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An Assistive Object Recognition System for Enhancing Seniors Quality of Life

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Abstract

This paper presents an indoor object recognition system based on the histogram of oriented gradient and Machine Learning (ML) algorithms; such as Support Vector Machines (SVMs), Random Forests (RF) and Linear Discriminant Analysis (LDA) algorithms, for classifying different indoor objects to improve quality of elderly people's life. The proposed approach consists of three phases; namely segmentation, feature extraction, and classification phases. Datasets used for these experiments, are totally consisted of 347 images with different eight indoor objects used for both training and testing datasets. Training dataset is divided into eight classes representing the different eight indoor objects. Experimental results showed that RF classification algorithm outperformed both SVM and LDA algorithms, where RF achieved 80.12 %, SVM and LDA achieved 77.81% and 78.76% respectively.

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Keywords: features extraction; Linear Discriminant Analysis (LDA); object recognition; support vector machines (SVMs); random forests (RF).

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1. Introduction

In 2010, Elderly who aged 65 or older were 524 million approximately of the world's population and the number of elderly rapidly grow. So, by 2050, it is expected to be nearly triple to about 1.5 billion world's population [1]. As a result of the growth in the elderly population, the attention to their complex needs will be increased. The elderly suffer from different problems and diseases such as, dementia, memory difficulty and low vision. Most of the elderly are not able to manage daily life by themselves due to these problems.

For Dementia, it isn't a specific disease. It is a degenerative condition and has no known cure. Symptoms of dementia disease are memory loss, cognitive weakness, communication difficulty, mood disturbances, executive dysfunction, aphasia, agnosia, apraxia, visuospatial impairment, behavioral and activity, these symptoms get worse over time an affect people's daily life and activities [2–4]. Also, for visually impaired, low vision people (by birth or by an accident or due to old age), they suffer from poor vision, sometimes they distinguish differ between objects [5]. Elderly people also suffer from memory difficulty; as they know how to use objects, but, they don't remember their names.

These situations are depressing for the individual and irritating for their loved ones. Individuals, who suffer from these problems, are worrying about their life as well as privacy as they can't act independently. Although there is no cure for these problems, they can still have a good quality of life, if the right long-term care plan was provided in a place. Since the cost of caring for elderly is very steep [4], so an indoor object detection and recognition system for elderly, visually impaired and low vision people, is required to support these people to act independently. Object detection and recognition is one of the most challenging problems in computer vision. Utilizing computer vision with machine learning techniques has recently been widely used in developing real world object recognition system based on the use of local features [6].

This paper is a part of the framework for designing an intelligent assistive system for indoor object detection and recognition for elderly people. The proposed system depends on computer vision and machine learning techniques. The dataset used in this paper, is downloaded from UMass Lowell University website. The rest of this paper is organized as follows. Section 2 introduces related research work. Section 3 describes the different phases of the proposed system. Section 4 discusses the tested image dataset and presented the obtained experimental results. Finally, section 5 presents conclusions and future work.

Nomenclature

ML	Machine Learning
SVMs	Support Vector Machines
RFs	Random Forests
HOGs	Histogram of Gradients
LDA	Linear Discriminant Analysis
PCA	Principal Component Analysis
SIFT	Scale Invariant Feature Transform

2. Related Work

As previously stated in the introduction section, object recognition is one of the most challenging problems in computer vision. In the last few years, there has been substantial work in the computer vision field, which tackling the problem of object recognition. This section gives a brief survey of recent work on object recognition.