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Alzheimer Disease with Blood Plasma Proteins Can Be Detected by using Convolutional Neural Network (CNN)

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ABSTRACT

The development of hardware technology, especially in mobile devices has provided a possibility to run large programs efficiently on smartphones such as virtual reality, augmented reality and neural network based programs. Augmented reality is a technology that works on computer vision based recognition algorithms to augment sound, video, graphics and other sensor based inputs on real world objects using the camera of your device. In this paper, a comprehensive review on Alzheimer's disease (AD) is carried out, and an exploration of the two machine learning (ML) methods that help to identify the disease in its initial stages. Alzheimer's disease is a neuro cognitive disorder occurring in people in their early onset. This disease causes the person to suffer from memory loss, unusual behaviour, and language problems. Early detection is essential for developing more advanced treatments for AD. Machine learning (ML), a subfield of Artificial Intelligence (AI), uses various probabilistic and optimization techniques to help computers learn from huge and complicated data sets. To diagnose AD in its early stages, researchers generally use machine learning.

I.INTRODUCTION

Although deterioration is natural, it can significantly influence some persons due to certain risk factors. Alzheimer's disease is a neurocognitive disorder occurring in people in their middle or old age, and it affects 46.8 million people globally and can impact a person's quality of life. AD populations are estimated to increase to 106.8 million by 2050. The estimated cost of long-term health care for dementia patients is about \$290 billion. Research toward early AD diagnosis is ongoing to slow down the abnormal degradation of neurons in the brain. It also produces emotional and financial benefits for the patient family. This disease causes the person to suffer from memory loss, unusual behaviour, and language problems. It is caused due to the tangled bundles of neurofibrillary fibres of the brain and certain regions of the brain like the entorhinal cortex and hippocampus. The initial symptoms, such as episodic memory impairment and the navigational problem of the patient, are typical variants. The higher order symptoms include memory loss, impaired judgment, and difficulty in identifying objects, confusion in paying bills and driving a vehicle, and placing objects in odd places.

Alzheimer's disease is divided into three periods: the primary period, the intermediate period, and the last period of dementia. AD is diagnosed through the brain monitoring modalities, such as CT (Computed Tomography) scan and PET (Positron Emission Tomography) scan resting-state functional magnetic resonance imaging (RS-FMRI). The successful development of amyloid-based biomarkers and tests for Alzheimer's disease (AD) represents an important milestone in AD diagnosis. However, two major limitations remain. Amyloid-based diagnostic biomarkers and tests provide limited information about the disease process and they are unable to identify individuals with the disease before significant amyloid-beta accumulation in the brain develops. The objective in this study is to develop a method to identify potential blood-based non-amyloid biomarkers for early AD detection. The use of blood is attractive because it is accessible and relatively inexpensive. Our method is mainly based on machine learning (ML) techniques (support vector machines in particular) because of their ability to create multivariable models by learning patterns from complex data.

Machine learning

Understanding machine learning and the standard machine learning approaches used in AD prognosis is necessary before starting the deeper examination of machine learning methodologies. Artificial intelligence includes machine learning, which contains various tools for making probabilistic and statistical judgments based on prior knowledge. Classifying new events and forecasting new patterns depends on prior learning (training). When compared to standard statistical methods, machine learning is much more powerful. For machine learning to be successful, it is essential to have a good

understanding of the problem and the algorithms' constraints. As a result, it has a fair chance of success if experimentation is carried out appropriately, training is used effectively, and outcomes are rigorously validated.

The most popular DL techniques have been explored in detecting those three leading neurological disorders from the MRI scan data. DL methods for the classification of neurological disorders found in the literature have been outlined. The pros, cons, and performance of these DL techniques for the neuroimaging data have been summarized. Prime observation of this study included the maximum usage of CNN in the detection of Alzheimer's disease and Parkinson's disease. On the other hand, DNN has been used with greater prevalence for schizophrenia detection.

Classification

The classification of images consists of grouping the different objects into distinct classes according to several classification criteria by a classifier. In our case, we have two classes (normal brains and brains with AD). So, once the blocks have been extracted, the classification phase will be done by two classification methods, namely CNN and Transfer Learning in order to make a comparison between the classification rates. Classification The classification of images consists of grouping the different objects into distinct classes according to several classification criteria by a classifier. In our case, we have two classes (normal brains and brains with AD).

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Medical imaging is an important area of medicine. It has recently evolved through its usefulness in helping with diagnosis and treatment. Among the most common imaging techniques we find magnetic resonance imaging (MRI), ultrasound, X-ray scanner, radiology. These methods are complementary and each of them has its own characteristics. They allow their users to provide more information about the human body, such as the brain. For example, MRI is considered as a very useful exam for getting a picture of the brain with high contrast. It is necessarily used to detect abnormality in a given organ, blood clots, and braintumours. Also it can be used to detect problems in different parts of the brain, such as AD. AD is a heterogeneous neurodegenerative disease. It is considered as one of the most known examples of dementia in the elderly. Among the symptoms of this dementia we can find: hard ability of expression, problem in memory, and various handicaps that makes the daily life of the patient very complicated.

Motivated by this efficiency of deep learning, we apply and compare in this article the efficiency of two deep learning based methods for detection of AD namely: the CNN and the Transfer Learning models.

II. LITERATURE SERVEY

1. Alzheimer's disease detection using convolutional neural networks and transfer learning based methods.

Author-MarwaZaabi , Nadia Smaoui , HoudaDerbel , Walid Hariri
Year-2020

Alzheimer's disease (AD) remains a major public health problem. This neurodegenerative pathology affects generally old people. Its symptoms are loss of memory followed over the years by more hard ability of expression and various handicaps. Therefore, early detection of AD is become an active research area in recent years. In this paper, we propose a deep based method for the detection of AD (i.e. classify brain images into normal brain or brain with AD). The proposed method contains two main steps. The first step is region of interest extraction; it is based on the partition of the image into separate blocks to extract only the part that contains the hippocampus of the brain. The second step is the classification of images using two deep based techniques namely convolutional neural network (CNN) and Transfer Learning.

2. Convolutional neural network to identify symptomatic Alzheimer's disease using multimodal retinal imaging.

Author - [C Ellis Wisely](#) , [Dong Wang](#) , [Ricardo Henao](#)
Year- 2020

To develop a convolutional neural network (CNN) to detect symptomatic Alzheimer's disease (AD) using a combination of multimodal retinal images and patient data.

Colour maps of ganglion cell-inner plexiform layer (GC-IPL) thickness, superficial capillary plexus (SCP) optical coherence tomography angiography (OCTA) images, and ultra-wide field (UWF) colour and fundus auto fluorescence (FAF) scanning laser ophthalmoscopy images were captured in individuals with AD or healthy cognition. A CNN to predict AD diagnosis was developed using multimodal retinal images, OCT and OCTA quantitative data, and patient data.

3. EARLY DETECTION OF ALZHEIMER'S DISEASE WITH BLOOD PLASMA PROTEINS USING SUPPORT VECTOR MACHINES.

Author -Chima Stanley Eke, Emmanuel Jammeh

Year -2020

The successful development of amyloid-based biomarkers and tests for Alzheimer's disease (AD) represents an important milestone in AD diagnosis. However, two major limitations remain. Amyloid-based diagnostic biomarkers and tests provide limited information about the disease process and they are unable to identify individuals with the disease before significant amyloid-beta accumulation in the brain develops. The objective in this study is to develop a method to identify potential blood-based non-amyloid biomarkers for early AD detection. The use of blood is attractive because it is accessible and relatively inexpensive. Our method is mainly based on machine learning (ML) techniques (support vector machines in particular) because of their ability to create multivariable models by learning patterns from complex data.

4. Alzheimer's Disease Detection Using Deep Learning-CNN

Author-MarwaZaabi, Nadia Smaoui

Year-2020

Alzheimer's disease is a stage-progressive brain disorder and also an incurable disease that causes the brain cells to shrink and die. One of the most common cause of dementia is Alzheimer's disease. Treatment for this disease has not been found yet. Early detection of Alzheimer's disease may help doctors to conducts trials which may temporarily improve or slow progression of symptoms and prevent brain to tissue damage. The proposed system predicts Alzheimer's disease using a deep convolutional neural network with the help of brain MRI scans. This model can deliver superior performance for early-stage diagnosis thus helping the doctor to diagnose the Alzheimer's disease accurately and lower the number of false negative results in those critical cases.

5. CLASSIFICATION AND VISUALIZATION OF ALZHEIMER'S DISEASE USING VOLUMETRIC CONVOLUTIONAL NEURAL NETWORK AND TRANSFER LEARNING

Author-Kaghan Oh, Young-Chul Chung, KoWoon Kim,

Year-2019

Recently, deep-learning-based approaches have been proposed for the classification of neuroimaging data related to Alzheimer's disease (AD), and significant progress has been made. However, end-to-end learning that is capable of maximizing the impact of deep learning has yet to receive much attention due to the endemic challenge of neuroimaging caused by the scarcity of data.

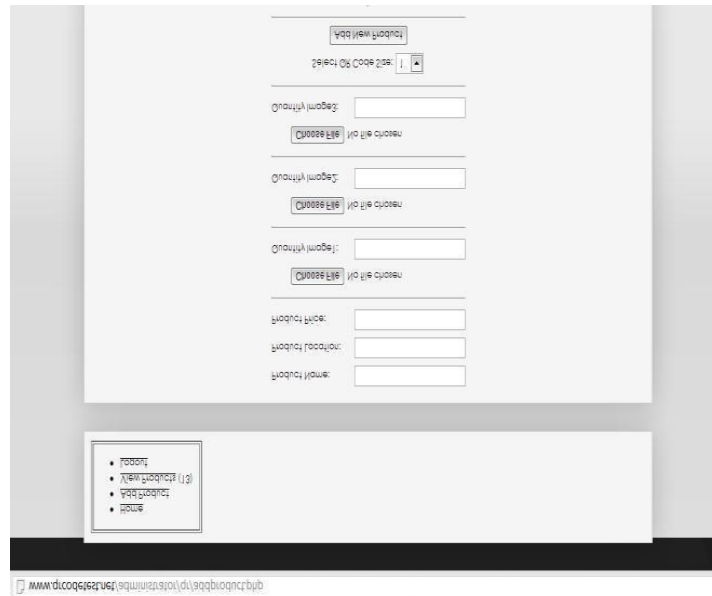
III. METHODOLOGY

The design methodology employed for this system is the prototyping design methodology of the Rapid Application Development (RAD). The basic phases of the prototyping methodology include planning, analysis, design and implementation of the proposed system. This prototype could form the integral part of an entire 'enterprise-system' focusing mainly on enhancing customers' experience. A typical diagrammatic illustration of the phases involved in a prototype development is given below.

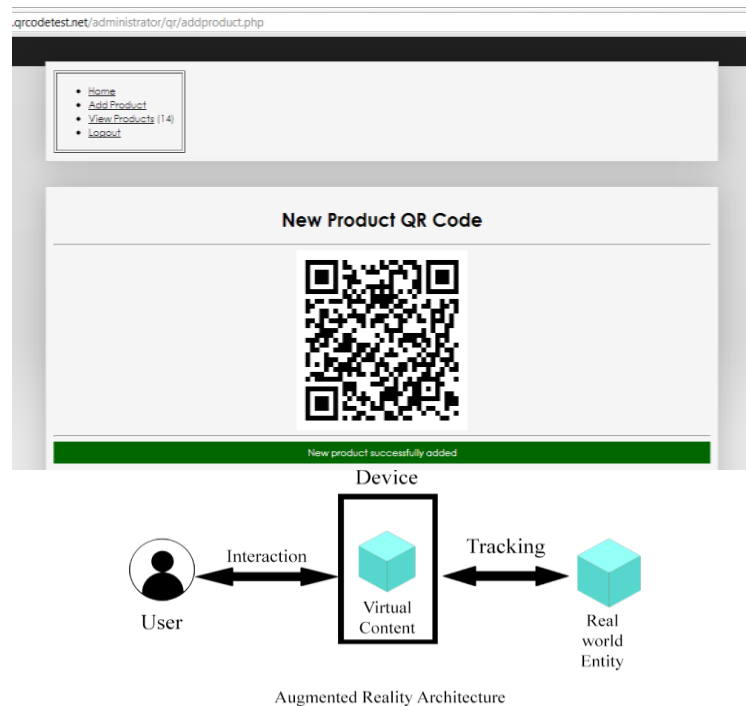
1. Augmented Reality (AR): Augmented reality is a technology that adds digital elements to a live view of the real world. It is used to enhance the user experience of a product or service and is most commonly used in mobile apps, gaming, and virtual reality.

2. Mixed Reality (MR): Mixed reality combines the physical and digital worlds to create immersive experiences. It uses digital objects and information to enhance the user experience of the real world.

3. Virtual Reality (VR): Virtual reality is a computer-generated environment that immerses the user in a simulated world. It is used to create experiences that are not possible in the real world, such as interactive gaming and exploration of virtual worlds.



4. Artificial Intelligence (AI): Artificial intelligence is a branch of computer science that deals with creating machines that can think and act like humans. AI can be used to create intelligent systems that can understand natural language, recognize images, and interact with users.



The system prototype was successfully developed and tested using PHP scripting language to design the various interfaces comprising of the product information interface (see figure 3) where new product information is uploaded and stored in the system's database and the code

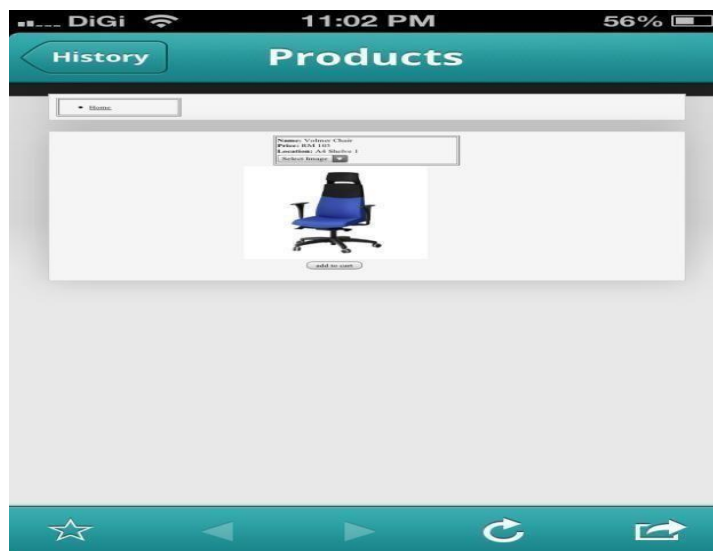
Where unique QR code for every product is generated. MySQL database was used as the backend tool, which was hosted on a domain site to reveal real time product information each time product code was scanned.

Advantage:

- Quick and Easy Access: QR codes provide a quick and easy access to digital content. All that is required is to scan the code with a smartphone or other device and the content is immediately available.
- Low Cost: QR codes are much cheaper to create and distribute than traditional barcodes.
- Versatility: QR codes can be used to store a variety of digital content including web links, images, documents, and videos.

a) **IV.CONCLUSION**

The **future of augmented reality** because it can make our lives more secure and hassle-free. AR can make the impossible possible. Humans have always strived to improve themselves through exploration and invention. Augmented reality is a representation of this intrinsic human trait. This paper establishes that the use of QR code in shopping malls can greatly influence fast and efficient shopping on the part of the customers by enabling them access online real time information (online catalog system) about products by simply scanning product QR code. It also promotes customer familiarization of the shopping mall through floor directions as provided by the system. In addition, the system



will enable accurate statistical data report and reliable data mining for the shopping mall on both consumer and product information. Customers are also given the opportunity to explore the capabilities of their smartphones.

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