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Effective Drug Dosage Monitoring Method for Immune Systems Using Reinforcement Learning Techniques

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ABSTRACT: This article develops a drug dosage control strategy based on reinforcement learning for immune systems with dynamic uncertainties and input constraints to maintain a amount of a tumors and enough immunological cells in the body. First of all, the state in the immune system and the desired number of tumor and immune cells are created into an augmented that to derive in an augmented immune system. A discounted non-quadratic performance index function was created solve the robust tracking control challenge. and unpredictable immune systems is converted into an ideal tracking control issue of nominal immune systems of the drug dosage are can limited within the particular specified range. After that, a reinforcement To determine the approximate ideal drug dosage, a critic-only structure and a learning algorithm are used. control approach.Furthermore, theoretical proof demonstrates that the suggested reinforcement learning-based drug dosage control technique guarantees that, in limited circumstances, the amount of quality tumor and immune cells reaches the predetermined level. medication dosages and uncertainty in the model. Lastly, a simulation analysis confirms that the created method for controlling drug dosage in various tumor cell growth models

KEYWORDS: Drug Dosage , Reinforcement Techniques, Cancer Treatment ,Machine Learning , Java

I.INTRODUCTION

In 2020, cancer will be responsible for around million deaths globally, making it major cause mortality in recent decades. By 2040, its morbidity predicts up to million cases . The process of developing cancer has multiple steps. Numerous factors can contribute to the development of tumors, such as poor diet, chronic infections, genetic modifications, and inactivity [2], [3]. When detrimental alterations disrupt the proper biological process of cells, normal cells proliferate uncontrollably and create precancerous lesions. Additionally, precancerous lesions grow into tumors. A malignant tumor is a characteristic of cancer. The three primary types of traditional cancer therapies are chemotherapy, radiation, and surgery. The kind and stage of the cancer, and each patient's unique situation, determine the available treatment options. The tumor-node-metastasis classification method divides most cancer types into different categories.encompassing phases I through IV [4]. Surgery can used to remove stage I cancer, which is restricted to the primary location. Cancers in stages II–III have extensively invaded surrounding tissues, including lymph nodes. Metastatic or advanced cancer is the term used to describe Stage IV cancer that has progressed to distant organs in the body. The majority of cancer-related deaths are caused by widespread metastases. Treatment options for cancer that is identified at stages II–IV include chemotherapy, radiation therapy.

II. LITERATURE SURVEY

1.Neural-Network-Based Immune Optimization Regulation using Adaptive Dynamic Programming
Author: Y Knnedy

it is studied the optimal regulation problem between the tumor and immune cells using the Adaptive Dynamic Programming (ADP) techniques. The aim of the therapy is not only to impede the development of tumor cells below an acceptable level, but also to ensure that parked immune cell numbers can be maximized at any given time. The obtained number of cells to reach the specific desired states using ADP approach leads to a robust controller. And most important, is that the main goal is to reduce chemotherapy and immunotherapy side effects it possibleminimized at a dose of chemotherapeutic and immunoregulatory drugs are running for treatment. The non-linear dynamical mathematical model of tumor cells, according tofood is reduced and enhanced trading system corresponding chemotherapy, immunotherapy drugs as a strong regulatory measures should able to think back control behavior

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(Figure 1). Convergence analysis is done by to show a states of system and critic weight errors are ultimately uniformly bounded with this optimization control strategy, which takea as front a simulation results verifying the efficacy of cybernetics methodology.

2.Adaptive Virotherapy Strategy for Organism with Constrained Input Using Medicine Dosage Regulation Mechanism
Author: RJ Ziance
the constrained adaptive metod depends on viroterapy is inestigate for the body organism and used the tablet dsage regulation mechanism . Mainly the virus called tumor virus immune interaction is install to investigate the model to model the relation among all tumor cells virus in organ immune cells in virus cells immune response.The method are adp is extended to check accurate optimal strategy uses to interaction system to decrease the population of Tc because to consider of asymmetric control over constraints,and the non quardric fuction are build to proposed the formulate to the value of ,they are corresponding Hamilton bellaman equation is explain it be demed as cornerstone of algorithum ADP After ,ADP algorithum of single network architecture which is integrates the MDRM method of single network architecture which is integrates the MDRM method is said the optimal stats. Design of MDRM makes possible the dosage to the agentia oncolytic virus that to be regulated timely.

3. Title: Evolutionary Dynamics Optimal Research-Oriented Tumor Immunity Architecture
Author: Duncan Matthews
In The chapter of devotes to evolutionary dynamics and optimal control oriented for tumor immune differential game system. the mathematical model of covering immune cells and tumor cells are considering the effects on chemotherapy drugs and immune agents. Next,the bounded optimal control are problem covering is transformed it into solving the HJB equation considering the actual data constraints and infinite-horizon to performance index related to minimize amount of medication administered. At last approximate the optimal control strategy it is acquired through the iteration dual and heuristic dynamic programming. algorithm are avoiding the dimensional disaster of effectively and providing optimal treatment scheme to the clinical application

4.Optimal Regulation Strategy for Nonzero-Sum Games of the Immune System Using Adaptive Dynamic Programming
Author: Abdul salam
The article investigates on the optimal control strategy and problem for nonzero-sum games the immune system on basis of adaptive dynamic programming (ADP). the main objective is to approximating Nash equilibrium between tumor cells and the immune cell population, in which is governed through the chemotherapy drugs and the immune agents guided by mathematical growth model of tumor cells. And a novel intelligent and nonzero-sum games-based ADP is put forward to to solve the over optimization control problem by decreasing the growth ratio of tumor cells and minimizing chemotherapy drugs and immuno therapy drugs. Meanwhile, the convergence analysis At last simulation are listed to account for the availability and effect the research methodology

III. EXISTING SYSTEM

In our existing system Typically, the current method for the best drug dosage control strategy consists of multiple parts. First, the immune system's dynamics and reaction to outside stimuli like medications are modeled mathematically. The behavior of the immune system under various circumstances can be simulated using this model as a foundation. After then, RL algorithms to determine the best course of action for dosage control. These algorithms investigate the range of potential dosage schedules and modify their choices in response to the results they see. RL algorithms converge to an optimal approach that achieves the desired objective, such as lessening the severity of the disease or reducing side effects, by iteratively modifying the dosage in response to the input obtained. Additionally, the current system might have features for adding previous knowledge orrestrictions inside the RL structure. This guarantees that, while still achieving the intended result, the learnt dosage control approach complies with safety regulations and physiological limitations.All things considered, there is considerable potential for enhancing patient outcomes and treatment efficacy through the incorporation of reinforcement learning into the optimization of medication dosage control procedures for immune systems. Researchers can create individualized and adaptive dosing regimens that are specific to each patient are features of their disease by using reinforcement learning (RL) algorithms to learn from immune system.

IV. PROPOSED SYSTEM

In this we proposed to blockchain-based solution to this healthcare supply path where a integrity , accountability , authorization , availability and mainly non repudiation are mainly consider to a key security goals
We do performance and analysis a practical application ,and a results shown that in the system improve the query efficiency and provide security of private information.

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V. FUNCTIONAL REQUIREMENTS

Calculation, particulars that are practical, data processing and operations, and other functions that are exclusive to the system are some examples of the types of things that are included in the functional requirements of a system, which explain the functional component of the system. Other examples of the kinds of things that are included in functional requirements include other functions that are exclusive to the system. It provides an explanation as to the aims that are supposed to be reached by the system, and it does it in a very clear and concise manner. In this section, we are able to monitor how the system generates outputs and results, as well as the types of services that are offered to end users by the system. In addition, we are able to see how the system serves end users. In addition, the technology enables us to view the types of services that are being offered to end consumers so that we may better serve them.

The functional requirements of the system can provide the information that is required to calculate the cost of the system. In addition to this, they provide information regarding the dependability of the system, which exposes whether or not the services provided by the system are effectively satisfying the needs that have been presented by the clients. This suggests that 3 an evaluation of the output that is now being produced by the system in order to establish whether or not it is the output that is required will take place. A record of high-level assertions will be preserved, and within that record, each of the above-mentioned points will be stated in full while adhering to the aforementioned standards of completeness and clarity. This record will also be kept for future reference. In addition to this, it provides the whole functioning of the several subsystems that, when combined, create the larger system. There is a good chance that the document will, in the not-too-distant future, integrate requirements, including safety and security, quality, manufacturability, usability, performance, dependability, and friendliness towards the environment

VI.CONCLUSION

In this project, This paper provides an immunotherapy regimen for cancer via RL technique. We show a content obtained by addressing the robust tracking control problem of immune systems subject to input constraints and dynamic uncertainties in control community. To Achive this goal, an augmented immunesystem and a discounted non-quadratic performance index function are established such that the robust tracking control problem of uncertain immune systems is converted to an optimal tracking control problem of its nominal plant. Subsequently, we develop constrained drug dosage control strategy by using RL algorithm and criticonly structure. According to the Lyapunov theory, we proof that the developed 2 RL-based drug dosage control strategy ensures the number of tumor and immune cells reaches to the preset level with limited drug dosages. At last, simulation results display that the developed immunotherapy regimen is feasible.

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