficult to say exactly why this was so, but her facial features seemed just right. A photo taken during her heyday is shown below-

Gina Lollobrigida, circa 1958

The face clearly has a pattern almost exactly like the symmetric double kite configuration shown earlier. The more subtle requirements needed for facial recognition in this case are high check bones, large eyes, small straight nose, and long hair. These latter enhancements are well understood by the cosmetics industry and makeup artists. It is also the reason that it is sometimes difficult to distinguish one Hollywood blonde from another. They all look the same at first glance.

(You can get a higher resolution view of the above two figures by going directly to-
http://www2.mae.ufl.edu/~uhk/ATTRACTIVE-AVERAGED.jpg and
http://www2.mae.ufl.edu/~uhk/Gina-Lollobrigida.jpg   )