

# Real-Time Human Face Tracker Using Facial Feature Extraction

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## Abstract

*Human face tracker is one of important research areas that is continuously increasing. Many applications have been benefited from this research field, such as human-computer interaction, animation development and security identification. Many methods have been developed for performing an effective and efficient face tracker application. One category of the face tracker methods is the real-time face tracker, which is a challenging task in this field. This paper presents a real-time human face tracker development with using facial feature extraction. The skin color method is adopt to obtain the face region because of its efficiency in computing which is required in real time face tracker. The experimental results show that the system can track the movement of the human face well as long as the whole face can be captured by the camera.*

**Keywords:** human face tracker, facial feature extraction, skin color

## 1. Introduction

There have been many efforts to increase the interaction between human and computers. One of these efforts is to give the computers the abilities to sense and give response to what it senses. This includes the ability to see and track the movement of an object. Object movement tracking is an active research field. Some of the applications that are benefited from this research are animation development, whether for games or movies, security identification, etc.

One important part of the object tracker is for human face (human face tracker). Many methods have been developed to perform human face tracker, such as tracking with *active contour* [1-2], *eigenspace matching*, and performing image convolution with feature detector. However, those methods required complex computation that reduces the efficiency of the system. A method that is efficient in computation is by employing skin color [3-5]. This paper presents face tracking system by using facial feature extraction that employ skin color to identify face position.

## 2. Previous Work

According to Wang and Yuan [5], to detect human face using skin color, HSV value from each pixel needs to be obtained. Then, normalization of RGB value is also needed. In their research, after extracting the human face region, they used wavelet decomposition algorithm to extract facial features and neural network to detect eyes region. The drawback of this process is time consuming, so it cannot be used as real time application.

Another method to detect human face is by using skin color, which is developed by Sandeep and Rajagopalan [4]. The first step of this method is the

same as Wang and Yuan's method, which is obtaining HSV value from each pixel. In addition, Sobel operation is needed to extract object region from RGB picture. Each region which is categorized as skin color is needed to calculate the ratio of its length and width. If this ratio falls between the *goldenratio* with a particular *tolerance*, then the region is detected as face region. *Goldenratio* value is approximately 1.1618 and *tolerance* value is approximately 0.65.

## 3. Skin Color

Human skin color ranged from very dark to nearly colorless (appearing pinkish-white due to the color of the blood under the skin) in different people. In general, people whose ancestors come from sunny regions will have darker skin than people whose ancestors come from regions with less sunlight. On average, women have slightly lighter skin than men. However, color changes in one race have been evolved based on genetic variation skin color and culture changes.

In order to process human face tracker, face skin color sample must be taken and RGB value from the image must be changed to HVS color system with the following equation [5]:

$$\begin{aligned}
 H1 &= \cos^{-1} \left\{ \frac{0.5[(R-G)+(R-B)]}{\sqrt{(R-G)^2 + (R-B)(G-B)}} \right\} \\
 H &= H1 \quad \text{if } B \leq G \\
 H &= 360^\circ - H1 \quad \text{if } B > G \\
 S &= \frac{\text{Max}(R, G, B) - \text{Min}(R, G, B)}{\text{Max}(R, G, B)} \\
 V &= \frac{\text{Max}(R, G, B)}{255}
 \end{aligned} \tag{1}$$