Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 7915 – 7921
Received 05 March 2021; Accepted 01 April 2021.

Early Segmentation and Voice Alert Management System for Diabetic Retinopathy Detection

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Abstract – Diabetic Retinopathy (DR) is extracted under later stages of vision blur or complete blindness or vision loss. The diabetic retinopathy resultant causes an irreversible blindness and hence requires a detailed attention and early detection framework. In this article, we propose a machine learning approach for early segmentation and classification of diabetic retinopathy using pre-morbidities and patient history with respect to diabetics. Typically, a uncontrolled diabetic lead to retinopathy formation. The proposed technique classifies the possibilities of occurrences with feature and attributes of electronics health records (EHR) systems. The proposed technique includes multiple data-dimensions and attributes. Both segmentation and classification of attributes and feature-sets are cross validated via an inter-dependency mapping of attributes. The technique uses primary-dependencies attributes such as diabetics levels post and pre fasting, history of diabetic treatment and retinopathy aging with reference to aligned ill'ment. The technique has successfully classified with a performance ratio of 97.81% with respect to aimed parameter evaluation. The process has also retained a voice based monitoring and alerting system.

Keywords – Segmentation, Early detection, Speech/Voice alerting system, diabetic retinopathy

I. INTRODUCTION

Diabetic Retinopathy (DR) is the most common variant of co-morbidities caused due to diabetic. The process of occurrence of DR is supported by un-attempted and undiagnosed change in vision and eye blurriness. Typically, the DR's reporting rate has significantly increased and hence a checksum of reliable alerting and diagnosis management system is required. The current process of DR detection and prediction models are supported and operated under the supervision of medical experts and hence an unstructured approach of information retrieval and management has to be proposed and evaluated.

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The major cause of diabetic retinopathy (DR) is a malfunction of retinal micro-vascular glands with a combination of blood retinal barriers and stream of layers in the glands. The process is to assure the regular flow of blood streams via retinal glands. The blood streams with higher ratio of glucose or dissolved quality of improper insulin levels is another major cause of diabetic retinopathy. With the aim of ICT based approach, the detection and paramedic evaluation of feature sets and attributes in diabetic retinopathy is further simplified and ease for the users in extraction and decision making.

In this article, the process is validated via a typical mechanism of identifying the information based on patterns and feature sets of diabetic retinopathy. The technique is aimed to process a voice based alert management system to assure the successful detection and validation of diabetic retinopathy patterns based on collateral attributes set. The proposed technique is future strengthened with an performance evaluator system and monitoring unit.

II. LITERATURE SURVEY

The process of diabetic retinopathy occurrence and formation is reported by various researchers and developers. The terminology of extraction, detection and identification of diabetic retinopathy is relevantly similar with respect to decision making on a concern or opinion with medical experts. The process was initially coordinated by typical image processing techniques such as DWT based compression and density validation. With advancement in technology, the improvisation is embedded with reference to the techniques and algorithms. The concept of deep learning is well explained and demonstrates by [1] (Nguyen Q H, et.al 2020), the study has used trivial convolutional neural networks (CNN) along with a dedicated classifier towards the extraction of sensitivity, accuracy, specificity for a reliable decision making.

The technique automating a DR detection using deep leaning is discussed by [2] (Qummar S, et.al 2019) with reference to a deep learning models. The model uses five dedicated CNN's for decision making and performance estimation using kaggle datasets. The approaches are supported by (Ahmed S T, et. al 2017) [3] has discussed on the evaluation of cataract density with reference to pixel size and ROI extraction. This process validates information sharing and diagnosis validation via a series of data pixel evaluation. The process also proposed a light-weight algorithm towards the objective of time optimizations. (Kumari. V. Vijaya, et.al 2010) [4] has proposed a primary technique for extraction and feature evaluation. The technique aims to extract first-line parameters and provide a decision support independent of trained datasets. The support of voice based communication and alerting system is unparalleled in existing models and hence reporting on voice based intelligence in alerting users with diagnosis status of diabetic retinopathy is first of its kind to be reported in this research article. [5][6]

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III. RESEARCH METHODOLOGY

The research objective of this proposed system is to extract the retinopathy encroached images from the input sample sets. The process of extraction is explained with respect to attributes interdependency extraction technique. This technique processes initial datasets under raw database link and thus the primary features are extracted and segregated. The independent attributes and referenced feature's interdependencies are processed and a feature selection is completed.

The interdependencies extraction of attributes and its referenced features are thereby supported to build a stable ecosystem of information mapping and reporting. The mapped files are backup via a log files to assure dependencies in propagating the information via framework as shown in Fig. 1.1.

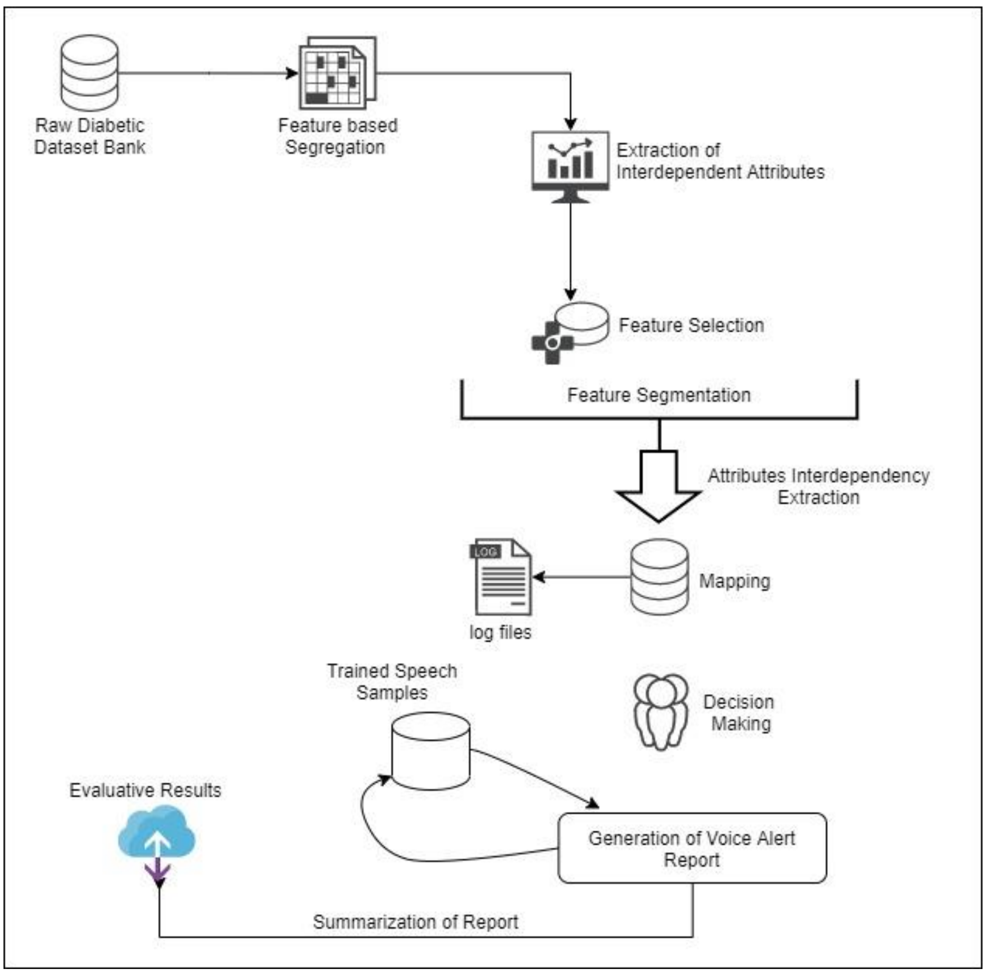

Fig. 1.1: Block diagram of proposed framework for diabetic retinopathy extraction

The mapped datasets are then processed via a decision making. These learning and decision is supported by an external and independent trained speech signals. The speech

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signals coordinated and extracts information decision array to generate emergency alert messages. The overall process report and diagnosis history is then computed and evaluated with a structural reporting format.

IV. MATHEMATICAL MODEL

Consider the dataset (D) of diabetic retinopathy, such that, each instances of (D) consist of interdependent parameters (P) as $P = \{P_1, P_2, P_3 ... P_n\}$. These parameters are represented under inter-dependencies module of the datasets. Hence each of $D \Rightarrow P$ for instant $D_i = P_j / j = \{j_1, j_2, j_3 ... j_n \subseteq P\}$ and re-extracted systems instances of each parameter. The parameters, internally is associated with attributes set and the proposed system is intended to evaluate such attributes sets (A).

The process is strengthen by a feature based segmentation approach, considering each of feature (f) is represented by a series of feature set (f_S) extracted from the inter-connections of parameters set as $f_S = \{P_i \subseteq F / f_i \in (f_S)_i\}$ where F is the universal feature set of diabetic retinopathy, the feature based segmentation is represented as in Eq. 1

$$f_S = \lim_{n \to \infty} \int_0^i \left[\frac{\delta (F_S)_i}{\delta P} \right] \tag{1}$$

$$\therefore f_S = \lim_{n \to \infty} \int_0^i \sum_{i=o}^{n} \left[\sum_{j=j+1}^{n-1} \left[\frac{\delta (F_S)_i}{\delta P_j} \right] \right] \tag{2}$$

The Eq. 2 represents data feature segmentation process of an individual feature set. The process can be extracted and expanded as $S = \{(f_S)_1, (f_S)_2, (f_S)_3 ... (f_S)_n\}$ where S is the segmented set of feature attributes and f_S is the instance of feature. The segment set *(S)* process the clustering of feature independent of attributes as shown in Eq. 3

$$S = \left[\lim_{n \to \infty} \int_0^n \left(\frac{\delta S}{\delta P} \right) \bigcup S \subseteq S^1 \forall P \in F \right] \tag{3}$$

Under the Eq. 3, the process extraction matrix of segmentation (S) is considered towards the feature extraction of independence of each variable. This process of streaming the system protocol is represented in Eq. 4.

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$$S^1 = \left[\left(\lim_{n\to\infty} \int_0^n \sum_{i=0}^{n} \left(\frac{\delta S_i}{\delta P} \right) \right) - \left(\frac{\delta (S)_i}{\delta P} \right) \right] \tag{4}$$

The dependencies are there-by extracted and eliminated as shown in Eq. 4 and thus Eq. 4 is mere extraction of parameters of features with-out dependencies. The process is then continued with a series of feature set (S^1) segmentation with respect to attributes extraction. These attributes are inter-dependent attributes of independent feature set as represented in Eq. 5.

$$S^1 = \left[\left(\lim_{n\to\infty} \int_0^n \sum_{i=0}^{n} \left(\sum_{j=i}^{n-1} \frac{\delta S_i}{\delta A_j} \right) \right) - \left(\sum_{j=j+1}^{n-2} \frac{\delta (S)_i}{\delta P_j} \right) \right] \tag{5}$$

The process extraction, results is interdependent attribute set (S_A), the machine learning based technique enables the mapping of each attribute set with inter-related dimensions of feature set as in Eq. 5, the mapping process as shown in Eq. 6

$$M = \left(\lim_{n\to\infty} \left(\sum_{j=i}^{n-1} \frac{\delta S_i}{\delta A_j} \right) \right) \tag{6}$$

Where mapping set (M) results in inter-locking of segmented attributes set (S_A) and independent attributes set (A), such that, each of (A) is extracted with dependencies of mapping.

The extracted mapping (M) as in Eq. 6 is shown to provide a reliable decision making of the system. The decision is processed with learning and training modules of proposed system. The functionalities paradigms of evaluation using trained datasets. The trained datasets are processed with respect to information of feature set attained via an independent attributes extracted with respect to probability evaluation function in Eq. 7 and Eq. 8 respectively.

$$E = \left(\left(\frac{P(T) + P(F)}{P(T).(F)} \right) - \left(\frac{P(F) - P(T)}{P(F).(T)} \right) \right) \tag{7}$$

$$E=\left(\left(\frac{\left(P\left(T\right)+P\left(F\right)\right)-\left(P\left(F\right)-P\left(T\right)\right)}{P\left(T\right).\left(F\right)}\right)\right) \quad (8)$$

V. RESULTS AND DISCUSSIONS

The structural attributes of information and results in a diabetic retinopathy is evaluated via a streamlined datasets. The

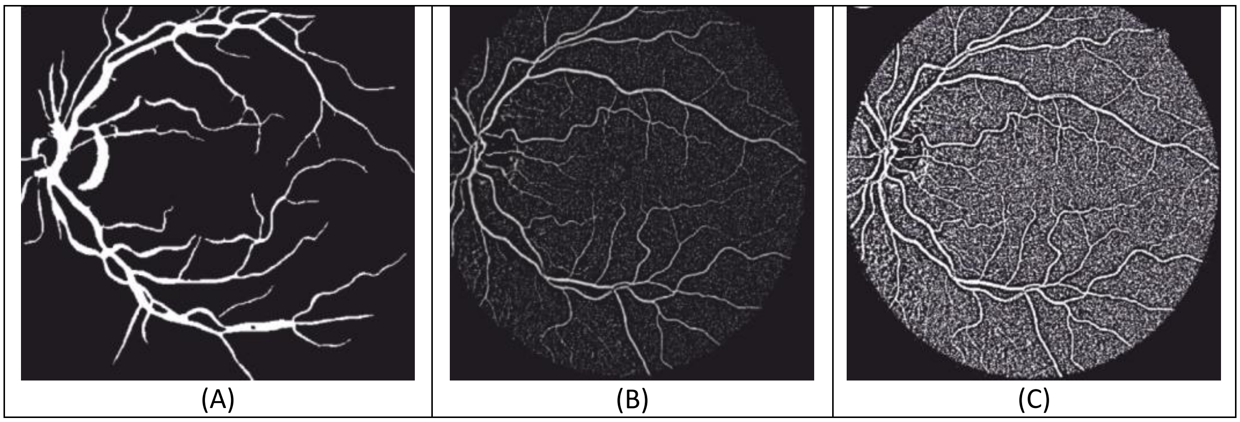

Fig 1.2: (A) represents the extraction of ROI, (B) feature set incubation and attribute mapping, (C) Mapping with initial dataset

In Fig 1.2, the process of evaluating information via retinopathy is demonstrated. Fig. 1.2 (A) extracts features of veins and supporting region of interest (ROI) towards summarization of information extraction range. The parameter is then over-lapped (as shown in Fig. 1.2 B) with a featured interdependent attributes of primary datasets and a consolidated framework is generated. The overall resultant of retinopathy extraction is shown in Fig. 1.2 C with exact region of implication and validation. The process extraction assures the information mapping of attributes with respect to dependency mapping.

VI. CONCLUSION

The proposed system has been designed and validated for the retrieval of retinopathy status and its classification using interdependency feature and attribute mapping technique. The proposed technique has screened datasets of retinopathy with internal attributes, typically termed as primary attributes. The attributes sets of each dependency matrix is set with reference to the threshold parameter of features instances and reflected to the occurrences. The proposed technique has gained a performance efficiency of 97.81% with evaluation ratio of classifying the retinopathy datasets. The proposed technique has further expanded to

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resolve and provide a real-time assistance via speech signals for emergency classified messages such as alerts.

References

1. Nguyen, Quang H., RamasamyMuthuraman, Laxman Singh, Gopa Sen, AnhCuong Tran, Binh P. Nguyen, and Matthew Chua. "Diabetic retinopathy detection using deep learning." In Proceedings of the 4th International Conference on Machine Learning and Soft Computing, pp. 103-107. 2020.
2. Qummar, Sehrish, Fiaz Gul Khan, Sajid Shah, Ahmad Khan, ShahaboddinShamshirband, Zia Ur Rehman, Iftikhar Ahmed Khan, and WaqasJadoon. "A deep learning ensemble approach for diabetic retinopathy detection." IEEE Access 7 (2019): 150530-150539.
3. Ahmed, Syed Thouheed, H. K. Priyanka, Shabana Attar, and Akshata Patted. "Cataract density ratio analysis under color image processing approach." In 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), pp. 178-180. IEEE, 2017.
4. Kumari, V. Vijaya, N. Suriyaharayananm, and C. ThankaSaranya. "Feature extraction for early detection of diabetic retinopathy." In 2010 International Conference on Recent Trends in Information, Telecommunication and Computing, pp. 359-361. IEEE, 2010.
5. Walter, Thomas, J-C. Klein, Pascale Massin, and Ali Erginay. "A contribution of image processing to the diagnosis of diabetic retinopathy-detection of exudates in color fundus images of the human retina." IEEE transactions on medical imaging 21, no. 10 (2002): 1236-1243.
6. Pires, Ramon, Herbert F. Jelinek, Jacques Wainer, SiomeGoldenstein, Eduardo Valle, and Anderson Rocha. "Assessing the need for referral in automatic diabetic retinopathy detection." IEEE Transactions on Biomedical Engineering 60, no. 12 (2013): 3391-3398.