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Prediction of Diagnostic Codes of Chronic Condition for Preventive Care

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Abstract

The advent of big data technology and Machine Learning, in clinical and healthcare sectors, it has become possible for detailed analysis of healthcare records to achieve early detection of chronic illness and making it possible for member patients to take preventive care. Nonetheless, the investigation exactness is decreased when the nature of clinical information is inadequate. Also, various regions show novel attributes of certain provincial sicknesses, which may debilitate the prediction of the outbreak of the diseases. The purpose of this work is to predict whether the member patient is suffering from chronic ailment or not using the medi-claim data. The medi-claim data is considered for the study because of its validity, authenticity and volume. The claim data of the member patient also provides history of ailments that the patient had suffered from. The claim data is pre-processed and transformed into Term Document Matrix (TDM) document. Five chronic disease such as heart disease, liver disease, kidney disease, cancer disease and diabetes disease are studied in this work. The experiment is conducted on TDM data and subspace data using individual prediction technique and ensemble approaches. Mean square error (MSE) is used for prediction model evaluation. Random forest regression technique produced promising result with average MSE of 0.06 after the outliers in TDM data were filtered. From this model it possible to draw significant clinical implications for preventive care of chronicle diseases.


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Classification of Diagnostic Codes of Chronic Condition and Performance Evaluation of Various Approaches

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Abstract: Health in simple words is normal functioning of human body and disease is abnormal condition that affects normal functioning of human body without any external injury. Health care is all about the prevention of diseases by diagnosis and treatment. The majority of the population across world suffers from chronic disease which is a long term disease leading to multiple ailments if not taken care and chronic diseases cannot be prevented by vaccines or cured by medication, nor do they just disappear. Efforts are needed to build an efficient system which can predict, classify diseases and detect anomalies from health records. Electronic medical records are not better than the old manual records. This paper focuses on Medi-Claim data as it stand out uniquely due to its authenticity, volume and demography attributes. Importantly HCC and ICD based coding are compatible with claim data set. This nature of ICD and HCC coding encouraged us to work with Medi-claim data set and HCC coding to build a Machine Learning model for preventive care of chronic diseases. The correlation between diabetes chronic disease and other chronic diseases is established through HCC codes using Machine Learning approaches. Effective inferences are drawn from the perspective of clinical relevance.

Index Terms: HCC, Chronic Condition, diabetes, Ensemble.

I. INTRODUCTION

'Health is wealth' is an old adage gaining significance than ever before in today's world. Though many epidemics have been eliminated from the society with medical inventions chronic ailments like Diabetes are threatening the well being of human race. Preventive measures for patients suffering from ailments using existing clinical tests and through available limited data records with practitioners have proven to be less efficient [1].

Different methods have been used in healthcare to classify and identify diseases. Risk Adjustment Factor- RAF is a parameter used in healthcare to assess the probable cost incurred by an individual towards the treatment of a disease. Individuals with family history of a particular ailment and old people are given High value of RAF and youngsters and individuals with no family history are assigned a smaller value. Similarly another parameter employed is interaction score. It is a score that predicts a person with X ailment has

the risk of getting affected by Y disease. Original Reason for Entitlement Code (OREC) score has limited scope as it tries to identify health issues occurring among only old age people. Co morbidity is a condition where two pathological conditions occur simultaneously in a patient. Moving further World Health Organization has adopted a coding system called International Classification of Diseases (ICD) [2][3] and Hierarchical Condition Categories (HCC). The code assigned in ICD is a 10 Digit number and each code is assigned to 70000 different diseases. The ICD code provides information pertaining to symptoms, patient complaints, reasons for injury and mental disorders. Also the ICD code can be entered into electronic health record of patient for further diagnosing, billing and reporting purposes. Further HCC helps in codifying 79 chronic diseases. HCC coding is mapped with ICD to fetch the ICD's associated with hierarchical chronic diseases. HCC can be used to correlate the chronic diseases which are suspected to be consecutive in nature and thus helps in preventive care of diseases. HCC also predicts the costs incurred in treating different category of patients like inpatient, outpatient and patients in office settings [2][3][4]. Usually the health professionals rely upon different kinds of data sets to detect ailments in a patient. Prominent among them are Hospital Records, Diabetic History [4][5], Electronic Medical Record, Medi-claim data, Heart health record, Hospital Service appointments, National Health Nutrition records etc. Many times these electronic medical records act as mere replacements of old paper charts and are less reliable. Amongst afore mentioned medical records that we analyzed Medi-Claim data stand out uniquely due to its authenticity, volume and demography attributes. Importantly HCC and ICD based coding are compatible with claim data set. This nature of ICD and HCC coding encouraged us to work with Medi-claim data set and HCC coding to build a Machine Learning model for preventive care of chronic diseases [6]. In healthcare the best machine learning (ML) [6][7] tool is the Doctor's Brain. But here the main limitation is the incapability of a single human brain to learn, store and analyze data of demographically dispersed and huge volume of data. So, Machine learning models with the ability to determine a set of rules using vast amounts of compute power which a human brain is incapable of processing. Hence there is need to analyze and design an efficient system which can classify diseases and detect anomalies from electronic health records.

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An Overview on Disease Prediction for Preventive Care of Health Deterioration

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Abstract: Machine learning in health care has recently made headlines. With the wide spread increase of population, the need for reliable mechanism to prevent diseases has increased in manifold. In the recent days there is an increase in health problems in majority of the population across the globe. The reason for health problems is not specific but it has become very uncertain. If we take a sample from the population, it should not be a surprise to see a person suffering from ailments irrespective of age and quality of life. For example chronic diseases are found in people at a very young age. So this situation poses a serious challenge for clinical experts to find the root cause. It is difficult to accurately predict the future health based on the current health status because the scenario might not be same for all the patients. Providing an affordable, high quality health care service has become a big challenge. In this regard, preventive care of diseases is investigated for decades. It is an area of regular extension of research works and progression day by day and there is sufficient literature available on prediction of diseases. Our work includes a disciplined study to consolidate existing works on prediction and classification of diseases. This paper will provide technical insight and paves way for future developments in the health care field.

Index Terms: Machine Learning, Health, Entropy, Disease Prediction, Diabetes, features, metrics, ICD, HCC.

I. INTRODUCTION

Preventive care of Health Deterioration (PCHD) is a concept to build intelligent application to meet the societal needs. It uses health care data from different sources and predictive human behavior is used for dispensing information that improves the quality of health. Health is said to be the biggest wealth one can have. In the view of biomedical perspective health can be defined as the ability of the human body to function normally [1]. Health can be disrupted by diseases from time to time. The functioning of the human body would become abnormal for various reasons such life style, food habits, poor immunity, smoking, narcotics, alcoholic habits and sometimes by hereditary. Health may also set off due to side effects of long term medication and one disorder may lead many other disorders if not taken care.

An abnormal condition that affects the normal functioning of the human body is called a disease and it should not be due to an external injury. Diseases are learnt by

their symptoms, which may be caused due to dysfunction. In humans diseases refer to conditions such as pain, dysfunction, distress, social problems or any similar problems. Diseases may also sometimes include syndromes, deviant behaviors, injuries, disorders, disabilities, infections and variations of function and structure. Diseases not only affect people physically, but also emotionally, as living with a disease can affect the person's perspective on life [2][3][4].

The disease can be categorized into acquired disease, acute disease, chronic disease, congenital disease, genetic disease, hereditary or inherited disease. The majority of the population suffers from chronic disease which is a long term diseases which leads multiple ailments if not taken care. Chronic diseases [4] are diseases which cannot be cured but controlled by vaccines and medication. Diseases usually develop slowly because of behaviors that spoil health. Chronic diseases [4] can be characterized based on factors such as stress, vague beginnings, prolonged affliction and long latency [4] later which leads to impairments. Diseases include both physical and mental disorders which are most common and costly health problems faced by the world. Many chronic diseases are not curable but controllable [3][4].

Chronic diseases are rapidly increasing across the world accounting 45.9% of global burden of disease and are challenging the effectiveness and efficiency of health-care systems without engendering and sparing serious economic and social consequences [4][5]. Chronic diseases are preventable. There is a need to develop intelligent health care system to target health and wellness. This process should include framing of health policies whenever appropriate and that make healthy choices the easy choice [4][6].

Efforts are needed to build sustainable Preventive Care of Diseases systems (PCD) to solve the problems created by the growing prevalence of health conditions. Decision support systems need knowledge about the type of health problems [7][8][9], the way the services are allocated to resolve these challenges. An interface is needed to access the electronic medical information systems to access the reliable medical information while improving communication with patients by follow-up reminders. The member patients should be provided with access to information about their health to help themselves to take care [4][10].

The technological advancements in electronic medical records have made easy to get information much better than the old paper charts. The advent of technology has improved the power of analytics and machine learning [11]. Machine learning methods develop a model knowing the input and output of the domain and it uses the large amount of computing power which a human brain cannot do. More the domain data fed to

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