



DHARAMPETH M. P. DEO MEMORIAL SCIENCE COLLEGE, NAGPUR

Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during the year 2023-24

BOOKS, CHAPTERS IN BOOK & PAPERS IN CONFERENCES PROCEEDINGS PUBLISHED

Sr. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Year of publication	ISBN/ISSN number of the proceeding	Name of the publisher
1.	Prof. (Dr.) Nitin Gaikwad	Symphony of Science and Technology	Study of Universe in Framework of Modified Theories of Gravitation	NA	2023-24	978-81-19998-12-8	Taran Publication, www.taranpublication.com, Email: taran.publication@gmail.com,
2.	Dr. Mrs. Vaishali Meshram	A Textbook of Introduction to Nanotechnology	NA	NA	2023-24	978-81-19140-30-5	R. K. Publication
		A Textbook of Principles of Environmental Science	NA	NA	2023-24	978-81-19140-43-5	R. K. Publication
3.	Dr. Mrs. Snehal Narale	Proceeding of National Conference	Ensemble Learning for Dementia Prediction	Proceeding of National Conference on Emerging Trends in Computational Science and Technology	2023-24	978-81-19435-61-6	Shri Shivaji Science College, Amravati

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- A. C. DONGAPURE,
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- DR. S. I. KHAN



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Preface

The Symphony of Science & Technology.

Science and technology are the pillars upon which the edifice of modern civilization stands. They have propelled humanity forward, unlocking the mysteries of the universe and empowering us to shape our world in unprecedented ways. It is in this spirit of exploration and innovation that we present "The Symphony of Science & Technology."

Within these pages, readers will embark on a journey through the ever-expanding landscape of scientific discovery and technological advancement. From the intricacies of nanotechnology to the complexities of biomedicine, each chapter offers a glimpse into the frontiers of human ingenuity.

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"The Symphony of Science & Technology" is more than just a collection of essays; it is a symphony—a harmonious blend of ideas, perspectives, and discoveries that resonate with the rhythm of progress. We invite readers to join us on this extraordinary journey and discover the beauty and wonder of the scientific world.

-Editors

Edited By

A. C. Dongapure

A R Thakare

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CHAPTER - 13

STUDY OF UNIVERSE IN FRAMEWORK OF MODIFIED THEORIES OF GRAVITATION

N. P. Gaikwad

Dharampeth M. P. Deo Memorial Science College, Nagpur (India)

Introduction

In the late 17th century, Isaac Newton calculated how the forces between planets specifically the gravitational forces interacted. Albert Einstein in the year 1905 proposed a special relativity. An experimental basis of special relativity is that the speed of light c is the same in all inertial frames. Special relativity fails to explain the fundamental ideas of relativity and gravitation.

General relativity generalizes special relativity and refines Newton's law of universal gravitation, providing a unified description of gravity as a geometric property of space and time or four-dimensional space time. In particular, the curvature of space time is directly related to the energy and momentum of whatever matter and radiation are present in the universe. The relation is specified by the Einstein field equations, a system of second order partial differential equations.

Using GR we are able to derive simple cosmological models, such as the Friedman or Lemaitre models, that describe quite well the evolution of the Universe in which we live in. Up to now GR has passed every experimental test that we were able to come up with. In the last decades in order to explain the astrophysical observations related to rotation curves of spiral galaxies we were more or less forced to introduce the concept of dark matter. It did not pass long time and once again we were forced to introduce the so called dark energy in order to explain the accelerated expansion of the Universe suggested by astrophysical observation of supernovae red shift. The term "dark energy" was first coined by Michael Turner in 1998. This is believed that the dark energy is responsible for the accelerated expansion of universe.

Modified Theory of Gravity

Equivalence principle is one of the foundations of general relativity; hence any experimental evidence of violation of equivalence principle will also act against general relativity. The predictions of general relativity are accurate in the weak gravitational fields (Solar system gravity) while in strong gravitational fields (outside solar system) predictions of general relativity are not accurate because of gravitational wave and black hole. Thus general relativity fails to probe gravity at all scale [22]. Because of above reason there was need to modify general relativity which help us to understand gravity beyond general relativity.

$f(R)$ gravity is one of the type of modified gravity which generalizes general relativity. In $f(R)$ gravity the scalar curvature R in the Einstein Hilbert action is replaced by the function of scalar curvature [23].

Another class of modified gravity is $f(G)$ gravity where the arbitrary function added to the action of the general relativity which is a function of Gauss-Bonnet invariant [23].

$f(T)$ gravity is modified gravity based on modifications of teleparallel gravity, where torsion is the geometric object describing gravity instead of curvature, have been proposed to explain the present cosmic accelerating expansion [24].

In 2011, Harko et al. [25] proposed a new modified theory named as $f(R, T)$ modified theory of gravity, where the gravitational Lagrangian is given by an arbitrary function of the Ricci scalar R and of the trace of the stress-energy tensor T .

The modified symmetric teleparallel gravity or $f(Q)$ gravity is a recently proposed theory of gravity where instead of curvature R , or torsion T , the nonmetricity term Q is used to describe the effects of gravity [26].

There are also several modified theories of gravity which extend the form of general relativity through various methods, leading to different field equations and thus to different cosmological implications. They play an essential role and contribute to modern cosmology, providing a foundation for the current understanding of physical phenomena of the Universe.

Contribution of people

P.K. Sahoo, et al., [1] investigated the LRS Bianchi type I anisotropic cosmological model in presence of bulk viscosity in the framework of $f(R, T)$ gravity and obtained exact solutions of the modified Einstein's field equations under the choice of deceleration parameter. P.H.R.S. Moraes et al., [2] construct a cosmological model from the simplest non-minimal matter–geometry coupling within the $f(R, T)$ gravitational theory and also discuss the energy conditions applications and the cosmological viability of model and showed that the deceleration parameter respects the observational constraints and predicts a transition from a phase of deceleration to a phase of acceleration of the universe expansion the model. P.K. Sahoo et al., [3] investigated axially symmetric cosmological model in $f(R, T)$ gravity in the presence of a perfect fluid. Simran Arora et al., [4] studied the $f(Q, T)$ gravity models with observational constraints. P.K. Sahoo et al., [5] have studied homogeneous and anisotropic locally rotationally symmetric (LRS) Bianchi type-I model with magnetized strange quark matter (MSQM) distribution and cosmological constant Λ in $f(R, T)$ gravity. They obtained exact solutions of the field equations for three different forms of deceleration parameter and observed that the first model with a bilinear DP represents a transition of universe from early decelerating phase to a recent accelerating phase. In second case, the universe lies at an accelerating phase. The third model shows a transition of universe for $\beta > 1$ and again lies at an accelerating phase for $\beta \leq 1$. P.K. Sahoo and M. Sivakumar [6] investigated the locally rotationally symmetric (LRS) Bianchi type-I cosmological models in $f(R, T)$ theory of gravity. Sanjay Mandal et al., [7] Studied Cosmography in $f(Q)$ gravity and use the cosmographic parameters as a tool to derive $f(z)$ and its derivatives (called functions of cosmographic set) in terms of cosmographic parameters. The dynamical features of the model including the oscillatory behaviour of the EOS parameter are studied by P.K. Sahoo, et al., [8] with FRW metric in the framework of $f(R, T)$ gravity and observed that the universe undergoes an accelerated expansion in the present epoch. Sanjay Mandal, et al., [9] studied Energy Conditions in $f(Q)$ gravity derived the strong, the weak, the null, and the dominant energy conditions for two different $f(Q)$ gravity models. V. R. Chirde and S. H. Shekh [10] investigated non-static plane symmetric dark energy model in $f(R, T)$ gravity with a variable EoS parameter in the presence of a perfect fluid source and observed that the EoS parameter, and the skewness parameters in the model are all functions of time. They also seen that the model is accelerating, expanding and has no initial singularity. V. R. Chirde and S. H. Shekh [11] investigated the plane symmetric space time with wet dark fluid (WDF), which is a candidate for dark energy, in the framework of $f(R, T)$ gravity and obtained exact solutions of the field equations for two different volumetric expansion laws, namely exponential expansion and power-law expansion. S.R. Bhoyar et al., [12] investigated the dynamics of locally rotationally symmetric and spatially homogeneous Bianchi type I (LRS) space-time with the linear equation of state filled with a perfect fluid in the framework of $f(T)$ gravity. V. R. Chirde and S. H. Shekh [13] investigated the dynamics of Spatially Homogeneous Bianchi type-I (LRS) space–time filled with two minimally interacting fields, Matter and Holographic dark energy components with volumetric power and exponential expansion laws towards the gravitational field equations for the linear form of $f(T)$ gravity and found that, power law model has an initial singularity while exponential model is free from any type of singularity. Both the models indicate that the Universe is accelerating. S.H. Shekh, and V. R. Chirde [14] investigated accelerating Bianchi type dark energy cosmological model with cosmic string in $f(T)$ gravity. S.H. Shekh, et al., [15] investigated energy condition of $f(T, B)$ gravity dark energy model with the validity of thermodynamics. S.H. Shekh, [16] investigated Models of holographic dark energy in $f(Q)$ gravity. M. Koussour, et al., [17] studied a spatially homogeneous and isotropic FLRW cosmological

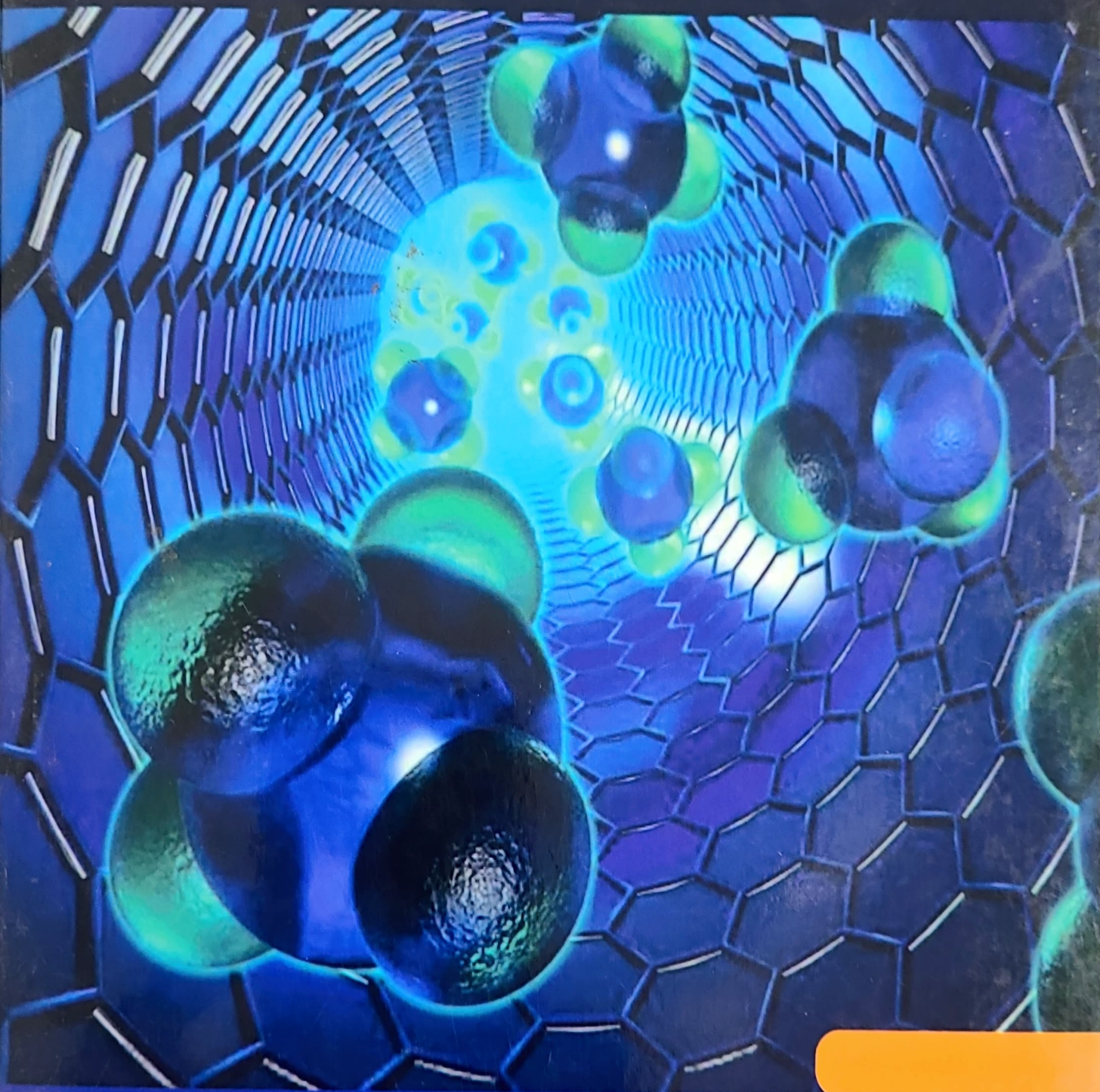
model in framework of the symmetric teleparallel $f(Q)$ gravity. M. Koussour, et al., [18] discussed anisotropic nature of space-time in $f(Q)$ gravity. N. Myrzakulov, *et. al.*, [19] discuss the analysis of reconstructed modified symmetric teleparallel $f(Q)$ gravity. M. Koussour, et al., [20] discussed late time acceleration in $f(Q)$ gravity. V. R. Chirde and S. H. Shekh [21] investigated the dynamics of magnetized anisotropic dark energy in $f(R, T)$ gravity with both deceleration and acceleration

References:

- 1) P.K. Sahoo *et al.*, IJGMMP, Vol. 14 (2017)
- 2) P. H. R. S. Moraes *et. al.*, Eur. Phys. J. C (2017) 77:480
- 3) P.K. Sahoo *et al.*, Eur. Phys. J. Plus (2014) 129: 49
- 4) Simran Arora *et al.*, Physics of the Dark Universe 30 (2020)
- 5) P.K. Sahoo *et al.*, New Astron. Vol. 60 (2018)
- 6) P.K. Sahoo, Mutuswamy Sivakumar, Astrophys Space Sci (2015) 357:60
- 7) Sanjay Mandal, *et al.*, Physical Review D 102, 124029 (2020)
- 8) P.K. Sahoo, *et al.*, Modern Physics Letters A Vol. 33, No. 33 (2018)
- 9) Sanjay Mandal, *et al.*, Physical Review D 102, 024057 (2020)
- 10) V. R. Chirde, S. H. Shekh, Astrophysics, Vol. 58, No. 1, March, 2015
- 11) V. R. Chirde, S. H. Shekh, J. Astrophys. Astr. (2016) 37: 15
- 12) S. R. Bhojar *et al.*, Astrophysics, Vol. 60, No. 2, June, 2017
- 13) V. R. Chirde, S. H. Shekh, Indian J Phys (2018)
- 14) S.H. Shekh, V.R. Chirde, Astrophys Space Sci (2020) 365:60
- 15) S.H. Shekh, *et al.*, Commun. Theor. Phys. 72 (2020)
- 16) S.H. Shekh, Physics of the Dark Universe 33 (2021) 100850
- 17) M. Koussour, *et al.*, Journal of High Energy Astrophysics 35 (2022) 43–51
- 18) M. Koussour, *et al.*, Physics of the Dark Universe 36 (2022) 101051
- 19) N. Myrzakulov, *et al.*, Front. Astron. Space Sci. Vol.9 (2022) 902552
- 20) M. Koussour, *et al.*, Annals of Physics 445 (2022) 169092
- 21) V. R. Chirde, S. H. Shekh, Bulg. J. Phys. 46 (2019) 94–106
- 22) S. Shankaranarayanan *et al.*, arXiv:2204.06533v1 [gr-qc] 13 Apr 2022
- 23) Shin'ichi Nojiri *et al.*, Physics Reports 505 (2011) 59–144
- 24) Rong-Jia Yang, Eur. Phys. J. C (2011) 71:1797
- 25) Tiberiu Harko *et al.*, PHYSICAL REVIEW D 84, 024020 (2011)
- 26) Laur Jarv *et al.*, PHYSICAL REVIEW D 97, 124025 (2018)

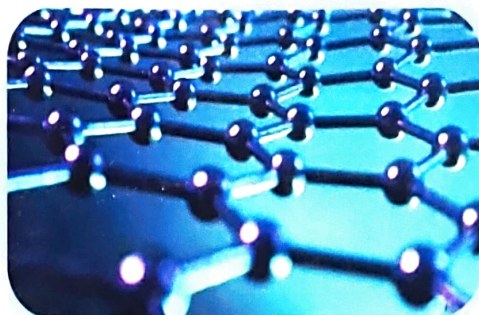
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Ensemble Learning for Dementia Prediction

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Abstract:

Dementia is a serious cognitive disorder that affects the affected person's memory, thinking, behaviour and ultimately daily life. It refers to a group of symptoms of cognitive decline. Dementia especially affects the elderly after the age of 60. The advanced stage of dementia is very difficult for both the person and their family. Early detection of dementia is very difficult and is the need of hour. Machine learning can be a patient-specific prediction of mild cognitive impairment using different algorithms such as support vector machine, logistic regression, Naive Bayes, Random Forest, Ensemble learning. Ensemble learning is a machine learning technique that makes use of multiple classifiers to improve the performance which in turn makes better predictions than a single classifier. A machine learning model can run concurrently with multimodal data such as neuroimaging, genetic testing, and cerebrospinal fluid biomarkers. This research work uses Random Forest and XGBoost learning algorithms on dementia dataset to calculate the accuracy for dementia prediction. The dataset consists of 150 subjects aged 60 to 96. Random forest algorithm gives the accuracy of 97.3 and XGBoost gives the accuracy of 89%.

Keywords:

Dementia, Artificial Intelligence, Machine Learning, Random Forest, XGBoost

Introduction :

Dementia is a general term representing serious illness or impairment of the brain of the affected person which can lead to serious problems in a person's life along with his family. Dementia is generally detected at a very later stage and till the treatment for the problems starts, the person starts degrading in all the cognitive, behavioural and thinking capabilities which are the most important functions of the brain. A small name but very notorious effects of dementia are very important to be detected at early stages of life so that the treatment or medical help can be started immediately which ultimately can just help to prolong the hazardous effects of dementia. Early detection of dementia which by the means of early intervention can slow the progression of

the disease which can avoid serious issues like accidents, falls, mental illnesses like risk of being disoriented and confused.

Dementia is known just as a problem for elderly people due to their biological age progression but the main reason of dementia and its impact is still not taken well cognizance of or identified or reported properly. With the highly evolving computer science field, scientists have come up with many high computing algorithms working on complex data.

Dementia is basically divided into three categories:

1. Cognitive impairment which includes loss of memory, difficulty in speech, difficulty in decision making, cerebral coordination issues.
2. Psychiatric dysfunctions and behavioural problems where problems like depression, agitations and hallucinations.
3. Third category includes performing daily activities.

Degenerative dementia is a neurological/brain illness that primarily affects elderly people. It happens when cognitively important neurons in particular regions of the brain are harmed or lose their activity. Seven phases are used to categorise the severity of dementia: impairment, very mild decline, mild decline, moderate decline, fairly severe decline, severe decline, and very severe decline. Although dementia's origins are unknown, research shows a connection between the disease's signs and the accumulation of dangerous proteins called amyloid and tau in the brain.^[1]

Diagnosis of dementia at an early stage is a very tricky task. The analysis of large and complex data is to be done to detect and predict dementia. It was the need of the hour to develop a model with the applications of machine learning to work on such a large and complex data.

Review of Literature :

According to a World Health Organization report^[2] facts that are important Dementia is a situation in which cognitive ability declines more quickly than may be anticipated from the typical effects of biological ageing. Despite the fact that dementia primarily affects older people, it is not a natural part of aging. There are already more than 55 million dementia sufferers in the world,

and ten million new cases are reported each year. Dementia is a result of numerous conditions and trauma that either directly or indirectly impact the brain. The most prevalent type of dementia, which accounts for 60–70% of cases, is Alzheimer's disease. One of the main causes of disability and dependency among older people worldwide, dementia is currently the seventh highest cause of death among all diseases.

Charlotte James et al.^[3] in their paper have done a study on 15,307 patients without dementia at baseline to perform secondary analysis of factors that can be used to perform dementia prediction. The work put into practise four machine learning algorithms: logistic regression (LR), support vector machine (SVM), random forest (RF), gradient-boosted trees (XGB). These algorithms carry out a classification task, identifying participants as belonging to class 0 (predicted to remain dementia-free 29 months from baseline) or class 1 (predicted to experience incident dementia within 29 months of baseline). The results drawn showed that 12, 136 attendees had dementia at baseline, 4557 attendees did not have any follow-up data, and 573 attendees who had their first follow-up more than 29 months.

Mitchell AJ, Shiri-Feshki M.^[4] in their medical study did meta-analysis of inception cohort studies to calculate the risk of developing dementia in the patients having mild cognitive impairment. The study identified 41 robust groups having mild cognitive impairment at baseline. The analysis concluded that many people even after having MCI did not progress to dementia while some were found having Alzheimer's dementia whereas some were found having vascular dementia.

Zhan Y et al.^[5] discussed that the early detection of conversion to Alzheimer's disease (AD) has become a crucial concern because AD is one of the most devastating progressive neurodegenerative illnesses affecting the elderly. The study used data from magnetic resonance imaging and positron emission tomography where multimodal support vector machines were used to determine the transition from moderate cognitive impairment (MCI) or Alzheimer's disease (AD). The participants included two separate groups from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database (Training set: 121 AD patients and 120 normal controls (NC); Testing set: 20 NC converters and 20 NC non-converters). The multimodal findings revealed that the classification between NC converters and NC non-converters had accuracy, sensitivity, and specificity values of 67.5%, 73.33%, and 64%, respectively.

Daoqiang Zhang,^[6] in their paper discussed variables from multi-modal data. They suggest a general methodology called multi-modal multi-task (M3T) learning. The variables consist of categorical factors as well as the clinical variables utilised for regression, with distinct tasks corresponding to the prediction of different variables. The approach

specifically consisted of two essential parts: a multi-task feature selection that chooses the common subset of pertinent features for multiple variables from each modality, a multi-modal support vector machine that combines the features from all modalities to predict multiple (regression and classification) variables. Using baseline MRI, FDG-PET, and cerebrospinal fluid (CSF) data from 45 AD patients, 91 MCI patients, and 50 healthy individuals. The paper worked on two sets of trials to validate the technique. On baseline MRI, FDG-PET, and cerebrospinal fluid (CSF) data from 45 AD patients, 91 MCI patients, and 50 healthy controls, we conduct two sets of trials (HC). In the first set of experiments, we use baseline MRI, FDG-PET, and CSF data to estimate two clinical variables, including the Mini Mental State Examination (MMSE) and the Alzheimer's Disease Assessment Scale-Cognitive Subscale (ADAS-Cog), as well as one categorical variable (with a value of "AD," "MCI," or "HC."). In the second set of studies, we extrapolate baseline MRI, FDG-PET, and CSF data to predict the 2-year changes in MMSE and ADAS-Cog scores as well as the transformation of MCI into AD.

Baiying Lei et al.^[7] observed that the majority of the earlier studies mainly concentrated on the FC generated from R-fMRI time series among various brain areas. It has also been observed that women are more likely than men to have MCI, and the chance of developing MCI rises with age. Moreover, graph learning can successfully use this information in the purpose of MCI detection. As a result, the performance of EMCI detection can be improved by combining demographic information (such as age and gender). All subjects are represented by an MCI-graph, a sparse network with each vertex representing a subject's traits and the edges containing both those features and demographic data. The paper proposes a unique Multi-scale enhanced(MSE)-Graph Convolution Network(GCN) model to take advantage of the characteristics of each subject and data related to subjects for MCI identification. A Structural connectivity(SC) network is then created using DTI and an Functional Connectivity (FC) network using R-fMRI. The performance of a single model is then improved using complimentary data discovery and fusion techniques using both FC and SC information.

Janani Venugopalan et al.^[8] discussed and investigated the issue of mild cognitive impairments and Alzheimer's disease (AD) (MCI). To classify patients into AD, MCI, and controls, the researchers employed deep learning (DL) to comprehensively examine imaging (magnetic resonance imaging [MRI]), genetic [single nucleotide polymorphisms [SNPs]], and clinical test data (CN). In this paper, we use 3D-convolutional neural networks (CNNs) for imaging data and stack denoising auto-encoders to extract features from clinical

and genetic data. The top-performing characteristics that the deep models learnt through clustering and perturbation analysis were also identified by the authors using a novel data interpretation technique. The paper demonstrates that deep models outperform shallow models, such as support vector machines, decision trees, random forests, and k-nearest neighbours, using the Alzheimer's disease neuroimaging initiative (ADNI) dataset. As a result models have identified hippocampus, amygdala brain areas, and the Rey Auditory Verbal Learning Test (RAVLT) as top distinguished features, which are consistent with the known AD literature. Authors demonstrate that integrating multi-modality data outperforms single modality models in terms of accuracy, precision, recall, and mean F1 scores. In the study of the research paper, authors report the potential of DL for multi-modal data fusion as a conclusion which includes:

- Deep-models outperform shallow models for single-modality Alzheimer's stage prediction.
- Novel DL framework for multi-modality data fusion outperforms single-modality DL.
- Novel perturbation and clustering-based feature extraction assisting DL model interpretations are capable of AD stage prediction.
- Application of 3D convolutional neural network architecture for MRI image data benefits the AD analysis.

Müller et al.^[9] discussed the problem of Dementia and an increase in the population of older people, as well as longer lifespans mean that numbers of dementia cases are exponentially rising neuropathological changes associated with dementia are thought to appear before the clinical manifestation of cognitive symptoms, i.e., memory impairments. Further, some older adults (OA) experience cognitive decline before it can be objectively diagnosed. For optimal care of these patients, it is necessary to detect cognitive decline and dementia at an early stage. In this vein, motor, sensory, and neurophysiological declines could be promising factors if found to be present before the onset of cognitive impairment. The authors aim was to detect possible motor, sensory, electroencephalogram, and cognitive predictors to develop a screening tool for dementia and its pre-stages in older adults, aged ≥ 80 years. Thus, affected individuals could receive optimal health care at an earlier stage to better maintain their health resources. From the study, some conclusions with some limitations on their study of the problem. Nevertheless, some study limitations have to be mentioned. First, cognitive decline will be determined based on the results of cognitive instruments (MoCA and CERAD-Plus) and not based on imaging or cerebrospinal fluid measures^[10]. Next, participation in the study is voluntary and the participants have to come to the labs by themselves. This may lead to an inadvertent recruitment of persons with

higher cognitive or physical performance levels. Due to the funding period of 3 years and the different time points of study recruitment, it is not possible to observe cognitive decline of the participants over an extended period. Despite the use of reliable and valid instruments to detect predictors for an early screening tool for cognitive decline, practice effects cannot be excluded completely. In spite of these limitations, a longitudinal design clearly outweighs a cross-sectional one. The present study is one of few studies^{[11] [12]} investigating cognitive, motor, sensory, and neurophysiologic markers in combination to develop a multi-dimensional instrument to predict cognitive decline or dementia.

Jia You, et al.^[13] studied the existing dementia risk models. During their study it is found that the models are limited to known risk factors and traditional statistical methods. Authors aimed to employ machine learning (ML) to develop a novel dementia prediction model by leveraging a rich-phenotypic variable space of 366 features covering multiple domains of health-related data. They have implemented a data-driven strategy to identify predictors from 366 candidate variables covering a comprehensive range of genetic and environmental factors and developed the ML model to predict incident dementia and Alzheimer's Disease (AD) within five, ten, and much longer years (median 11.9 [Interquartile range 11.2–12.5] years). Different models were compared and a follow-up of 5,023,337 person-years, 5287 and 2416 participants developed dementia and AD was taken respectively. A novel UKB dementia risk prediction (UKB-DRP) model comprising ten predictors including age, ApoE e4, pairs matching time, leg fat percentage, number of medications taken, reaction time, peak expiratory flow, mother's age at death, long-standing illness, and mean corpuscular volume was established.

Our prediction model was internally evaluated based on five-fold cross-validation on discrimination and calibration, and it was further compared with existing prediction scales. The UKB-DRP model can achieve high discriminative accuracy in dementia (AUC 0.848 § 0.007) and even better in AD (AUC 0.862 § 0.015). An ML-based UKB-DRP model was developed which incorporated ten easily accessible predictors with solid predictive power for incident dementia and AD within five, ten, and much longer years, which can be used to identify individuals at high risk of dementia and AD in the general population.

Jungyoon Kim 1 and Jihye Lim,^[14] studied the use of data from 7031 people aged over 65 who were obtained from the Korea National Health and Nutrition Examination Survey (KNHANES) between 2001 and 2005 to apply a deep neural network (DNN) to the prediction of dementia using health behaviour and medical service consumption data. Principal component analysis (PCA) highlighting and min/max scaling are

utilised in the proposed model to preprocess and retrieve pertinent background features.

In the proposed model authors were examined five well-known machine learning methods with their own suggested methodology, a DNN/scaled PCA. The area under the curve (AUC) is 85.5% when using the suggested methodology, which is a higher percentage than when using alternative algorithms. Both patients and clinicians can employ the suggested early dementia pre-screening approach.

The rising incidence of dementia among the aging Korean population will swiftly place a financial strain on society, yet prompt detection of dementia's early warning signs and appropriate responses to its emergence might improve medical care. Clinical data are less readily available than data on health behaviour and use of medical services, therefore a prescreening tool with readily available data could be an useful answer for issues relating to dementia.

Carol Y Cheung, et.al.^[15] did multicentre case-control study. There is no straightforward method to detect Alzheimer's disease, in part because the condition is difficult to diagnose and sometimes necessitates costly and occasionally intrusive procedures that are uncommon outside of highly specialized healthcare settings. Our goal was to create a deep learning system that could only detect Alzheimer's disease-related dementia using retinal photos, which is the most popular non-invasive way of examining the retina. Authors collected data from 11 studies that enrolled patients with Alzheimer's disease-dementia and people without disease from various countries to train, validate, and test a deep learning algorithm to detect Alzheimer's disease-dementia from retinal photographs. The main goal of this study was to create a bilateral model that could recognize dementia-related Alzheimer's disease just from retinal images. Using retinal images from six researches, authors created and internally validated the bilateral deep learning model. To extract features from the photos, built the model around the EfficientNet-b2 network. For each person, integrated characteristics from four retinal photos (macula- and head-centered fields from both eyes' optic nerves) were utilised to create supervised deep learning models and give the network access to unsupervised domain knowledge. From the study it was observed that A retinal photograph-based deep learning algorithm can detect Alzheimer's disease with good accuracy, showing its potential for screening Alzheimer's disease in a community setting.

Akshay Zadgaonkar 1,* Ravindra Keskar 2 and Omprakash Kakde 1^[19] studied and discussed Alzheimer's and dementia detection using machine learning, acknowledging their impact on cognitive health beyond normal aging. The objective of this study was to design and test a model for early dementia

detection using lifestyle data from the National Health and Ageing Trends Study (NHATS). Artificial neural networks and random forest techniques are employed to build a model that identifies key dementia-related parameters. Temporal analysis reveals features that exhibit declining social interactions, quality of life, and increased depression as individuals age. Results show the random forest model achieving an accuracy of 80% for dementia risk prediction, with precision, recall, and Citation.F1-score values of 0.76, 1, and 0.86, respectively.

Eunhee Cho1, Sujin Kim2, et.al.,^[20] studied and discussed the machine learning models which were used to predict the occurrence of BPSD among community dwelling older adults with dementia. The Authors included the sample data of 187 older adults with dementia for model training and 35 older adults with dementia for external validation. In their Demographic and health data and premorbid personality traits were examined at the baseline, and actigraphy was utilized to monitor sleep and activity levels. Several prediction models were also employed, including logistic regression, random forest, gradient boosting machine, and support vector machine. The random forest models revealed the highest area under the receiver operating characteristic curve (AUC) values for hyperactivity, euphoria/elation, and appetite and eating disorders;

Jie Wang, Zhuo Wang, et.al.^[21] studied that the RF algorithm can be a useful tool to classify CU, MCI, and dementia among a population with normal MMSE. In the result of the study authors found that the optimized NTB, consisting of six neuropsychological tests (AVLT-H, PAL, modified Rey figure, LMT, DST, and TMT A), enables detection of MCI and dementia with good sensitivity and specificity. As cognitive markers, neuropsychological assessments have the excellent performance to identify cognitive disorders. For low- and middle-income countries, this has advantages over using classifiers based on more invasive, expensive, and time-consuming methods such as cerebrospinal fluid markers.

Meenakshi Dauwan, Jessica J. van der Zande^[22] studied the concept of building of a random forest classifier and how it can be used to improve the diagnostic accuracy in differentiating dementia with Lewy bodies (DLB) from Alzheimer's disease (AD) and to quantify the relevance of multimodal diagnostic measures, with a focus on electroencephalography (EEG). However, when studying variable importance, different "profiles" were found. (q) EEG features were identified as the most important for discrimination between DLB and AD and DLB and controls. Interestingly, the accuracy of the classifier for discrimination between DLB and AD was higher when only qEEG features were used, than with a combination of clinical features (including MRI and CSF analysis) and visual EEG.

Morshedul Bari Antor, I.A. H. M. Shafayet Jamil, I Maliha Mamtaz, et.al,^[23] represented the result and analysis regarding detecting Dementia from various machine learning models. In this paper the author studied the data set from the Open Access Series of Imaging Studies (OASIS) for the development of the system. The dataset is small, but it has some significant values. The dataset has been analyzed and applied in several machine learning models. Support vector machines, logistic regression, decision tree, and random forest have been used for prediction. First, the system has been run without fine-tuning and then with fine-tuning. Comparing the results, it is found that the support vector machine provides the best results among the models. It has the best accuracy in detecting Dementia among numerous patients. The system is simple and can easily help people by detecting Dementia among them.

Laboni Akter, Ferdib Al Islam^[24] discussed and classified dementia into three classes (AD Dementia, No Dementia, and Uncertain Dementia) for identifying Alzheimer's disease in its beginning phase using Extreme Gradient Boosting (XGBoost) algorithm and also shown the feature importance scores. We got an enhanced performance in terms of accuracy (81%), precision (85%), and other performance metrics, and "ageAtEntry" was the most important feature.

Seong-Eun Ryu 1, Dong-Hoon Shin 2, And Kyungyong Chung^[25] discussed dementia and For dementia risk prediction, this study has proposed the XGBoost model through the derived variable extraction and hyper parameter optimization with the use of gradient boosting. It is a CART based ensemble learning model using Boosting that enables weak classifier models to learn sequentially and thereby generates a strong classifier model. The purpose of this study was to apply a XGBoost model, which shows strong performance for classification prediction, to OASIS dementia data and thereby to propose a more effective model of dementia risk prediction. This study had some limitations : Firstly, all the hyper-parameters of XGBoost failed to be optimized. Secondly, the size of the OASIS data set was not large enough.

Bojan Bogdanovic, Tome Eftimov & ,Monika Simjanoska^[26] presented a test that is related to the existing hypothesis regarding the causes and indicators of Alzheimer's disease. At the beginning of the research, four hypotheses were established considering the existing published literature. Hereafter, a large data set was obtained containing various types of features considering the lifestyle, personal information, medical analysis and cognitive tests of 12741 individuals (subjects). The data set was used in accordance with ethics and after obtaining a special permission for research goals. To test the established hypothesis, intelligent models were built by following a ML approach. The high performance of the model

(XGBoost) was used in advantage of explainable ML methods able to interpret the relations among the various features and therefore, to derive conclusion over the causes and indicators of the Alzheimer's disease

ShirJaveed, Ana Luiza Dallora, et.al^[27] discussed and studied how to conduct a comprehensive evaluation of ML-based automated diagnostic systems considering different types of data modalities such as images, clinical-features, and voice data. Authors collected the research articles from 2011 to 2022 using the keywords dementia, machine learning, feature selection, data modalities, and automated diagnostic systems. The selected articles were critically analyzed and discussed. It was observed that image data driven ML models yield promising results in terms of dementia prediction compared to other data modalities, i.e., clinical feature-based data and voice data. Furthermore, this SLR highlighted the limitations of the previously proposed automated methods for dementia and presented future directions to overcome these limitations.

Machine Learning Algorithms Used In Dementia Detection And Prediction

Support Vector Machines (SVMs): In machine learning, SVMs are frequently employed for classification problems. SVM's work on binary or multiple-class classification problems. SVM's divide the data points into various classes by creating a hyperplane. SVM's have been successfully applied to dementia prediction.^[16]

- **Random Forest (RF):** is an ensemble learning technique that uses decision trees and is used for classification and regression applications. Building numerous decision trees, then averaging the outcomes to produce forecasts, is how RF operates. It has been demonstrated that RF is effective at predicting dementia.^[17,21]
- **Neural Networks (NNs):** These machine learning algorithms are modelled after the way that the human brain is organised. Classification, regression, and grouping are just a few of the activities that NNs can be utilized for.
- **Logistic Regression:** Binary classification tasks can be performed using the statistical model of logistic regression. Using clinical and demographic information, it has been used to anticipate the onset of dementia.^[18]
- **Convolutional Neural Networks (CNNs):** CNNs are a subclass of neural networks that excel at classifying images. Based on the results of brain imaging, they have been used to categorise patients who have dementia.
- **Long Short-Term Memory (LSTM) Networks:** These recurrent neural networks operate well for jobs requiring sequence prediction. Based on

longitudinal data, they can be used to forecast the onset of dementia.

- **XGBoost** : This algorithm belongs to the ensemble learning category, specifically the gradient boosting framework. It utilizes decision trees as base learners and employs regularization techniques to enhance model generalization. Known for its computational efficiency, feature importance analysis, and handling of missing values. XGBoost is widely used for tasks such as regression, classification, and ranking^[24,25].

Experimental Work :

The dataset “dementia.csv” consists of 150 participants between the ages 60 to 96. Each participant had 2 or more visits in a year and 3 to 4 T1-weighted MRI scans were obtained. The subjects were men and women who were right handed. 72 individuals were categorized nondemented in study. 64 individuals among the participants were detected as demented in initial visits. 51 subjects were mild to moderately demented whereas 14 were initially labelled to be nondemented initially but in later visits were classified as demented. After preprocessing of data Random forest algorithm was applied. The analysis with respect to different parameters is as follows:

1. Algorithm classified that 50% of subjects were nondemented, 39% were labelled to be demented and 10% were converted from non-dementia to dementia in later visits.
2. More men were detected as demented than women but in converted cases women were more in number.
3. It shows that most of the subjects affected by dementia were of the age from 70 to 80.
4. Seventy-five records make up the test dataset. It can be inferred from the confusion matrix that:
 - All subjects who do not have dementia are categorized correctly.
 - Identifying people who were borderline, meaning they weren't initially diagnosed as demented but turned into such during the data collection process, the model makes more errors. From the start of the survey to the finish, 2.67% of them are identified as having dementia, while 4% are classed as not having dementia.

The same dementia.csv dataset was then studied with the XGBoost ensemble classifier. The Kfold accuracy was calculated as 89.28% i.e. 89% approximately. The heatmap shows that gender, normal brain volume and SES(socio economic status) has the highest correlation to dementia in the dataset.

Conclusion :

The use of machine learning algorithms can help reduce the subjectivity of diagnosis and provide a more

objective and standardized approach to diagnosis. This can lead to improved outcomes and more personalized treatment plans for individuals with dementia.

It can very well be concluded that use of machine learning in dementia detection holds great potential in advancing our understanding of the disease and improving diagnostic accuracy, which can ultimately lead to better care and outcomes for those affected by dementia.

The study shows that random forest algorithms can be accurately predicted using clinical variables. As compared to XGBoost, Random Forest classifier performed better. Random forest classifier gives the accuracy as 97% whereas XGBoost gives the accuracy of 89% approximately.

Our findings demonstrate that clinical features can perform better than MRI-based models. This is crucial because acquiring a patient's neuropsychological scores, which is a substantial subset of our selected features, may be significantly less expensive and time-consuming than collecting their MRI images.

References :

- 1] M. Deture and D. Dickson, “The neuropathological Diagnosis of Alzheimer’s Disease,”. *Mol. Neurodegener.*, vol. 14, pp. 1-18, 2019.
- 2] W.H. Organization, “Dementia,” WHO, 2022.
- 3] P. Charlotte James and R. E. D. J. L. Janice M. Ranson, “Performance of Machine Learning Algorithms for Predicting Progression to Dementia in Memory Clinic Patients,” *JAMA Network Open*.2021;4(12), vol. 4, no. 12, pp. 1-11, 2021.
- 4] S.-F. M. Mitchell AJ, “Rate of progression of mild cognitive impairment to dementia – meta-analysis of 1 robust inception cohort studies,” *Acta Psychiatr Scand*, vol. 119, p. 252–265, 2009.
- 5] Chen K, “Alzheimer’s Disease Neuroimaging Initiative. Identification of Conversion from Normal Elderly Cognition to Alzheimer’s Disease using Multimodal Support Vector Machine,” *J Alzheimers Dis.*, vol. 47(4), pp. 1057-67., 2015.
- 6] D. S. Daoqiang Zhang, “Multi-modal multi-task learning for joint prediction of multiple regression and classification variables in Alzheimer’s disease,” *NeuroImage Elsevier, Science Direct*, vol. 5, no. 2, pp. 895-907, 2012.
- 7] S. Wang et.al, “Multi-scale enhanced graph convolutional network for mild cognitive impairment detection,” *Journal of Pattern Recognition, Elsevier*, vol. 134, p. 109106, 2023.
- 8] L. JananiVenugopalan, “Multimodal deep learning models for early detection of Alzheimer’s disease stage”.
- 9] S. F. Katrin Müller^{1*}, “Sensor-based systems for early detection of dementia (SEND): a study protocol for a prospective cohort sequential study,” pp. 1-15, 2020.

- 10] D. Albert MS, "The diagnosis of mild cognitive impairment due to Alzheimer's disease: recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines," *Alzheimer's Dement.* Pubmed, vol. 7, no. 3, pp. 270-279, 2011.
- 11] S Montero-Odasso MM, "Association of Dual-Task Gait with Incident Dementia in mild cognitive impairment: results from the gait and brain Study Association of dual-task gait with incident," *JAMA Neurol.*, vol. 74, no. 7, pp. 857-865, 2017.
- 12] B. Farhan SM, "The Ontario neurodegenerative disease research initiative (ONDRI).," *Can J Neurol Sci.*, vol. 44, no. 2, pp. 196-202, 2017.
- 13] a.W. C. Jia You, "Development of a novel dementia risk prediction model in the general population: A large, longitudinal, population-based machine-learning study," *EClinicalMedicine*, vol. 53, pp. 1-13, 2022.
- 14] Jungyoon Kim 1 and Jihye Lim 2, "A Deep Neural Network-Based Method for Prediction of Dementia Using Big Data," *Int. J. Environ. Res. Public Health*, vol. 18, no. 5386, pp. 1-13, 2021.
- 15] Carol Y Cheung*, "A deep learning model for detection of Alzheimer's disease based on retinal photographs: a retrospective, multicentre case-control study," *digital-health*, vol. 4, pp. 806-815, 2022.
- 16] G. S. Senthilkumar Mohan, "Effective Heart Disease Prediction Using Hybrid Machine Learning Techniques," *IEEE Access*, vol. 7, no. 1, pp. 81542-81554, 2019.
- 17] V. M. Arunim Garg, "Role of machine learning in medical research: A survey," *Elsevier*, vol. 40, no. 1, pp. 1-17, 2021.
- 18] Y. Kobayash, "Alzheimer-type dementia prediction by sparse logistic regression using claim data," *Computer Methods and Programs in Biomedicine*, vol. 196, pp. 105581-105589, 2020.
- 19] Akshay Zadgaonkar 1,* , Ravindra Keskar 2 and Omprakash Kakde 1, Towards a Machine Learning Model for Detection of Dementia Using Lifestyle Parameters, *Researchgate, Appl. Sci.* 2023, 13, PP 1-19, 2023
- 20] Eunhee Cho¹, Sujin Kim², et.al., Machine learning based predictive models for the occurrence of behavioral and psychological symptoms of dementia: model development and validation, *Scientific Reports*, PP 1-12, 2023.
- 21] Jie Wang, Zhuo Wang, et.al. Random Forest Model in the Diagnosis of Dementia Patients with Normal Mini-Mental State Examination Scores, *Journal of Personalized Medicine* 12, 37, PP 1-11 2022.
- 22] Meenakshi Dauwan, Jessica J. van der Zande, Random forest to differentiate dementia with Lewy bodies from Alzheimer's disease, *Elsevier*, PP 100-106, 2016.
- 23] Morshedul Bari Antor, 1A.H. M. Shafayet Jamil, 1 Maliha Mamtaz, et.al, A Comparative Analysis of Machine Learning Algorithms to Predict Alzheimer's Disease, *Hindawi Journal of Healthcare engineering, Open Access Volume 2021*, PP 1-12, 2021.
- 24] Laboni Akter, Ferdib Al Islam, Dementia Identification for Diagnosing Alzheimer's Disease using XGBoost Algorithm, *Researchgate, Conference paper International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD), At: Dhaka, Bangladesh, April 2021.*
- 25] Seong-Eun Ryu 1, Dong-Hoon Shin 2, And Kyungyong Chung, Prediction Model of Dementia Risk Based on XGBoost Using Derived Variable Extraction and Hyper Parameter Optimization, *IEEE Access, Special Section On Behavioral Biometrics For Ehealth And Well-Being, Volume 8, 2020, PP 177708 -177720, Sept 21 2020*
- 26] Bojan Bogdanovic, Tome Eftimov & , Monika Simjanoska , In-depth insights into Alzheimer's disease by using explainable machine learning approach, *Scientific Reports | (2022) 12:6508, PP 1-26, 2022.*
