

A Survey of Precision Medicine Strategy Using Cognitive Computing

Gandikota Ramu, P. Dileep Kumar Reddy, and Appawala Jayanthi

Abstract—Personalized Medicine is an important strategy for disease diagnosis and pre-care. This approach considers his/her personal data, circumstances, and genes to cure the disease. This method allows physicians and researchers to prognosticate the medication and prevent policies for appropriate viruses. The concept of cognitive computing works like a human brain to analyze and process the data. This method includes an automated system for using natural language processing, pattern recognition, and data mining to simulate how the human brain works. In this review, the synthesized overview of the current status of research on personalized medicine and how to address personalized medicine, using cognitive computing, are discussed. In addition, the national and international status of the research and issues, regarding personalized medicine, are presented.

Index Terms—Personalized medicine, traditional medicine, healthcare, cognitive computing.

I. INTRODUCTION

Preventing is every time more beneficial than cure. National Institutes of Health (NIH) defines Personalized Medicine is "Personalized Medicine is an important strategy for disease diagnosis and pre-care. This approach considers he/she personal data, circumstances and genes to cure the disease" [1]-[4]. This method allows physicians and researchers to prognosticate specifically what medicine and preventing policies for an appropriate virus to individually. This paper is in contradiction to a "one-size-fits-all" method, in that illness therapy and preventing processes are improved to the average person, with limited concern for the variations among people. While the word "Personalized Medicine" is almost recently introduced, past decade the thought is part of health care. For instance, in the emergency, we can transfer the blood only from donor to injured person based some matching criteria unlinked randomly. These matching criteria will reduce the risk of difficulties. We can find such examples in many fields of healthcare; the function of Personalized Medicine in daily life healthcare is nearly less. But, many researchers are trying increasing this approach almost all area in healthcare in coming years.

A person cells' nuclei contain Human DNA. This DNA

includes nearly twenty thousand genes. Each gene is a represented by a compound identifier, This type of kind design for proteids and additional materials required for life. Human Cells produce the particles based on ancestral pans. Human's total design is the equal, this design built from three billion "letters" of identifiers, every letter relating to a synthetic subpart of the DNA fragment. However, complex modifications of one percent human DNA — usually the outcome of only a separate compound letter holding various — given person identifications. Behind natural occurrence, genes point to different chemistries in various parts of the human parts. Before-mentioned exceptions seldom teach individuals to a particular illness, and any dramatically change the direction a person will react to therapeutic. Physicians are finding disease and provide treatment based on personal differences, this idea usually mentioned to as "Personalized Medicine" [5]-[8]. The core idea of Personalized Medicine about treats the patients individually by combining genetic information with the personal health records, unlike trial and error method. Finally, Personalized Medicine will change the future medicine based on person proteids and biochemical effects.

In [9] Lawrence Lesko, U.S. Food and Drug Administration says "Personalized Medicine," is the new path to reach optimized individual healthcare decisions like disease diagnosis, disease prevention, and treatment. Previously, personalized medicine applies only limited places for specific. Modifications of a gene associated with breast cancer, for example, can predict a woman's true sensitivity to growing or bearing the illness, a significant design for practicing defensive actions. In some cases of breast cancer, the result of a special proteid indicates a further dynamic model of the virus that force be further efficiently compared with the medication Herceptin. However, many hurdles continue in the search for a general operative arrangement of Personalized Medicine. People will be directed by the collaboration works of researcher from various systems, from geneticist to medical specialist to engineer.

Information technology (IT) enables significant transmutations in various enterprises, giving effortless way to data of various forms in a quasi-instantaneous and omnipresent way [10]. Those modifications require the regeneration of high -built systems and necessitate different types, about both possible results and person anticipations. Biomedicine is an important privilege. Nearly two decades later the original study was written by Powsner and Tufte [11] including graphical representation of a particular patients' state. Notwithstanding significant progress in biological science, image processing, and treatments the area has still to completely profit from the IT change to combine medical and

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biomarker information of different species for research, or to use “Bigdata” in a new work situation [12]-[15]. The reasons for the suspension are numerous and cover the free world of healing sub-systems; the center of EHRs preferences on agreement and billing rather than clinical research; a paucity of prospectively ascertained. Intensely interrogated patient cohorts to support decision analysis; and a failure to standardize recording of charging results, neuro imaging stands or normal lab conditions. As e-health and IT are redefined to reach to medical devices and research information, the common use of illness-based taxonomy itself is holding collected into a problem. Unique events are designed to tailor the system of dose to individual cases soon than to rely only on testimony from various populations who take a simple diagnosis [16]-[23].

The theory has been that everybody ought to get a similar care supported clinical trials. Personalized medication is that the construct that managing a patient's health ought to be supported the individual patient's specific characteristics, as well as age, gender, height/weight, diet, setting, etc. Potential applications of customized medication customized medication aims to spot people in danger for common diseases like cancer, heart condition, and polygenic disorder. The simple case history has long been utilized by physicians to spot people at accumulated risk and to advise preventive measures like life-style modifications (changes in diet, stop of toxic habits, accumulated exercise) earlier screening, or perhaps prophylactic medications or surgery. Scientific advancements supply the potential to outline a human risk supported their genetic make-up. Fields of travel analysis termed “-omics” (genomics, proteomics, and metabolomics) study the contribution of genes, proteins, and metabolic pathways to human physiology and variations of those pathways which will result in malady susceptible. It is hoped that these fields can alter new approaches to identification, drug development, and personalized medical aid. Pharmacogenetics genetic science (also termed pharmacogenomics) is that the field of study that examines the impact of genetic variation on the response to medications. This approach is geared toward trade drug medical aid at a dose that's most applicable for a private patient, with the potential advantages of skyrocketing the effectiveness and safety of medicines. Gene-centered analysis may additionally speed the event of novel medicine.

Personalised medication may be a move faraway from a ‘one size fits all’ approach to the treatment and care of patients with a specific condition, to 1 that uses new approaches to higher manage patients’ health and targets therapies to realize the simplest outcomes within the management of a patient’s malady or predisposition to malady. We are all distinctive. Our health is decided by our inherent variations combined with our lifestyles and atmosphere. By combining and analyzing data regarding our ordering, with different clinical and diagnostic data, patterns may be known that may facilitate to see our individual risk of developing disease; find malady earlier; and, confirm the foremost effective interventions to assist improve our health, be they medicines, manner decisions, or maybe easy changes in diet. The thought of individualized medication isn't new.

Clinicians are operating to change care, tailored to people’s

individual health desires, throughout the history of drugs, however ne'er before has it been potential to predict however every of our bodies can reply to specific interventions, or establish that folks is in danger of developing associate degree malady. New prospects ar currently rising as we have a tendency to assemble novel approaches, like whole ordering sequencing, knowledge and IP, and wearable technology. it's the interconnections between these innovations that produces it potential to maneuver to associate degree era of actually individualized care. Technological and scientific advances ar already here and can still develop and improve medical practice; modification is inevitable. For the NHS, we have a tendency to should think about not whether or not we must always go down this path of individualized medication, however instead however we will best respond and adapt, to make sure everybody advantages – despite wherever individuals live, the sicknesses they need, or wherever their care is provided. We are on a journey towards embedding a individualized medication approach into thought tending. NHS England is starting a discussion regarding what we have a tendency to mean by individualized medication, currently and within the future, and also the approach we'll take, operating with our partners, in order that we will embrace new approaches, whereas making certain that moral, equality and economic implications a totally understood and self-addressed. Through the a hundred,000 Genomes Project, a ground breaking and world leading initiative, the NHS is building partnerships with domain and trade to rewrite the human ordering, in individuals with rare diseases and cancer. this can facilitate to predict the longer term development of malady, to create a identification wherever one has not existed antecedently and to spot treatments wherever potential. Please see the genetic science page for more data.

Traditionally, medication has been designed around clinical groups specializing during a specific organ system working back from a patient’s symptoms to gain a identification. Personalized medication turns this approach on its head. It recognizes that complicated diseases should not be thought-about as one entity. One malady might have many alternative forms, or ‘subtypes’, ensuing from the complicated interaction of our biological make-up and also the numerous pathological and physiological processes in our bodies. These won't solely vary between patients who have an equivalent malady however additionally at intervals a personal patient as they grow old and their body changes. As we have a tendency to integrate and analyses genomic and different knowledge, we will realize common factors and causes of variation, leading to the invention of latest pathways of malady, dynamic however diseases are thought of and treated. It allows North American country to recognize that an equivalent underlying modification in our deoxyribonucleic acid or ordering will cause issues in terribly totally different components of the body, which might not are previously known with a additional ancient care approach. Cancer is one condition wherever this approach is already additional common place, following major biological insights and medical advances. All cancer incorporates a genetic base. Today, we will supply a genomic, or ‘molecular’ identification, which suggests that we have a tendency to higher perceive the genetic base and can use this data to assist choose the foremost effective treatment, greatly up probabilities of survival. This may be used for a good vary

of cancers like malignant melanoma (skin cancer), leukaemia, colon, brain and breast cancers. This understanding implies that cancer patients may be stratified per what's going to be most effective for his or her condition. It should additionally mean that patients with totally different types of cancer might, on the premise of the genomic identification, receive similar treatments.

II. TRADITIONAL MEDICINE VERSUS PERSONALIZED MEDICINE

In traditional medicine, as shown in Fig. 1, the doctor uses trial and based method. The doctor suggests same medicine with equal dosage based on the assumptions. This type of treatment sometimes works and many times may not work. So, one size does not fit all. Strategies that benefit any victims are weak for others and the corresponding injection may produce surface results in only some cases.

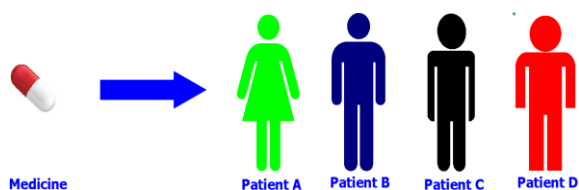


Fig. 1. Traditional medicine approach.

Personalized medicine is the orienting of clinical strategy to the particular characteristics of the individual patient. The method depends on accurate findings in our knowledge of how a patient's unique little and transmitted outline gives them sensitive to some conditions. The corresponding analysis is improving our knowledge to divine which therapeutic directions be reliable and valid for any case, and which people wish negative be. As shown in Fig. 2, the doctor suggests medicine and dosage based on person DNA and personal health information.

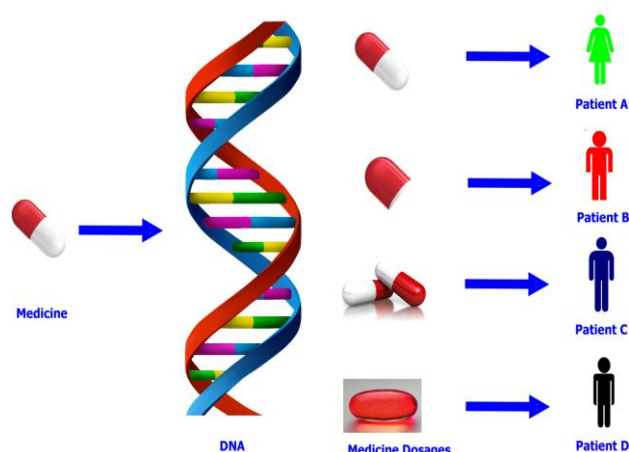


Fig. 2. Personalized medicine approach.

While current uses are limited, pharmacogenomics has the potential to offer multiple advantages on a larger system inside the following various times. Amazing of the complete important interests cover:

- **Guaranteed medicine collection:** Each year, several people die and much more hospitalized due to different effects of drugs. While medications support accurate

reports and trial rules before people are allowed for business, there is usually no system to foretell how a particular person will respond to a particular cause. Also if a medicine seems harmless for maximum personalities, any victims may encounter a deadly effect because of differences in their genes. Pharmacogenomic may be ready to divine the you are expected to produce a serious response to a medication before people always get it and the who will be expected to return strongly.

- **Reliable dosing choices:** Following FDA support and medical examination conditions, the size of medicine based on traditional medicine like one-size-fits-all dose or important organs like liver or kidney operate, mass, and lifetime. Those considerations force not be enough, but. A regular size may show deadly to one human and not different because of genetic change. Using pharmacogenetics, physicians bypass this difficulty by foretelling the optimal treatment to work, not exactly which medicine is best for a particular case.

Advances in drug reinforcement: Pharmaceutical organizations necessity usually use times leading the study on and medical experiments of a different medicine before it moves to business. Symptomatic and design firms, simultaneously with pharmaceutical companies, typically hold to examine a result in several patients to assure that it is secure and efficient. Pharmaceutical may support those organizations adjust their trial. For instance, if a corporation understands first of the season that someone has a hereditary change that will make an opposing response to a medication or that will make a medication weak; the cases can be dismissed from the clinical trial. That may further up the clinical examination method and target the particular group that can be supported by each one medication.

Over the past six decades, much evidence has emerged indicating that a substantial portion of variability in drug response is genetically determined, with age, nutrition, health status, environmental exposure, epigenetic factors, and concurrent therapy playing important contributory roles. To achieve individual drug therapy with a reasonably predictive outcome, one must further account for different patterns of drug response among geographically and ethnically distinct populations.

These observations of highly variable drug response, which began in the early 1950s, led to the birth of a new scientific discipline arising from the confluence of genetics, biochemistry, and pharmacology known as pharmacogenetics. Advances in molecular medicine have spawned the newer field of pharmacogenomics, which seeks to understand all of the molecular underpinnings of drug response. Commercialization of this research application is now known as personalized medicine (PM). Demonstrated success is emerging for several conditions and treatments, but whether PM will achieve widespread benefits for all remains as yet unrealized.

For the average patient, the benefits have not yet been realized, but ultimately PM will affect the entire landscape of our health care system. Since the mapping of the human genome in 2003, the pace of discovery, product development, and clinical adoption of what we know as PM has accelerated.

PM may be considered an extension of traditional approaches to understanding and treating disease but with greater precision. A profile of a patient’s gene variations can guide the selection of drugs or treatment protocols that minimize harmful side effects or ensure more successful outcomes. PM can also indicate an individual’s susceptibility to certain diseases before they become manifest, allowing physicians and patients to design a plan for monitoring and prevention. Physicians can now go beyond the one-size-fits-all model of prescribing to make more effective clinical decisions for each patient.

PM offers a structural model for efficient health care; it is preventive, coordinated, and proven. PM works best with a network of electronic health records that link clinical and molecular information to make it easier to help patients and their physicians make appropriate treatment decisions. PM is participatory, engaging patients in lifestyle choices and active health maintenance to compensate for genetic susceptibilities.

Substantial progress has been made toward implementing PM. When all of the pieces of infrastructure fall into place; when we begin to classify and treat diseases not only by their most obvious signs and symptoms but also by their molecular profiles; when physicians combine their knowledge and judgment with a network of linked databases that help them interpret and act upon a patients’ genomic information; when insurance companies pay for tests and treatments that anticipate the needs of the patient as well as react to them; and when regulators insist on using all information available to the physician, including genetic tests, to ensure the safety and efficacy of an approved drug—then PM will be known, simply, as “medicine.”

III. PERSONALIZED MEDICINE APPROACH USING COGNITIVE COMPUTING

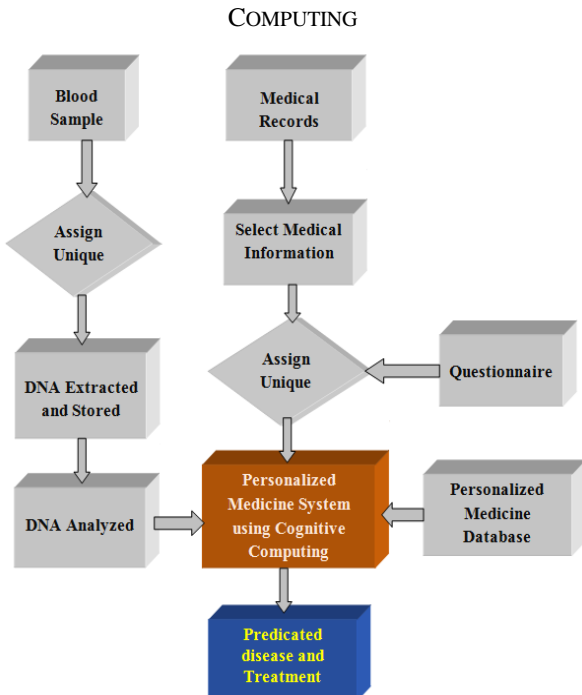


Fig. 3. Data flow diagram for personalized medicine approach using cognitive computing.

Cognitive Computing (CC) is the model of individual assessment methods in an electronic design. It includes

self-learning methods that use Natural Language Processing (NLP), data mining and pattern recognition to simulate the process the personal mind acts. The purpose of this approach is to build automated IT operations that are able of doing obstacles externally needing person support. These systems utilize computer training algorithms. Before-mentioned systems constantly get information from the data supplied by them by opening information for knowledge. The methods improve the process people watch for models and as well as the means both means information, so people become capable of anticipating new problems and modeling possible answers. The computing is done in various Artificial Intelligence (AI) uses, including able methods, NLP, virtual reality, neural networks, robotics and robotics. The word cognitive computing is intimately connected with IBM’s cognitive computer system, Watson. As shown in Fig. 3, the data flow diagram to predict disease using cognitive computing. This system collects the all the personal health data and analyzes the information using cognitive computing using personalized data base.

IV. PERSONALIZED MEDICINE IMPACT ON NATIONALLY AND INTERNATIONALLY

In India, Personalized medicine is a young but quickly developing area of healthcare that is notified by person’s different medical, transmitted, genomic, and environmental data. The article declares that incurable illnesses are the head case of being in India as people consider for 16% of all deaths yearly shooting longer than 5 million personalities each year. Those conditions it includes several diseases in the model of diabetes, box, cardiovascular disorders, cerebral form disease, cancers, and chronic lung illnesses will cost India throughout two hundred eighty trillion from 2012 to 2030 in words of industrial producing. The story was written through the ship of a global partnership for the City of Government of Chronic Environment between the All India Institute of Medical Sciences, Emory University, the London School of Hygiene & Tropical Medicine, and the PHF [17]. The largest investor in personalized medicine now is the UK (approximately 200 million pounds). To improve research in the field, UK is stretching out to researchers in India as well. As part of a committee of British Prime Minister Theresa May, delegates from attending universities and medical organizations in the UK came down to Chennai, India for a ‘first ever workshop’ on personalized medicine.

We face a difficult time within the NHS. Demand continues to rise, putting our services and our workers below large pressure. Despite this, the NHS continues to confirm that the immeasurable people that use health services each day receive glorious care. however it's clear, once funding is thus tight, that the pressures on the NHS can't be alleviated by continued with business as was common. within the NHS 5 Year Forward read, the NHS leadership started a compelling vision for the long run. A vision for the way the NHS will shut the finance and potency, care and quality and health and prosperity gaps by turning into a system abreast of and formed by analysis and innovation, targeted on hindrance and earlier detection of malady, and ready to deliver enhancements in

outcomes through new models of care. Personal medication with science and innovation at its core is integral to creating the vision a reality. The potential edges of personal medication area unit important, and therefore the changes area unit inevitable, however we tend to should rise to the challenge in a very thought of and proactive manner. We are going to get to plant consistently the approach into thought care while making certain the moral, equality and economic implications area unit absolutely recognized and self-addressed. We tend to should make sure that patients and therefore the public area unit assured within the use of those technologies which we will mitigate any potential issues, notably within the space of knowledge security and confidentiality. The approach the NHS takes to authorization personal medication can get to align with activity across the health and care system to confirm it's delivered in a reasonable manner. We are going to get to make sure that the system develops acceptable education and coaching, effective digital and information processing, with deepening patient involvement and authorisation. The potential is important, and there area unit real and tangible developments that may come about over the approaching decade. Technological developments across unfold of area unitas are coming back along to produce the mandatory ingredients to spread a personal medication approach across care. Genomic technologies area unit Associate in Nursing progressively giant a part of the evolution of contemporary medication and our understanding of genomic implications is growing. The speed and repertoire of medicine a lot of typically is increasing. And information processing advances area unit creating discoveries and connections at a colossal pace. This can be the dawn of a brand new era in medication that may get to move and evolve at the dimensions and pace of scientific and technological advances if real enhancements for patients and therefore the public area unit attending to be created. Figure four sets out the changes we would see within the coming back decade. Clinical recommendation and leadership is significant. We've been operating with the Academy of Medical Sciences to develop ideal clinical pathways in key priority areas, like polygenic disease and disorder, wherever there's a true chance to enhance outcomes for patients and our population. We are going to still work with the Academy additionally like the Academy of Medical Royal schools, its constituent schools and different skilled teams, to create the proof base Associate in Nursing.

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In rest of India, as per the World Health Organization (WHO), non-communicable conditions or prolonged illnesses like cancer, diabetes heart sicknesses, respiratory illnesses and diabetes, kill thirty-eight million people annually [18]. In spring 2015, President Obama stated a study work concentrating on producing personalized medicine to various features of health care. The Presidents statement for the financial year 2016 included \$216 million dollars in funding for the force for the investigation in the field of personalized medicine to NIH.

V. CONCLUSION

In this review, we presented personalized approach using cognitive computing survey and current progressed. We contributed a case study to explain how traditional medicine is different from personalized medicine. The Data flow diagram for Personalized Medicine Approach using

Cognitive Computing explains how personalized medicine predicts the disease based on various parameters. Finally, we also discussed research issues and impact of personalized in India as well rest of the foreign countries.

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