Chapter 17
The Role of Biomarkers in Alzheimer's Disease Progression

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ABSTRACT

The research examines various approaches and analyses that by using a hybrid approach for Alzheimer's disease diagnosis, the early detection and efficiency can be achieved. The important neuroimaging methods that provide deep knowledge of the structure and function of the brain include PET scans, structural MRIs, and functional MRI. The main symptoms of biomarkers from blood and brain fluid samples are the beta-amyloid and tau proteins. In order to improve the accuracy and treatment of disease, these techniques along with various machine learning models can be used. The study shows that by using a hybrid framework Alzheimer's disease diagnosis and treatment can be done in well-organized manner.

INTRODUCTION

The two important terms used for creating a hybrid approach are “biomarkers” and “neuroimaging”. These terms refer to methods for detecting, defining, and monitoring what is going on in the brain. In the field of neuroimaging, various approaches are employed to provide deep understanding of brain system(Márquez

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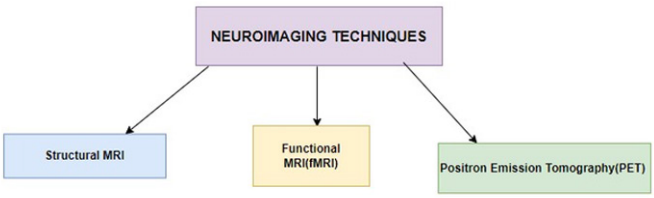
& Yassa, 2019). Fig. 1 shows various approaches used in Neuroimaging which are discussed as:

- MRI: It provides images of the whole brain and can identify any weakness as well as reduction, in any particular brain regions.
- fMRI: It identifies and analyses the brain activity and flow of blood in order to examine the effects on brain connections .
- PET: It uses radioactive tracers to detect and measure various changes in blood flow, brain metabolism, and the presence of tau tangles or amyloid plaques associated with Alzheimer's disease.

Figure 1. Various Neuroimaging Techniques



Biomarkers is a term used as a warning signal of certain diseases or biological processes. Various ways are used to get biomarkers associated with Alzheimer disease including cerebrospinal fluid, blood samples, and neuroimaging detection(Barber, 2010; Steyaert et al., 2023). The below mentioned biomarkers are used in treatment of Alzheimer disease:

- Biomarkers for cerebrospinal fluid (CSF): It includes beta-amyloid, phosphorylated tau protein, and tau protein. These compounds are found in CSF and can be used to identify Alzheimer's disease pathology.
- Blood-based biomarkers: Chemicals and proteins found in the bloodstream that may point to underlying changes connected to Alzheimer's disease, such as tau protein and inflammatory markers as shown in Fig. 2.