

Application of Recommendation Systems for Automatic Physician Recommendations

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Abstract

This Paper presents systematic literature review on novel framework regards automatic medical specialist recommendation using various data mining methods. Paper investigated the well-known recommendation method like content base, demographic filtering, & collaborative filtering to address the problem of medical specialist recommendations. The previous studies show the problem of personalized recommendation through analyzing the patient's showing towards choosing appropriate doctor. The adoptive method to build the doctor's ranking function designed in this work. Whatever, that ranking architecture has been utilized for translate criteria of patients' regards choosing doctor under rating of numerical base, & it's purposely utilised for recommendation of doctors. Literature presented through using the recent studies & comparative analysis of existing methods.

Keywords-: Recommendation system, Automatic Physician, medical, Patient's, Artificial Intelligence

1. Introduction

In the field of clinical & wellbeing informatics, key opinion leaders (KOLs) are the specialists who can impact general opinion & lead the clinical local area through their exploration papers & facility rehearses. These KOLs assume significant parts in the medical services industry at each phase of their item life cycle. Subsequently, there is a basic requirement for canny KOL distinguishing proof administrations. Customarily, counseling organizations offered types of assistance for recognizing KOLs through leading client studies. These business arrangements utilize just a set number of data assets & spotlight on few included customers. Advances in informatics innovations have empowered us to gather a lot of clinical related information [1], which thusly gives another transporter to KOL ID. To this end, we led an enormous scope quantitative examination of multisource clinical related information & built up a recommender framework for viably recognizing KOLs of some random sort of illness through utilizing such information.

KOL recognizable proof is likewise critical to patients, since KOLs can impact which specialists patients need to approach. A few sites give data on applicable specialists to patients, like Yelp & Zodiac. Cry gives client surveys of specialists, yet the nature of the audits isn't ensured. Zodiac works fundamentally as a front end for dealing with a specialist's training. The data utilized in the two sites about specialists is moderately straightforward & not dependable.

Through & through, one approach to distinguish dependable KOLs is through references—at the end of the day, the occasions a specialist is eluded through another specialist. This can be treated as one kind of friendly trust for specialists. In our strategy, we abused co initiation connections & reference connections to copy such

references. This cycle can be seen as building specialist focused organizations from co authorships & references, which has been infrequently considered (in spite of the fact that there has been research on a patient-focused organization [2]). Then again, in spite of the fact that we can't perceive great specialists exclusively through tallying their distributions & every one of their references [3], specialists whose papers are exceptionally referred to or who have distributed numerous papers in high-sway diaries can advance their thoughts & opinions to others all the more effectively [4]. This is the very rationale as that behind the Page Rank calculation for the Google web index, which has additionally been utilized in the investigation of informal community impact. In wellbeing informatics, KOL recognizable proof ought to encode evenhanded & approved estimations of KOL exercises, including scholarly distributions, welcomed talks, nature of clinical exploration, patient assessments, & media openings. These exercises ought to likewise be utilized as positioning highlights to distinguish KOLs.

The point of this investigation was to build up a recommender framework for recognizing KOLs for a particular infection. Here we present the plan, execution, & sending subtleties of such a KOL ID framework. Our framework comprises of 5 parts: procurement, mix, stockpiling & access, demonstrating, & proposal. The framework is extensible & configurable, & has been conveyed online for a while. In the suggestion segment, we picked the profile of specialists, the skill of specialists, & the social trust of specialists as the positioning highlights. The positioning capacity intended for KOL ID was developed dependent on those highlights. We further built up a solo positioning collection approach for KOL positioning. In a genuine arrangement of our framework, we additionally consolidated some outer information & improved the settings of our framework physically as indicated through the suggestions of our activity group.

The improvement of data innovation has advanced a wide scope of electronic applications, for example, internet business, web based booking of carrier & inn, just as online administrations in medical services industry. For instance, models & investigations the electronic visits in essential consideration, & [3] study online arrangement frameworks. Notable electronic or portable based medical services applications incorporate Zodiac, Quest Diagnostics, just as We Doctor & Hao DF in China, & these frameworks are social occasions of countless assets, i.e., doctors, from various emergency clinics of various regions. As indicated through certain perceptions in industry, patients can't track down the most reasonable doctors for their disease condition in light of their absence of suitable clinical information. The assessments give a model to general experts to decide an award for coordinating with doctor with patients through proposals, & among the suggestions, the patient will pick one for the clinical benefit ultimately [4].

The fundamental objective of doctor proposal application is to stay away from patients' visual deficiency in looking for & choosing doctors, with the goal that the assets are viably used to satisfy the interest. As of now, the suggestions are primarily cultivated through broad professionals who assume parts of emergency in a healthcare framework. In view of their free encounters, general professionals examine the ailment depictions transferred through patients themselves & convey doctor suggestion dependent on the assessment on the coordinating with level between doctor ability & patient ailment. Notwithstanding, along tide of artificial intelligence (AI), it turns into a well known subject to achieve redundant & monstrous manual work through most recent innovations, explicitly AI calculations, since AI procedures can lessen costs as well as it could keep away from yield inconsistency brought about through lopsided encounters among faculty staffs. Healthcare is quite possibly the main application enterprises of such methods, & the mix of huge healthcare information & learning calculations is relied upon to have an effect in assistant indicative & dynamic in healthcare administrations. As on account of an arrangement framework, there is a likely chance to play out the suggestion administrations through learning calculations naturally [5].

The prizes incorporate the potential health improvement of patients, administrations costs, etc. For the most part, under the decision model, too couple of doctors remembered for the collection lead to a "no-arrangement" decision with an enormous likelihood, i.e., patients leave without picking any doctors, while such a large number of doctors bring down the opportunity patients pick the most fitting doctors [6]. We likewise expect that the patient inclinations, which demonstrate how patients respond to doctor highlights, like medical clinic areas, proficient titles, & remarks from different patients, are exogenous yet obscure [7].

In certain conditions, patient inclinations may repudiate to the coordinating between doctor mastery & patient ailment. For instance, a patient may introduce solid inclination toward senior subject matter experts, albeit a lesser doctor has adequate abilities to treat the patient well. Consequently, patient inclinations are critical to oversee doctor patient coordinating in arrangement application [8].

As referenced before, we expect that patient inclinations are obscure, which contribution to the furthest reaches of recorded information on how patients respond to doctor highlights. Despite the fact that, in certain situations, the accessible verifiable information is introduced, the test actually exists. Note that patient inclinations are gained from their reactions to the framework tasks, i.e., doctor suggestions, & past activities may have just investigated a subset of all potential tasks dependent on the approaches received, so the authentic information can't completely uncover patient inclinations. Thus, a learning calculation is needed to perceive patient inclinations in doctor suggestions [9].

The calculation gathers patient inputs to proposals & learns inclinations (investigation) from one perspective, & utilizes the current learned inclination to convey suggestions (abuse) then again. Ordinarily, abusing the current data to acquire moment rewards shows conveying the doctors previously been investigated, which prompts a contention of investigating adequate doctors to learn patient inclinations against misusing the current data to convey an imperfect proposal. Through & large, the more endeavors spent in investigation, the less in abuse. In this way, the harmony among investigation & misuse is essential to the goal amplification. We consolidate an inclination update stretch as adaptability in changing investigation & misuse endeavors into the calculation, which could give an enhancement model on the investigation abuse balance as indicated through our mathematical outcomes. Expanding health data needs & changes in data looking for conduct can be seen round the globe. As per late investigations 81% of U.S. grown-ups utilize the Internet & 59% say they have looked online for health data in regards to illnesses, analyze & various medicines.

Such impacts impact the patient-doctor relationship as taught patients bring up issues or examine treatment alternatives. Along these lines, patients will in general become dynamic members in the dynamic cycle. This adjustment of the perspective is regularly alluded to as tolerant strengthening.

Be that as it may, data over-burden & unessential data are significant impediments for making inferences on the personal health status & making satisfactory moves. Confronted with a lot of clinical data on various channels (e.g., news destinations, web gatherings, & so forth) clients frequently get lost or feel unsure when examining all alone. Furthermore, a complex & heterogeneous clinical jargon represents another boundary for laymen [9]. Hence, improved personalized conveyance of clinical substance can uphold clients in discovering applicable data [10–11].

Clinical data accessible for patient-situated dynamic has expanded radically however is frequently dissipated across various locales. As arrangement, personal health record systems (PHRS) are intended to unify a person's health information & to permit access for the proprietor just as for approved health experts. Recommender systems (RS) propose things important to clients of data systems or e-business systems & have developed in ongoing many years. A common & notable model is Amazon's recommend administration for items. We accept the thought behind recommender systems can be adjusted to adapt to the unique

prerequisites of the health space. Paper organized as in section 2 Literature review has been described, in section 3 comparative analyses described, Section 3 talk about research gap, & finally conclusion described in section 5.

2. Literature review

This section deals with the general view of the Application of Recommendation Systems for Automatic Physician Recommendations. This section presents the interests & contribution of the researchers in the recent developments.

In [1] author learned about the solid inward sensations of specialists on selection regards electronic health records under essential healthcare. A few issues distinguished during starting stages like uneasiness, dithering, disarray, worry & use of PC. The investigation is fruitful in perceiving the recipients of innovation appropriation. The future investigation can be done on the prerequisites of specialists & staff.

In [2] author analyzed the clinical staff insight on the reception of innovation for healthcare administrations. Experts appear to fear innovation because of a suspicion that innovation will supplant them, so opposed the innovation. With regards to nurses" dominant part of them altogether showed interest on innovation selection. Te prior investigates on innovation reception to healthcare tracked down that the expectation & genuine utilization of innovation is intentional.

In [3] author attempted to distinguish the purposes behind opposing the selection of innovation in healthcare from nurses" point of view. It was recognized that the attendants are feeling that through receiving innovation their responsibility & responsibility will increment just as male medical caretakers are altogether opposing than female. Another perception was the medical attendants are inadequate in required expertise, experience & backing. The investigation was confined to just to the medical attendants of private emergency clinic & the example is additionally low thus, it should be tried with enormous example size.

In [4] author uncovered that It was additionally accentuated fundamentally that the determination section, recommending meds, customary caution/alarms in regards to medications & drugs & legitimate dose observing should be possible effectively. The whole world is stressed over giving quality healthcare openness, it tends to be accomplished with less specialists or accessible specialists for less expense, however it tends to be effectively received when there is a help from the others, associations & government strategies.

In [5] author learned about how health care administrations embrace portable innovation to help their work. Strategies used to do this are through directing overview to gather information. This was planned with a two section survey. The initial segment utilizes ordinary inquiries & the subsequent part utilizes typical seven point scaling. Consequences of this joining of points of view to propose an exploration model for investigating the appropriation of versatile health care. Future examination can be overhauled with contextual investigations to longitudinally notice the handiness of this exploration. This can be expanded dependent on the particular highlights for profoundly investigating expectation to utilize versatile innovation.

In [6] author concentrated The EMR"s contain data like perceptions, lab tests, & symptomatic imaging reports, medicines, treatments, drugs directed, patient distinguishing data, legitimate authorizations, & sensitivities. At present, this data is put away in different exclusive arrangements through a multitude of clinical data systems accessible available. This framework is along these lines interoperable. Moving patient data consequently between care destinations will speed conveyance & decrease copy testing & recommending. Programmed updates will lessen mistakes, enhance profitability, & advantage patient consideration.

In [7] the author learned about the appropriation of electronic health records in the required idea rehearsal. The observation was directed at patients who grew up alone.

In [8] author concentrated about distinguishing attendants inclinations for electronic documentation of clinical information & to discover alterations to the electronic health records framework. The strategies used to do are through leading study in around 23 clinics. The finish of it gives data about obstacles, necessities & inclinations of nursing staff & attendant's mentality was discovered to be certain about improving clinical documentation. Future investigates ought to enhance the electronic health records framework give fundamental prerequisites to nursing care documentation.

In [9] the author has prescribed to enhance their relational abilities & the use of electronic medical records should be polished through the attendants & the hazards of the results must be investigated & the medical attendant studies should be taught in order to obtain information about the medical attendants was directed to - an electronic approach to health records. The investigation was carried out in 165 clinic results showing that a SHE applies proposals for clinical selection & support inside the association & future examinations should be on time movement studies.

In [10] author concentrated about deciding the perspectives & view of vital consideration medical attendants to utilize telemedicine around there. The strategies used to do this are through sending poll through email & through straightforwardly meeting the medical caretakers in 3 clinics. The aftereffect of this is medical attendants felt unequivocally that telemedicine staff ought to present themselves when essentially going into room.

In [11] author learned about looking at information & view of telemedicine innovation among various gatherings of specialists. Strategies used to do this are through directing review among 532 specialists & three facilities. Results uncovered through the majority of the specialists have little information on telemedicine innovation & they utilized it Up somewhat. Future examination must be accomplished for a bigger populace to enhance results about what is the specialist's discernment towards telemedicine innovation.

In [12] author depicted Primary consideration, the foundation of the country's healthcare framework, is at the danger of breakdown. Patients are disappointed because of helpless admittance to mind, & doctors are despondent & wearing out with a huge measure of undertakings.

In [13] author Motivated through the expanding utilization of online arrangement booking stages, we concentrate how to offer arrangement openings to clients to augment the all out number of spaces booked. We create two models, non-consecutive contribution & successive contribution, to catch various kinds of communications among clients & the planning framework. In these two models, the scheduler offers either a solitary arrangement of arrangement spaces for the showing up client to browse, or multiple sets in succession, separately.

In [14] author depicted A contextual investigation dependent on the genuine information is done to approve & carry out the proposed strategy. The aftereffects of the contextual analysis show the suggested Pareto ideal patient stream dispersion can enhance the in general various leveled framework exhibitions & our philosophy are qualified as a quantitative choice instrument for leaders.

In [15] author depicted patient inclinations & decision conduct in planning clinical arrangements. We lead four discrete decision investigates two particular populaces & recognize a few "operational" ascribes (e.g., postponement to mind & decision of specialist) that influence patient decision. We notice an intriguing sex impact as for how patients compromise speed (postponement to mind) & quality (specialist of decision), & exhibit that hazard perspectives intercede the effect of sexual orientation on the view of speed & quality.

In [16] author depicted an online grouping streamlining issue, where in each round, the retailer offers a K-cardinality subset (arrangement) of N substitutable items to a buyer, & notices the reaction. Author model shopper decision conduct utilizing the generally utilized multinomial log it (MNL) model, & consider there tailor's concern of powerfully learning the model boundaries, while enhancing aggregate incomes over the selling skyline T.

In [17] author portrayed utilized information from the EHR on all sets of prescription, lab, imaging & blood item things at a scholastic emergency clinic & a thing set mining way to deal with separate requests that every now & again co-happened with request set use. Author distinguished the accompanying four markers: rare requesting of request set things, fast withdrawal of medicine orders from request sets, extra individually requesting of things excluded from request sets & individually requesting of things regardless of being recorded in the request set.

In [18] author depict Informal audit of the clinical writing with iterative survey & conversation among the authors to show up at six tomahawks (information, information, deduction, engineering & innovation, execution & reconciliation, & clients) to outline the audit & conversation of chose boundaries & facilitators to the viable utilization of CDS.

In [19] the author evaluated the initial 24 hours of organized electronic health record information for > 10 K inpatients. Drawing a relation between organized things (eg, clinical order) for words in a material collection, the authors demonstrated the passive Dirichlet distribution probabilistic subject. These subject models use clinical commands to initiate clinical data for a different approval set of > 4K patients. The authors evaluate these theme model-based forecasts, which are the current human-author requests set through the collector's trademarks, turns, accuracy, & area under review for currently working trademark orders.

In [20] the author indicated that EMR information was separated through 1 year of hospitalization (with 1 patient.5 patients > 5.6M arranging things including clinical orders, laboratory results, & analysis codes were). The association measure meant .1.5K requests the most basic things to recommend. The authors evaluated the emergency clinic's confirmation orders & recommended ability to anticipate outcomes, relying on introductory experience information from individual approval patients.

3. Comparative analysis

Ref. No	Year	Author name	methodology	Parameter
21	2018	Chen, J. H., et. Al.	The patient's electronic health record was extracted from tertiary scholarly emergency clinics during 2010–2013. Physicians were divided into (n = 1,822) low-mortality (21.8%, n = 397) & high-mortality (6.0%, n = 110) using two-way P-Esteem	$S_j = -\log P_{ji}$ f observed rate, expected rate,

			<p>scores. Observed whose deviation vs. evaluation was 30-day expected patient mortality The three patient associates were gathered: low-death physicians, high-mortality physicians, & patients seen through an unfiltered gang, all equal (n = 1,046, 1,046 & 5,230 post-tilt score concordance, respectively).</p>	
22	2020	Chiang J, et. Al.	<p>Clinical choice help instruments that naturally spread examples of clinical orders can possibly enhance patient consideration through lessening blunders of exclusion & smoothing out doctor work processes.</p>	CPOE, CSF, AK, JH, LH, & JHC
23	2018	King, A. J., et. Al.	<p>This paper proposes Sufficient information we recalled to prepare prescient models for 80different targets Author arrangement to apply these models to another arrangement of</p>	electronic medical record (EMR), AKF

			patient cases & adjust the LEMR interface to feature pertinent patient information, & consequently give compact, setting touchy information.	
24	2017	Emani, S., et. al.	Online study of doctors at two scholarly clinical focuses (AMCs) in the upper east who were partaking in the significant utilization of the EHR motivating force program & were utilizing an inside created EHR was led.	electronic health record (EHR), academic medical centres (AMCs), MRI, MU, PCP
25	2016	Brown, K. E., et. Al.	This investigation was performed when execution of an automated request set for patients hospitalized for COPD intensifications.	COPD exacerbation, EHR, FFV1,

4. Research Gap

Patient focused methodology is essential in the appropriate clinical benefits that could be delivered through a medical clinic or an individual specialist. Remembering the different boundaries for a patient-focused way to deal with clinical consideration giving, the researcher has attempted to get to data on the various regions & classes of patients where a patient-focused methodology could be carried out. There is a causative of data particularly with respect to the administrative principles that could be executed under a patient focused methodology especially here under India. This huge space of clinical benefit has not been experimentally analyzed nor have the information been indexed. Being an understudy of the executives, explicitly presented to emergency clinic the board & health sciences, the analyst has felt a pressing need to investigate the expressways of the subject as well as the through paths & valleys of the administrative parts of a patient-focused way to deal with healthcare & unified administrations. There is need for study that would mirror the social, social & monetary foundation of this country. This created model would address a mix of the multitude

of four models to be specific paternalistic, instructive, interpretive & deliberative kinds of the western world. A patient focused methodology is indispensable in the legitimate clinical benefits that could be delivered through an emergency clinic or an individual specialist. The Internet of Things (IoT) [26-29] based web services also receiving the significant attentions for intelligent applications.

This investigation mostly centers around the consideration got through the patients & the view of healthcare experts from chose tertiary emergency clinic on the significant patient-focused perspectives like regard for patient's qualities & requirements, coordination & incorporation of care, patient data, correspondence & training, actual solace & passionate help.

The fundamental point of the investigation is to survey & think about the impression of patient & healthcare experts towards the superb parts of patient-focused consideration like Respect for patient's qualities & necessities, Coordination & Integration of care, Involvement of loved ones, Information, Communication & Education given to patients, Physical solace & Emotional help at tertiary health care focuses.

Calculations exist to compromise good fortune & inclusion for improved precision, for example through suggesting things with more information. Furthermore, since every one of the three of these actions are essential to clients in numerous applications, planning calculations in such a style might be sufficient, yet less helpful in clinical situations. Here a Dill approach could likewise be useful through coordinating the specialist in the calculation. Decisions that are intrinsically human (for example what is fascinating?) can be coordinated in the suggestion interaction, however we will require more exhaustive proportions of value consolidating exactness, luck & inclusion, to permit calculation planner to enhance compromises acclimated to clinical situations in Dill settings.

Another vital examination issue is trust in recommender systems. This is especially valid for health recommender systems, as they will be utilized to give end clients more proactive & personalized data pertinent to their health. Yet, there are as yet many open examination questions thinking about trust, security & closeness in the utilization of clinical innovation. Client variety assumes a part, with an accentuation on sex & age.

This is significant with respect to client fulfillment. Some examination proposes looking further into displaying client fulfillment, with the point of prescient fulfillment models. On account of health recommender systems, this expectation is exceptional, as there are diverse important client gatherings. Contrasts in ability, outline information, yet additionally errands should be perceived to make recommender systems appropriate to health professionals, clinical specialists, biomedical scientists, parental figures & patients, the same.

As the result of health proposals are intrinsically dubious, correspondence of this vulnerability is exceptionally significant. Discovering approaches to picture vulnerability in a bunch of proposals is significant to permit the client to assess the choice enough. This issue is connected to the danger & span of the result of a decision. Picking a terrible film may cost you an hour & a half of your life; picking an awful treatment could lessen personal satisfaction for a long time. This progressions how run of the mill assessment standards (for example k-top proposals accuracy) are judged. One terrible choice in the initial not many proposals could have exceptional results. The creator of health recommender systems should be cautious & act dependably in both producing proposals & imparting them.

5. Conclusion

Web-based arrangement systems are arising under healthcare industry giving patients advantageous & diversiform administrations, among which doctor suggestion is turning out to be increasingly more

mainstream apparatus to make tasks of doctors to patients. Propelled through a famous doctor proposal application on a web-based arrangement framework under China, this paper gives a pioneer work under displaying & tackling the doctor suggestion issue. The application conveys personalized suggestions of doctor groupings to patients with heterogeneous ailment conditions, & afterward, patients would choose one doctor for arrangement as per their inclinations. Catching patient inclinations is fundamental for doctor suggestion conveyance; nonetheless, it is likewise difficult because of the absence of information on patient inclinations. Under this paper, we detail the doctor suggestion issue dependent on which the inclination learning calculation is recommended that advances the proposals & learns patient inclinations simultaneously. Since the ailment states of patients are heterogeneous, the calculation means to make personalized suggestion for every patient.

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