AMRITA
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CANCER PROGNOSIS AND DRUG RESPONSE PREDICTION USING ML

Molecular biology and basic cellular physiology and
Ethics, innovative research, businesses & IPR
[24AIM112] [24AIM115]

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Introduction

- Cancer is one of the leading causes of mortality worldwide, with millions of new cases diagnosed each year.
- Due to the complexity and heterogeneity of cancer at the molecular and cellular levels, predicting disease progression and drug response remains a significant challenge.
- ML has emerged as a powerful tool in precision oncology, offering the ability to analyze vast amounts of genomic, clinical, and drug response data.

OBJECTIVE:

- Develop a machine learning-based system for cancer prognosis prediction using patient-specific molecular and clinical features.
- Analyze cancer cell responses to various drugs to predict drug efficacy.
- Enable personalized treatment selection by integrating patient data with drug response predictions.
- Improve clinical decision-making through AI-driven insights for cancer treatment.

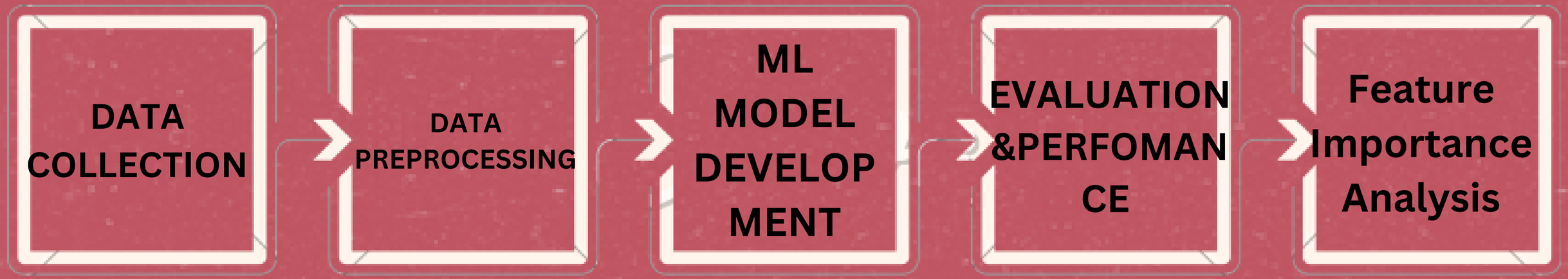
RESEARCH GAP:

- Traditional cancer treatments follow generalized protocols, often ignoring individual genomic and molecular profiles.
- Existing models fail to fully incorporate biological factors such as mutations, epigenetics, and immune system influences.
- Most ML models are trained on common cancer types, leading to poor performance in predicting prognosis and drug response for rare cancers.
- The integration of AI in clinical settings is hindered by regulatory hurdles, data privacy concerns, and the need for extensive validation before clinical deployment.

PROBLEM STATEMENT:

- Traditional treatment approaches rely on generalized guidelines, ignoring individual genetic variations and molecular profiles.
- Patients may receive ineffective treatments or experience severe side effects due to non-personalized therapies.
- Variability in genetic mutations and diverse cancer cell responses make prognosis and drug response prediction difficult.
- Lack of precision medicine approaches in many clinical settings limits personalized treatment strategies.

METHADOLOGY:



ROLE OF ETHICS:

- “Participation in genomics trials requires that prospective patients be informed of genomic testing and the potential of future therapies based on genomics results”

- Equitable access for evidence-based screening, diagnosis, and treatment of cancer in underprivileged populations.

- Cancer Cellular Immunotheraphy -. If cells are to be cultured in vitro, strict monitoring of cell cultures and detection is required. Ensuring the high quality of the cellsused in cancer cellular immunotherapy can avoid violation of the ethical principle of non-harm.

ROLE OF IPR &PATENTS:

Patent: US 11,462,325 B2 (Multimodal Machine Learning-Based Clinical Predictor)

This patent allows the system to combine molecular data (RNA sequencing, DNA mutations, protein expressions) with biopsy images for more precise predictions.

Analysis of Patent EP1876893B1: Telomerase Inhibitor for Cancer Treatment
The EP1876893B1 patent protects an innovative cancer treatment strategy that combines telomerase and proteasome inhibitors. This combination has shown strong potential in cancers like multiple myeloma, lung cancer, and glioblastoma.

GRAPH PLOT OF LGG:

Dataset taken from GDSC(Genomics of Drug Sensitivity in Cancer) for LGG(Brain lower grade glioma)
two types of dataset was used to plot Copy number Alteration of top 15 genes in LGG(Plot1)
and IC50 Drug data of top 10 for LGG(Plot2)
With Plot 1 we can infer the alteration of gene in LGG and the alteration count
Plot 2 we can find which drug is more effective using IC50 as a feature
So, basically the idea is to develop a Machine learning model which can learn from multiple dataset and output the prognosis of the cancer and the drug treatment response
further adding extra features and different type of cancers makes the model more generalized

APPLICATION:

- Precision Medicine
- Cancer Research
- Pharmaceutical Development
- Healthcare AI Systems

Thank you!