A Literature Review for Eye Tracking Driven Motor Wheelchair

Introduction

This project is trying to setup a reliable eye tracking driven motor wheel. Since the technology for parts like motor control, communication between PC and micro controller and GUI development are relatively mature, this review focus on the eye tracking algorithms and challenges involved.

As one of the most vital features of face characteristics, eye motion play an quite important role in expressing a person's desires and needs, cognitive processes, emotional states, and interpersonal relations. [1]Although enormous researches have been carried out on eye motion and eye tracking in many fields such as biometric security, human-computer interaction, challenges are still blocking the way to implement it easily in practise. Challenges of eye detection and tracking are caused by illumination changing, in-plane rotation, out-plane rotation appearance changing and occlusion.

As shown in [2], eye location may be implemented in 5 ways:

1. Shape detection, an approach that try to match iris, pupil and shape of eyes.
2. Feature detection, which captures characteristics of human eye to locate features including limbs, pupil and cornea reflections.
3. Photometric appearance detection. This approach detect eyes directly using its photometric result characterized by the colour or some filter response of the eye and its surroundings.
4. Combination approach. This approach combines several different methods together in one system.
5. Other way. Such as symmetry operators, temporal information.

In addition to eye location, eye tracking is another field reviewed in this report. Since eye tracking is one of object tracking issues, this review focused on object tracking to discuss advantages and disadvantages of ways currently available.

Generally there are two classes of object tacking algorithms. They are generative and discriminative respectively. Generative algorithms build a model for the object tracked and use this model to the region in an image that has minimum differences. Discriminative algorithms pose the tracking problem as a binary classification task in order to find the decision boundary for separating the target object from the background [15]. Eye tracking has been studied in many fields. Zhu and JI illustrate a eye tracking system using IR illumination [15]. Villanuev et al. also showed an eye tracking system to identify gaze direction with extra hardware [16]. As shown in [17], face detection can be carried out first prior to eye tracking to improve the performance. Hansen et al. present a new approach that may perform in large information spaces with noisy inputs.

Face detection is the third issue being reviewed. It may be used as an alternative method to improve or even substitute eye tracking and eye location.

References

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