Field article of the issue

The Application of Deep Learning for Helping Visually Impaired People Navigating QU

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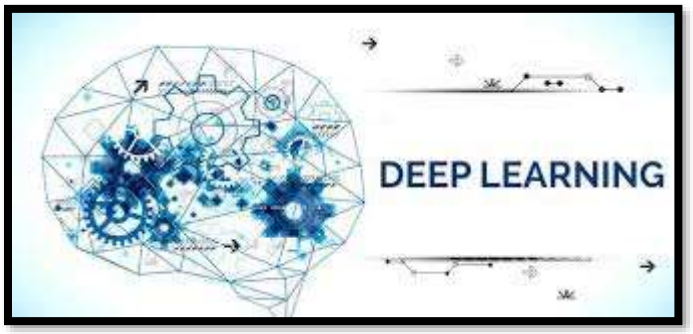

Introduction

In the last few years, signal processing had witnessed significant scope widening with machine learning technical area [1], especially with the great development that emerged in 2006 for deep learning [2] which is a new area of machine learning. Unlike traditional machine learning techniques which exploit shallow architectures that have a single layer feature transformation, deep learning exploits deep architectures that cope with complex features in problems like human vision and speech processing [3]. One application of deep learning is computer vision which aims to give computers the ability to extract high-level understanding from digital images and videos. Some tasks of computer vision include image classification, object detection, object segmentation and many others. One of the applications that can benefit from computer vision are applications that help people with visual disabilities for navigation from one place to another.

There are about 285 million visually impaired people in the world. They struggle to walk; they struggle to identify. There is much research done in computer vision to make those people struggle less. Computer vision is an analogue system that converts optical information into demonstrative signals. It allows visually impaired to have less of struggle in life. Take walking, for example, they will usually have a stick or an adult that lead the way for them. Computer vision guides them by a camera that captures the information of the environment the one blind persons in and that information is processed by the computer that in return vocally informs the person using the device of what is around them. Computer science researchers at Qatar University have been trying to develop a new mobile device which could potentially allow the blind people to see the world around them. Led by Dr. Somaya Al-Maadeed, head of the Department of Computer Science and Engineering and a team of researchers, the first prototype of the system is completed.

General Overview of the system

CamNav is a computer-vision based system, which utilizes a trained deep learning model and SVM model to perform indoor scene recognition. The architecture of the system shown in Figure 1 is a client-server architecture. The server part is responsible for performing complex processing computations. The use of image processing as well as deep learning techniques on a mobile device consumes a considerable amount of processing resources resulting in a significant loss in the battery life that's why these parts are placed in the server side. In the other hand, the client side is the mobile application that provides the services of indoor positioning and navigation. The mobile application is configured to send in real-time captured images to the server and wait for their recognition. Figure 1 shows the complete architecture of the system.

The Testing Environment

In order to show the effectiveness and efficiency of the proposed system, another two systems which utilize QR code markers (QRNav) and BLE beacons are developed to guide the people with visual impairments using the system. The performance of CamNav, QRNav and BLE beacons based navigation system are evaluated in real-world