Computer Vision Based Navigation System for the Visually Impaired

Shahedur Rahman[*]
Middlesex University

Abu Syeed Md. Zakaria Shah[†]
Middlesex University

Gill Whitney[‡]
Middlesex University

Extended Abstract

A navigation system for visually impaired people primarily involves sensing the surrounding environment and providing meaningful feedback with the aim of enhancing the mobility of the user. Researchers in this field have experimented with different approaches to sense the surrounding environment. The navigation system proposed here incorporates Computer Vision techniques. Everingham et al[1999], Rahman and Hassan [2002], Molton [1998] and others [Gavrila] have experimented with different variations of Computer Vision techniques for vision based navigation systems. The main objective of this research is to adopt novel techniques to enhance the existing methods used in navigation systems to aid the visually impaired people. The results obtained from the research are encouraging and it also demonstrates the suitability of using computer vision techniques in such navigation systems.

The research is looking into two aspects of the navigation system: matching *key objects* from image sequences and matching a *pre-defined scene* from the image database with image sequences. The key objects are the stationary objects which are usually encountered as one walks along a route. As the user travels along the route, the system tries to match the pre-defined objects from image sequences. The second option will match a pre-defined path with moving image sequences. The pre-defined path will be kept in the image database and it will be captured as required by the user. This paper is highlighting the first aspect of this research.

The *key objects* considered for this research are lamppost, bus stop, traffic signal, post box, waste bin, trees and edges. A database of these key features was developed and a number of matching algorithms were applied on moving image sequences to identify these objects. The algorithms investigated are: gray level template matching, shape model matching, scale invariant shape model matching, and edge based shape model matching. Approaches used for Gray Level Template Matching are: matching with gray scale or edge templates using a maximum-likelihood and shape-based method using Distance Frame Difference (DFD). The shape models were correlated with moving images and the best match was given by the score estimation. The shape model matching technique was extended to include the scale invariant shape model matching technique for different sizes. The research then focused on applying the shape model on edge-detected images. The strategy of this navigation system can be used in both outdoor and indoor environments which is quite novel. Some of these results are shown in Figure 1 and Figure 2. The research is hoping to continue in the following areas: taking into account the varying lighting/weather conditions and the blurring effect, and detecting objects at a lower height such as bricks/stones. The research will also be looking at other issues like detecting indoor objects, DSP based implementation issues, rendering the visual information and the usability issues.

[*]email:s.rahman@mdx.ac.uk
[†]email:a.s.shah@mdx.ac.uk
[‡]email:g.whitney@mdx.ac.uk

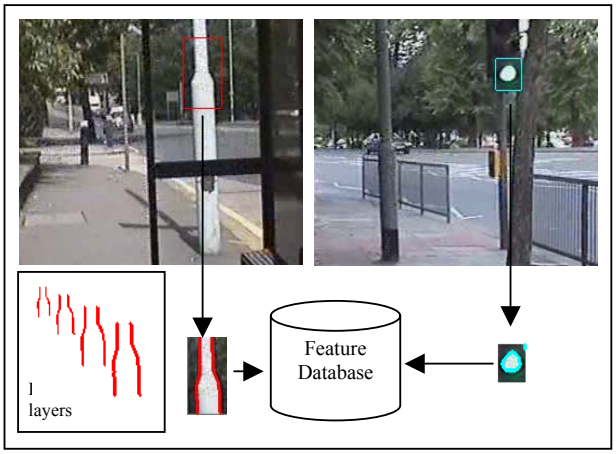

Figure 1: Shape model feature database

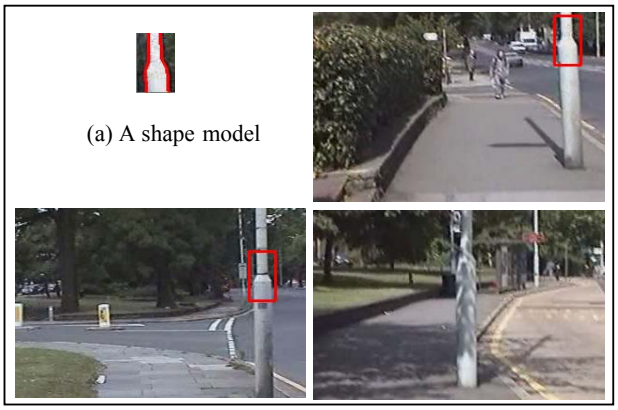

Figure 2: Examples of shape model matching

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