**LITERATURE SURVEY**

**1) Natural image bases to represent neuroimaging data**

**AUTHORS:**  A. Gupta, M. Ayhan, and A. Maida

Visual inspection of neuroimagery is susceptible to human eye limitations. Computerized methods have been shown to be equally or more effective than human clinicians in diagnosing dementia from neuroimages. Nevertheless, much of the work involves the use of domain expertise to extract hand–crafted features. The key technique in this paper is the use of cross–domain features to represent MRI data. We used a sparse auto-encoder to learn a set of bases from natural images and then applied convolution to extract features from the Alzheimer’s Disease Neuroimaging Initiative (ADNI) dataset. Using this new representation, we classify MRI instances into three categories: Alzheimer’s Disease (AD), Mild Cognitive Impairment (MCI) and Healthy Control (HC). Our approach, in spite of being very simple, achieved high classification performance, which is competitive with or better than other approaches.

**2) DeepAD: Alzheimer's Disease Classification via Deep Convolutional Neural Networks using MRI and fMRI,**

**AUTHORS:** S. Sarraf, G. Tofighi, D. DeSouza and J. Anderson

To extract patterns from neuroimaging data, various techniques, including statistical methods and machine learning algorithms, have been explored to ultimately aid in Alzheimer’s disease diagnosis of older adults in both clinical and research applications. However, identifying the distinctions between Alzheimer’s brain data and healthy brain data in older adults (age > 75) is challenging due to highly similar brain patterns and image intensities. Recently, cutting-edge deep learning technologies have been rapidly expanding into numerous fields, including medical image analysis. This work outlines state-of-the-art deep learning-based pipelines employed to distinguish Alzheimer’s magnetic resonance imaging (MRI) and functional MRI data from normal healthy control data for the same age group. Using these pipelines, which were executed on a GPU-based high performance computing platform, the data were strictly and carefully preprocessed. Next, scale and shift invariant low- to high-level features were obtained from a high volume of training images using convolutional neural network (CNN) architecture. In this study, functional MRI data were used for the first time in deep learning applications for the purposes of medical image analysis and Alzheimer’s disease prediction. These proposed and implemented pipelines, which demonstrate a significant improvement in classification output when compared to other studies, resulted in high and reproducible accuracy rates of 99.9% and 98.84% for the fMRI and MRI pipelines, respectively.

**3) A deep CNN based multi-class classification of Alzheimer's disease using MRI**

**AUTHORS:** A. Farooq, S. Anwar, M. Awais and S. Rehman

In the recent years, deep learning has gained huge fame in solving problems from various fields including medical image analysis. This work proposes a deep convolutional neural network based pipeline for the diagnosis of Alzheimer's disease and its stages using magnetic resonance imaging (MRI) scans. Alzheimer's disease causes permanent damage to the brain cells associated with memory and thinking skills. The diagnosis of Alzheimer's in elderly people is quite difficult and requires a highly discriminative feature representation for classification due to similar brain patterns and pixel intensities. Deep learning techniques are capable of learning such representations from data. In this paper, a 4-way classifier is implemented to classify Alzheimer's (AD), mild cognitive impairment (MCI), late mild cognitive impairment (LMCI) and healthy persons. Experiments are performed using ADNI dataset on a high performance graphical processing unit based system and new state-of-the-art results are obtained for multiclass classification of the disease. The proposed technique results in a prediction accuracy of 98.8%, which is a noticeable increase in accuracy as compared to the previous studies and clearly reveals the effectiveness of the proposed method.

**4) Convolutional neural network based Alzheimer’s disease classification from magnetic resonance brain images**

**AUTHORS:** R. Jain, N. Jain, A. Aggarwal and D. Jude Hemanth

Alzheimer’s disease, the most common form of dementia is a neurodegenerative brain order that has currently no cure for it. Hence, early diagnosis of such disease using computer-aided systems is a subject of great importance and extensive research amongst researchers. Nowadays, deep learning or particularly convolutional neural network (CNN) is getting more attention due to its state-of-the-art performances in variety of computer vision tasks such as visual object classification, detection and segmentation. Several recent studies, that have used brain MRI scans and deep learning have shown promising results for diagnosis of Alzheimer’s disease. However, most common issue with deep learning architectures such as CNN is that they require large amount of data for training. In this paper, a mathematical model PFSECTL based on transfer learning is used in which a CNN architecture, VGG-16 trained on ImageNet dataset is used as a feature extractor for the classification task. Experimentation is performed on data collected from Alzheimer’s Disease Neuroimaging Initiative (ADNI) database. The accuracy of the 3-way classification using the described method is 95.73% for the validation set.

**5) Multi-class Alzheimer Disease Classification using Hybrid Features**

**AUTHORS:** T. Altaf and S. Anwar and Nadia Gul and M. Majid and Muhammad

Alzheimer's disease (AD) is the most common form of dementia, which results in memory related issues in subjects. An accurate detection and classification of AD alongside its prodromal stage i.e., mild cognitive impairment (MCI) is of great clinical importance. In this paper, an Alzheimer detection and classification algorithm is presented. The bag of visual word approach is used to improve the effectiveness of texture based features, such as gray level co-occurrence matrix (GLCM), scale invariant feature transform, local binary pattern and histogram of gradient. The importance of clinical data provided alongside the imaging data is highlighted by incorporating clinical features with texture based features to generate a hybrid feature vector. The features are extracted from whole as well as segmented regions of magnetic resonance (MR) brain images representing grey matter, white matter and cerebrospinal fluid. The proposed algorithm is validated using the Alzheimer's disease neuro-imaging initiative dataset (ADNI), where images are classified into one of the three classes namely, AD, normal, and MCI. The proposed algorithm outperforms state-of-the-art techniques in key evaluation parameters including accuracy, sensitivity, and specificity. An accuracy of 98.4% is achieved for binary classification of AD and normal class. For multi-class classification of AD, normal and MCI, an accuracy of 79.8% is achieved.