

CHAPTER

2

FACIAL CARICATURE GENERATION USING MORPHING TECHNIQUES

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2.1 INTRODUCTION

The cartoon is a simple drawing that can show the characteristics or features of humans, animals and other objects. The two-dimensional (2D) cartoon is being sketched or drawn to create a story that is usually used inside comics or animation, film, or the entertainment industry. Cartoon images can convey many meanings behind the characters or features that are being created or drawn by the cartoonists. Each character that is inside the film for 2D animation needs to have its own story so that it can have an impact on the audience.

For the cartoonists, to create an image for the character, they need to have an idea of the character of the cartoon so that it can make the cartoon look alive. Therefore, it is important for them to do research for each character, especially if the character will be created in human form or as an object that is alive, such as an animal. This idea can also be implemented for film industries like animation industries that are involved in human history, for example, Lee Chong Wei as a Malaysian professional badminton player. The animated film can create a character of Lee Chong Wei by analysing his facial features from his

teenage years to the present. Based on these observations, the character can be designed to look realistic and accurately represent Lee Chong Wei at different stages of his life.

A caricature is a cartoon that is drawn to resemble someone as defined in Perkins (2017). It should look like the actual person, but in cartoon form. The real individual can be recognised by looking at the caricature of their face. The 2D cartoon image and human photograph can be suitably merged to produce a new image that forms a face caricature. The face caricature that is being produced can be used in the film industry or the animation industry. The difference between the two images can be combined so that they can form a new form of face and also can produce an avatar-like character. However, it is important to choose the correct technique so that it enables the two pictures to be perfectly aligned.

The technique of merging two images is known as the morphing technique (Ferrara & Franco, 2022). Morphing has been widely applied across various industries, particularly in entertainment. It allows images to be transformed in ways that create a markedly different appearance from their original form. For example, it can be used to age a young human face or to combine an animal face with a human face to generate a new character. In this project, the morphing technique will be employed to merge an artist's caricature with an individual's facial image, producing a caricature that closely resembles the individual. There are multiple types of morphing techniques, each suitable for different applications. Choosing the appropriate method can facilitate the creation of face caricatures and substantially enhance animation in film and entertainment.

2.2 UNDERSTANDING THE BASICS

There are various morphing techniques commonly used by researchers in the field of computer vision and image processing, including field morphing, mesh morphing, and view morphing. Each technique serves a distinct purpose, depending on the intended application.

2.2.1 Field Morphing

The field morphing technique is one of the approaches used by animators to define feature lines on both the source and destination images. As discussed by Aloraibi (2023), this feature-based morphing method provides a simple way to manage the user interface through pairs of corresponding lines. In this technique, two images are first warped so that corresponding features align in both position and size, followed by a cross-dissolve operation to generate the final output image.

Field morphing, also known as the warping technique in Islam et al. (2013), can be implemented using either forward mapping or reverse mapping. In forward mapping, each pixel from the source image is scanned and mapped to its corresponding position in the destination image. Conversely, in reverse mapping, the destination image is scanned pixel by pixel, and the correct pixel value is sampled from the source image.

Earlier definitions have been discussed in Wolberg (1998), field morphing uses mathematical functions to define the transformation from one image to another, enabling very smooth and fluid transitions by mathematically modelling the underlying transformation field. Successful morphing depends on accurately aligning corresponding features between the images, such as the eyes, nose, mouth, and overall facial structure. Proper alignment ensures that the resulting transformation appears natural and continuous.

2.2.2 Mesh Morphing

Mesh morphing techniques use algorithms that combine features from the source and destination images, provided they share the same structure shape. For example, the image will be separated into small regions with a mesh of interconnected points, and they will be mapped to each other for the process of morphing to happen. Mesh warping, founded by Smythe was used in the 1988 movie *Willow* (Wolberg, 1998) and is also known as Control Grid Interpolation. Then it was