

PREDICTION OF RHEUMATOID ARTHRITIS SEVERITY USING BIOMARKERS AND BLOCKCHAIN

24AIM112 Molecular biology and basic cellular physiology

24AIM115 Ethics, innovative research, businesses & IPR

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PROBLEM STATEMENT

Autoimmune diseases, such as rheumatoid arthritis (RA) involve multiple biomarkers like cytokines and immune cell markers. RA diagnosis and treatment strategies often depend on subjective clinical evaluations which leads to delay in treatment. So, there's a need to develop a model to predict severity of RA and also to recommend treatment strategies.

PROPOSED SOLUTION

To develop a Graphical User Interface (GUI) which allows the users to input the biomarker levels which can predict the severity of RA using Multi Layer Perceptron (MLP) and recommend treatments. Blockchain technology is integrated in our project for data privacy.

DATASETS AND PREPROCESSING METHODS

- These datasets are being taken from the NCBI's Gene Expression Omnibus(GEO) and hence their respective accession IDs are given here

1.GSM1068616-IL-10

2.GSM993402-IL-17

3.GSM993406-TNF-Alpha

4.GSM258773-CD4+

5.GSM211514- IL-6

link for GEO=<https://www.ncbi.nlm.nih.gov/geo/>

- Preprocessing was done using MinMaxScaler

LITERATURE REVIEW

S.No	TITLE	METHODOLOGY	RESEARCH GAP
1	Identification of diagnostic biomarkers of rheumatoid arthritis based on machine learning-assisted comprehensive bioinformatics and its correlation with immune cells	Seven accurate diagnostic biomarkers were identified for rheumatoid arthritis.	Lacked detail clinical data, had a small validation dataset, focused solely on transcriptions, and lacked external validation and cross study comparisons.
2	Machine leaning approaches to improve patients with rheumatoid arthritis: review and future directions	RA research, demonstrating high accuracy in diagnosis, imaging, monitoring, and treatment response prediction.	Limited standardized datasets, data variability, model overfit, ethical concerns, and limited real world implementation

3

Securing patient data in the healthcare industry: A blockchain-driven protocol with advanced encryption.

A secure protocol using blockchain technology and advanced cryptography to protect patient data.

Challenges in legal compliance, scalability, and infrastructure highlight the need for standardized frameworks and enhanced blockchain optimization for healthcare systems.

4

Mapping the ethical landscape of digital biomarkers: A scoping review

A review on ethical concerns in digital biomarkers, data security informed consent with in-depth discussion.

Limited domain and context specific guidelines for the use of digital biomarkers in various clinical settings.

ASSOCIATION OF THE SEROLOGICAL STATUS OF RHEUMATOID ARTHRITIS PATIENTS WITH TWO CIRCULATING PROTEIN BIOMARKERS: A USEFUL TOOL FOR PRECISION MEDICINE STRATEGIES

- 1.Objective : To investigate the serological status of RA patients by correlating two specific circulating protein biomarkers, ACPA and RF with the goal of improving patient stratification for personalized treatment strategies.
2. Methods: To analyse serum samples from RA patients, assessing the levels of the two targeted protein biomarkers and comparing them across different serological profiles.
3. Findings: Identifying significant associations between the serological status of RA patients and the levels of the two circulating protein biomarkers, verifying and using various Multiple Reaction Monitoring(MRM) from 31 peptides bindings

4. Implications for Precision Medicine: The results support the integration of these biomarkers into clinical practice to tailor treatment plans more effectively, aligning with the principles of precision medicine.

5. Ethical Considerations: Implementing biomarker-based stratification must ensure equitable access to testing and treatments, maintaining patient autonomy and informed consent. Additionally, the potential psychological impact of stratification on patients should be carefully managed.

6. Future Directions: Further research to validate findings in larger cohorts and to explore the integration of these biomarkers into routine clinical workflows, ensuring that ethical considerations are addressed throughout the process.

PROBLEMS WITH ETHICAL APPROVAL AND HOW TO FIX THEM: LESSONS FROM THREE TRIALS IN RHEUMATOID ARTHRITIS

- Barriers to Transparency: We experienced extensive delays and challenges in obtaining documents and information for all the trials.
- Roche initially refused, to share the ethical documents.
- Use of Placebo in RA trials: Inadequate treatment can lead to irreversible structural damage, additional pain, and functional impairment.
- Informed Consent: The main ethical concern with this study is the need for the control arm to receive placebo ocrelizumab infusions. However, the committee did not ensure that participants were told this.
- The consent forms did not explicitly state the additional risks such as increased pain, impairment, and permanent structural damage.
- The exclusion criteria was completely different from the ethics committee to that of research protocol.

AN OVERVIEW OF A RECENT COURT CHALLENGE TO THE PROTECTION OF BIOMARKERS AS INTELLECTUAL PROPERTY

- Case provides guidance to inventors in the biomarker field who may be interested in obtaining intellectual property protection for their inventive work, as well as their patent counsel.
- The company attempted to patent isolated DNA sequences and methods for detecting genetic mutations.
- Anything man-made under the sun is probably patent eligible, if it is a practical application of science, operating in a physical realm.
- To obtain a patent, the invention must be useful (utility), new (novel), and not obvious.
- Inventor must provide adequate written description of his invention, must set forth the elements (or steps) needed to practice the invention sufficiently.
- Factors to be considered: The cost for patenting, market demand, timing, and the perceived value.

REFERENCES

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