



DIAGNOSIS OF LIVER DISEASE BY DEEP LEARNING AND MACHINE LEARNING TECHNOLOGY

DR PAWAN, ASSOCIATE DEAN – BBA, HIERANK BUSINESS SCHOOL

ABHA SRIVASTAVA, ASSISTANT PROFESSOR, HIERANK BUSINESS SCHOOL

**DR NEETIKA, ASSOCIATE PROFESSOR, INSTITUTE OF MANAGEMENT STUDIES
GHAZIABAD UNIVERSITY COURSES CAMPUS**

**DR JITIN GAMBHIR, ASSOCIATE PROFESSOR, SCHOOL OF MANAGEMENT & COMMERCE,
KR MANGALAM UNIVERSITY**

DR PRAGATI SAXENA, PRINCIPAL-UG, HIERANK BUSINESS SCHOOL

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ABSTRACT

The liver is the biggest organ in the human body. It is answerable for all metabolic capabilities inside the body from the change of supplements inside the eating routine into usable body substances to putting away these substances and afterward providing them to the cells when required. It is additionally answerable for the change of poisonous substances into innocuous substances. Other indispensable elements of the liver incorporate bile creation, protein creation, putting away and delivering glucose, handling hemoglobin, blood cleaning, resistant factor creation, clearing bilirubin, and so on. In this way, it is the essential and most vital body organ, and the upkeep of its wellbeing is fundamental for worked on by and large wellbeing. Yet, the truth of the matter is that individuals for the most part ignore it on account of wellbeing. Because of undesirable way of life schedules, the vast majority of the populace across the globe.

Globe are experiencing intense to serious liver issues.

Liver illnesses include:

- Viral diseases, e.g., hepatitis A, hepatitis B, and hepatitis C,
- Safe framework issues, e.g., immune system hepatitis, essential biliary cholangitis, essential sclerosing cholangitis,

- Illnesses caused because of medications, toxic substances, or high liquor utilization, e.g., greasy liver sickness, non-alcoholic greasy liver infection (NAFLD), non-alcoholic steatohepatitis (NASH) and, cirrhosis .
- Acquired sicknesses, e.g., hemochromatosis, hyperoxaluria, alpha-1 antitrypsin inadequacy, and
- Malignant growth and growth, e.g., Liver Disease, bile pipe disease, and liver cell adenoma.

The counteraction of liver disappointment is conceivable by diagnosing and treating liver illnesses at a beginning phase.

There are four phases of liver sickness, among which the main stage is set apart by aggravation, which might show any side effects in patients. Delayed aggravation replaces the sound liver tissue with the scar tissue, which makes the illness enter in the subsequent stage, i.e., fibrosis, which is additionally for the most part asymptomatic. Extreme scarring on the liver causes cirrhosis, which is the third stage. In this stage, the patient begins to encounter side effects like stomach torment, weariness, shortcoming, jaundice, and so forth.

1. At the point when there is an extreme crumbling in liver capability, then it is End-stage liver illness (ESLD). In this, the patient shows extreme complexities yet can be treated without relocating the liver. In the fourth stage, undesirable cells begin to create and grow, which causes Liver disease. These circumstances pointed to the requirement for strategies that give early expectation of liver illnesses so the impact can be alleviated, furthermore, harm can be constrained by giving suitable treatment at a beginning phase.

The usually involved determination and tests for liver infections or Hepatic illnesses incorporate a liver blood test, complete blood count (CBC), Stomach and Pelvic CT, Stomach Ultrasound, Elastography, ERCP (Endoscopic Retrograde Cholangiopancreatography), Lactate Dehydrogenase (LDH) Isoenzymes Test, Lactate Dehydrogenase (LDH) Test, Liver Biopsy, Liver Capability Tests (LFT), Attractive Reverberation Cholangiopancreatography (MRCP), X-ray of the body (Chest, Midsection, Pelvis), and Needle Biopsy.

The traditional techniques for treating liver illnesses experience the ill effects of different restrictions. Some of them are as follows:

- A lot of clinical information is created, while the quantity of master onlookers to investigate this information is fundamentally less. Besides, a doctor could possibly have skill in the investigation of different kinds of information and pictures.
- Finding stowed away examples and connections in gigantic clinical information is frequently thought of immaterial.
- The ultrasound pictures might contain commotion, can be of terrible quality, and are frequently not quite the same as various machines that influence the determination. Additionally, manual discovery can be slow and equivocal.
- Liver biopsy is dangerous and frequently deciphered distinctively by various onlookers.
- Liver Transplantation in hepatocellular carcinoma (HCC) is seldom performed due to organ deficiency, and consequently other compelling medicines like liver resection (LR) are given more significance. Yet, this can prompt a reoccurrence of the sickness in patients with high gamble.
- A solitary biomarker isn't adequate for infection expectation. In this way, it is crucial for utilize a blend of biomarkers to increment symptomatic precision. In addition, the Biomarkers which are generally utilized for conclusion of illnesses might give misleading outcomes.

- Discovery of NAFLD at a beginning phase can safeguard the liver from additional harm and consequently can keep the patient from extreme sicknesses like HCC. There are different harmless techniques of distinguishing NAFLD, however these frequently need precision on account of incorrect blood-marker tests furthermore, may incorporate expensive imaging processes.
- HCC can be altogether anticipated by microvascular attack (mVI), however the pre-employable appraisal of mVI is troublesome.
- Expectation of postoperative endurance is for the most part not given a lot of significance, which prompts the reoccurrence of the sickness.
- Sickness finding by doctors is less exact and tedious.

Progression in software engineering is expanding quickly, and particularly the ideas of fake knowledge (computer based intelligence), in particular profound learning (DL), ML, and enormous information, are being utilized in different fields for making expectations overwhelmingly of data from information.

Because of its unparalleled powers, computer based intelligence is likewise utilized in Medical care for breaking down records of patients to find data, early sickness analysis, and subsequently helping doctors and patients in choosing therapies.

A notable field of software engineering and designing called Information revelation in enormous data sets (KDD) has been broadly utilized for separating fundamental and valuable data from huge clinical datasets, which generally are trying to be reasoned by a clinical master in a brief period time. Consequently, the utilization of ML order calculations for dealing with broad clinical information and making clinical expectations is useful for distinguishing factors that assistance in the guess of patients with different liver sicknesses. KDD includes a progression of steps that are to be completed appropriately, and all levels are similarly significant. The component of KDD incorporates choice, pre-handling, change, information mining, translation, and assessment.

2. Making a ML model:

This segment portrays every one of the means engaged with making an AI model for the conclusion also, expectation of liver illnesses. These means are characterized as follows:

2.1. Information assortment and pre-handling The records of patients are utilized for reasoning data, which helps in the guess of gentle to serious liver sicknesses. The normally utilized information incorporate Ultrasound pictures, CT Sweeps, X-ray examines, Blood-test reports, general data about the patient counting age, orientation, BMI, liquor utilization, dietary patterns, youngster pugh stage, histologic evaluating, and so on.

The information utilized can be either essential or optional, single-focused or multi-focused, planned, or review. Essential information is the information gathered from emergency clinics, clinical foundations, or testing focuses by the specialist himself/herself. Auxiliary information is the one which is overseen by the scientist from online stores or from another specialist for playing out the examination. Single-focused information is the one that is gathered from one single area, e.g., a clinic or a clinical foundation from a particular country. Conversely, multi-focus information is the one that is gathered from different destinations, which could in fact be from various nations. Here, the majority of the examinations audited were performed on optional information obtained from a solitary community. Not many investigations were additionally led for both huge scope and limited scope essential information gotten from either single-focus or different focuses. By the term planned information, we mean information gathered when there is an adjustment of the qualities with time. Interestingly, review information is the one that has proactively been brought up previously.

In information mining and AI, the prescient exhibition can be upgraded by pre-handling of information, which changes over the crude information into clean information. It incorporates cleaning, standardization, change, filling the missing qualities, really taking a look at conflicting qualities, eliminating copy values, eliminating loud information, highlight collection, include inspecting, dimensionality decrease, include encoding. It tends to be performed by utilizing different apparatuses like R system, Weka, Rapidminer, Python, SPSS, and so forth.

2.2. Area of interest (return on initial capital investment) division When the dataset to be utilized contains pictures, then the preprocessing is finished by picture division. It is a course of isolating the head and insignificant regions inside the picture and subsequently making it more significant and thus, simple to examine by applying measurable information mining strategies. The return for money invested is the assortment of the sectioned districts of the picture, which are to be centered around extricating helpful data. It is either set apart by a radiologist or master doctor not entirely set in stone by changing the pixel force values.

2.3. Include Choice Element determination can be characterized as the method involved with choosing the huge highlights that are emphatically connected with the result from the dataset for quicker preparing of the model, intricacy, decreased dimensionality, clear understanding, and further developed precision. Huge factors/biomarkers are extricated from the records of clinical data and lab trial of patients by utilizing measurable information mining and ML calculations. Previously mentioned instruments for pre-handling likewise contains bundles that permit include determination.

2.4. Cross-Approval and Parting of informational collection In cross-approval, a piece of the dataset is held for testing the model, and the excess information is utilized for preparing the model. It dodges the issue of overfitting and underfitting. Normally utilized cross-approval methods are 'Hold-out cross-approval (early halting)' and 'K-overlap cross-approval' [2]. Information parting is a division of a dataset into two or three sections, i.e., Preparing information, Approval information, and Test information to dispose of predisposition. It is finished by a part proportion that relies upon the dataset being utilized and the kind of model being made. It is performed as per an inspecting strategy, which can be either Basic irregular examining, trail-and-mistake examining, deliberate inspecting, comfort testing, CADEX, DUPLEX, or delineated testing .

The most usually utilized inspecting strategy by ML calculations is straightforward irregular testing. The ML calculations are prepared by utilizing the preparation information to foster the prescient model, which is then approved by utilizing the approval information. The model gains from the preparation information, while it doesn't gain from the approval information and just purposes it for working on the hyperparameters. Subsequent to choosing the hyperparameters, the test information is utilized to actually take a look at the exhibition of the made model.

2.5. Grouping calculations - Order can be characterized as the most common way of making a model of class credits that are gotten from a dataset so a class mark can be doled out to a concealed record with high precision. ML calculations utilize the preparation information with huge elements for performing characterization. There are different sorts of ML calculations that are chosen by the sort of prescient and analytic model to be made. The ML calculations can be comprehensively characterized into three classifications, in particular Administered learning, Unaided Learning, and Support Learning. A brief depiction of them is as per the following:

2.5.1. Directed learning-These calculations map a contribution to the ideal result and work as peran outcome that will be accomplished. With these calculations, the preparation cycle is gone on until the model is made. Instances of these calculations incorporate Choice Tree (DT), Irregular Woodland (RF), K-closest neighbor (KNN), Strategic Relapse, Backing Vector Machine (SVM), Gullible Bayes (NB), and so on.

2.5.2. Unaided learning-In these calculations, no objective outcome must be accomplished and is basically utilized for taking care of grouping issues. Instances of these calculations incorporate the Apriori calculation, k-implies, and so on.

2.5.3. Support learning-These calculations are utilized when explicit choices are to be made by the machine, which trains itself utilizing experimentation technique and attempts to work on its exhibition by gaining as a matter of fact. Instances of these calculations incorporate Markov Choice Interaction.

Here the point is making a prescient and demonstrative model that is supposed to convey results inside a explicit limit. Hence, regulated learning calculations are by and large utilized for making anprogrammed sickness discovery model.

2.6. Prescient model creation-This step delivers the ML model, which serves the ideal outcomes and speculation. The presentation of calculations is contrasted with select the one that gives the most noteworthy exactness by utilizing a cross-approval strategy. By utilizing the tuned dataset containing huge characteristics is utilized for preparing and approval of the ML characterization calculation, which yields the last prescient or symptomatic model giving programmed choices about the new and inconspicuous dataset.

2.7. Assessment The assessment of the created model is done in light of disarray lattice, exactness, accuracy, review, particularity, F1 score, ROC (recipient working qualities) bend, truepositive rate (TPR), bogus positive rate (FPR).

3. Related Investigations:

This segment incorporates concentrates on connected with the utilization of simulated intelligence in the field of liver illness analysis in the last six years. The Indian Liver Patient Dataset (ILPD) from the UCI machine vault [3] has been utilized in many investigations ([4,5,14-16,6-13]). The dataset contains 583 records for 11 credits in which class 1 incorporates 416 liver patients, and class 2 incorporates 167 non-liver patients. The majority of these investigations utilized 80%

of the dataset for preparing the model, and the excess 20% for testing the model and the characterization was completed by utilizing 10-crease cross-approval. BUPA dataset from the UCI machine store [3] was utilized by ([17-19]). It comprises of 345 unique examples of 7 credits, and one additional characteristic was added that demonstrate the presence and seriousness of the illness. Numerous scientists likewise utilized essential information from clinics and clinical establishments. The survey of these examinations is as per the following:

3.1.Related Examinations in 2015:

The prescient capacity of C5.0 and C4.5, SVM, DT, KNN, LR, NB, RF, and NN classifiers was contrasted utilizing ILPD and Quick Digger and IBM SPSS Modeler apparatuses. From Quick Digger Programming, SVM showed the most elevated exactness (72.54%), and from the SPSS Programming, C5.0 showed the most noteworthy precision (87.91%) [4]. In another review [6], NB and SVM calculations were analyzed, and it was seen that SVM beat the NB calculation by giving more exact order on the ILPD dataset. A mixture model called NeuroSVM was created by consolidating SVM and ANN, which accomplished an exactness of 98.83% in the order of ILPD [7]. Utilizing the CT sweeps of 80 patients, the critical elements were extricated from the return for capital invested utilizing SFSS and GA (hereditary calculation).

Probabilistic Brain Organization (PNN), Straight Vector Quantization (LVQ) Brain Organization, and Back Proliferation Brain Organization (BPNN) were utilized for the arrangement of greasy and cirrhosis liver. PNN beated LVQ and BPN with precision (acknowledgment pace) of 95% [20].

In an examination of SWE estimations and biopsy scores in assessing fibrosis in patients with ongoing liver sickness, the exact outcomes showed that SWE assessments of liver solidness are connected with the seriousness of fibrosis and can be utilized as an instrument for separating fibrosis patients [21].

3.2.Related examinations in 2016:

A clever Neuro-Fluffy surmising framework gave an exactness of 79/83% after characterization with critical variables being complete bilirubin (TB), direct bilirubin (DB), soluble phosphate (Alkphos), serum glutamic-oxaloacetic transaminase (Sgot) from ILPD [8]. A ML model that could foresee the phase of liver fibrosis utilizing the DT classifier was proposed by utilizing the records of 100 HCV patients. After the pre-handling of information, the fundamental elements were chosen utilizing the ANOVA and BOX plot tests. The accomplished precision was 93.7% [22]. Rather than blood markers, ten different factors were utilized from the clinical record of 2060 patients, to be specific sex, age, alcoholic cirrhosis, non-alcoholic cirrhosis, alcoholic hepatitis, viral hepatitis, unique sorts of persistent hepatitis, alcoholic greasy liver infection, different kinds of greasy liver sickness, and hyperlipidaemia. The dataset was partitioned into two gatherings of 70% and 30% for preparing and testing, individually of ANN, LR, SVM, and DT classifiers. Among them, ANN showed the best outcomes with AUROC of 0.873 [23]. 512 elements were separated from 100 liver ultrasound pictures with the assistance of Significance descriptors. The list of capabilities was diminished to 18 by utilizing the Negligible Fisher Examination (MFA)

incorporated with the Wilcoxon marked rank test. Then, at that point, the pictures alongside the critical highlights were taken care of as contribution to the classifiers, in particular DT, Adaboost, KNN, PNN, SVM, NB Fluffy Sugeno, straight, and quadratic discriminant investigation with 10-overlay cross-approval. The assessment demonstrated that PNN gave a superior determination of greasy liver infection with a characterization precision of 98% [24].

J48, NB, MLP ANN, ZeroR, 1BK, and VFI calculations were thought about for characterization of LFT dataset for anticipating liver illnesses. The investigation showed that MLP beat different calculations [25].

KDD furthermore, ML approach could identify fibrosis in HCV patients [26]. ANOVA strategy was utilized for choosing fundamental highlights from the records of 100 HCV patients, and medium KNN, direct SVM, and cubic SVM calculations were utilized for grouping. The assessment showed that cubic SVM gave the most noteworthy exactness of 98%. A multi-facet classifier troupe model named HMV (progressive larger part.

4. Research Holes and Future Extensions:

It is seen that a few methodologies don't show effective results when utilized on an enormous dataset and groups an example of datasets with more noteworthy precision than the excess dataset. Various strategies have a changed scope of proficiency and responsiveness. It is likewise seen that particular methodologies don't show something very similar level of precision when applied to ongoing information. Gathering enormous scope clinical information for research and choosing the main elements are the difficult parts of involving ML ideas for liver infection location. These issues can be settled via doing enormous scope concentrates on various focuses with underscoring the assortment, division, and pre-handling of information.

The proposed approach in [1,9,12,17,18,32,42,49,58] ought to be tried on a huge free test set to demonstrate its power. Joining different ML calculations and executing them for huge scope optional and ongoing information from different areas will be helpful in demonstrating their strength ([4,6,67,68,7,37,38,40,53,55,57,61]). In a review [5], just two classifiers were looked at, and the highlights were positioned by the increase proportion. More exact element determination strategies are required to demonstrate the unwavering quality of the model. Also, a broad examination of classifiers is essential to demonstrate the power of the chose calculation.

The capacities of the ML models can be expanded from illness forecast to infection discovery and giving treatment choices [14,45,56,60]. In [15], the goal is the forecast of the reoccurrence of the illness. In any case, there is no proportion of recognizing regardless of whether the condition had repeated. In this respect, ceaseless checking of the patients' records is required however an internet based gateway by expanding the point from only expectation to genuine movement identification.

The majority of the investigations have involved the irregular inspecting strategy for dataset division for preparing and testing. Be that as it may, there is an absence of studies looking at the consequences of various testing methods over the dataset. In addition, it can likewise be conceivable that different testing strategies suit various circumstances and datasets. Depending on just a particular way restricts the potential outcomes of additional upgrades [16].

A great deal of examination has been finished in determining liver sicknesses, while the examinations focussing on the progress of the illness are not very many. High accentuation ought to be laid on distinguishing the phase of the ailment so the doctors can straightforwardly teach the treatment to patients without with nothing to do in exorbitant tests

[8]. Different investigations including [10] utilized ILPD. An examination of this large number of studies utilizing a similar device will be gainful in conveying the best performing model. An examination of component choice procedures would be worthwhile in separating critical and sickness related boundaries ([11,28]). The utilization of information mining procedures can give stowed away viewpoints in hereditary profiles, blood test results, bone thickness, pulse, circulatory strain, diabetic status, pee tests and other related information.

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