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Eczema Disease Detection and Recognition in Cloud Computing

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Abstract: Eczema Disease (ED) is the most common form of skin inflammation in humans. Most of the skin disease is curable at initial stages with the advancement of technology. So, an early detection of skin disease can save the patient's life and prevent the progression of the disease. It is proposed to have a study on the diagnosis of ED using BPNN (Back Propagation Neural Network) in cloud computing approach due to that BpNN is currently widespread research area in medicine and plays an important role in a decision support system. In this study, an attempt has been made to make use of BpNN in the medical field along cloud computing to detect ED.

Key words: BpNN, cloud computing, EDD (Eczema Disease Detection), skin inflammation, GA (Genetic Algorithm), system

INTRODUCTION

Skin Agitation (SA) is a dermal disease that affects the skin of human being. This agitation medically called eczema. Eczema may appear as crack open skin, skin rash or sores form. The present early detection system is a classification system which discriminates between different types of skin diseases. The system uses digital color image processing technique, BpNN and cloud computing for the skin diseases classification purpose. Usually such images contain noises and garbage data, so, they are undergone pre-processing. In order to smooth the image and eliminate noise from input color image, the mean filter is used for reducing the amount of intensity variation between one pixel and the next. It is often used to reduce noise in images in order to keep edges of an image during processing, post-processing is done to enhance the shape and edges of image. Canny edge detection filter is used to detect edges of Eczema input image. The BpNN is applied successfully in different fields. These fields include patterns distinguishing, risk management prediction, forecasting marketing, etc. In this system, the concepts of BpNN engaging cloud computing technique are present.

Literature review: Most of the research in disease detection is done towards enhancing and increasing the lifetime of patient by proposing a new ways of efficient healthcare. Rajkumar *et al.* (2013) proposed a comparative study of diagnosis a cancer using neural network approach in cloud computing. A new development framework for cloud computing called UIMS (User Interface Medical Services) is formulated (Rajkumar *et al.*, 2013). Maithili *et al.* (2012) proposed a study on the diagnosis of cancer using neural network approach engaging in cloud computing. The present study focuses on cloud computing services extended to medical diagnosis of cancer as well as selection of therapeutic strategies. Bourouis *et al.* (2013) presented a study about skin disease analysis system using smartphone camera. This study described an innovative development of a low cost smartphone based intelligent system using integrated camera. Amarathunga *et al.* (2015) developed an expert system of a skin diseases diagnosis which allows user to identify diseases of the human skin and to provide advises or medical treatments in a very short time period. Abbadi *et al.* (2008) proposed a method for skin texture recognition using neural network. They proposed a skin recognition system. This system is using skin color feature and texture feature. Abbadi *et al.* (2008) suggested of a skin recognition system for different classes of skin disease images and tested.

MATERIALS AND METHODS

A brief description of eczema

Eczema defenition: The term "eczema", Fig. 1 is used widely to describe any rash-like skin conditions. It is

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Fig. 1: Different types of eczema

usually used specifically to refer to the most common type of these skin conditions. Some people outgrow the condition of eczema while some people will continue to have it into adulthood. There are many different types of eczema including: allergic contact eczema; contact eczema; dyshidriotic eczema; neurodermatitis; nummular eczema, seborrheic eczema, stasis dermatitis (William *et al*., 2005).

Cause of eczema: Environmental factors are also known to bring out the symptoms of eczema. These include irritants, allergens, microbe shot and cold temperatures, foods, stress and hormones.

Cloud computing behavior

Cloud computing definition: Cloud computing, Fig. 2 is a distributed computing paradigm that focuses on providing a wide range of users with distributed access to scalable, virtualized hardware and/or software infrastructure over the internet (Wayne and Timothy, 2011). This paradigm is enabling in everywhere, convenient on-demand network access to a shared with computing resources such as networks, servers, storage, applications and services that can be rapidly released with minimal management service provider interaction. The cloud computing model consists of five essential characteristics, 3 service models and four deployment models (Grossman, 2009). Cloud computing helps and promotes to protect data and easy access to the various medical records. The system focuses on extended services of cloud computing to medical diagnosis of skin disease. The proposed computational model of disease detection and recognition is simple, easy and accurate in variant environments. The resources of cloud computing consist of mainly two parts: hardware part and software part. The global network (internet) provides these resources immediately. To access these

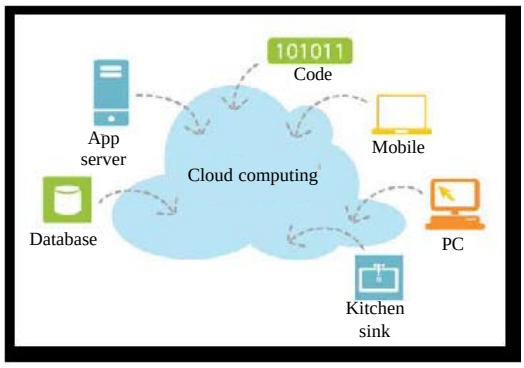

Fig. 2: General form of computing

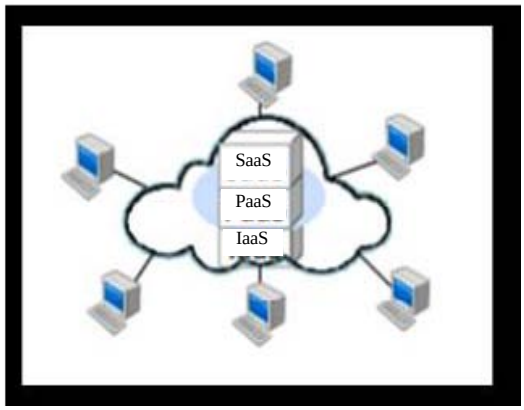

Fig. 3: Cloud services

resources on the internet, there are third part services to provide access to the server computers (Soman, 2011; Anonymous, 2010).

Characteristics of cloud computing: Cloud computing helps servers to share the work to process numerous data. It can be divided into main three segments as shown in Fig. 3 (Maithili *et al*., 2012).

IaaS (Infrastructure as a Service):

- Sharing hardware resources
- Extending the infrastructure on demand
- Networking capability
- Internet connection
- Cost effective cause it replace the need for buying, installing, configuration, customization, extending, support and upgrade

PaaS (Platform as a Service):

- Developers build their applications over it
- The platform is extending with other web services and with more features in the future

- The platform is hosted by the vendors
- The vendor is responsible for updating, upgrading, security and management of the platform

SaaS (Software as a Service):

- Targeting the end users
- User has no need to worry about updating, upgrading, security
- Easy to extend with more features
- The vendor is hosting the services, storing the files, the customer information and data (Maithili *et al*., 2012)

Canny edge detection filter: In general, the purpose of edge detection is to significantly reduce the amount of data in an image while preserving the structural properties to be used for further image processing. Due to edge defines all boundaries of different objects in digital image, edge detection is the popular problem in digital image processing. In this proposed algorithm, the CED (Canny Edge Detection) is known as the optimal edge detector for eczema contour shown in Fig. 4 (Luo and Duraiswami, 2008). The Canny edge detector is widely used in computer vision to locate sharp intensity changes and to find object boundaries in an image. There are five steps to detect edges using Canny detector: smoothing, blurring of the image to remove noise, finding gradients, the edges should be marked where the gradients of the image have large magnitudes, non-maximum suppression, only local maxima should be marked as edges, double thresholding, potential edges are determined by thresholding, edge tracking by hysteresis: final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

The technical reasons for using CED to improve the edge detection by the following criteria: LER (Low Error Rate) and EPL (Edge Points be well Localized). LER means edges occurring in images should not be missed. During a process, the CED first smoothes the image to eliminate the noise (denoising), then finds the image gradient to highlight regions with high spatial derivatives (Canny, 1986).

GA (Genetic Algorithm)

GA operation: GA are algorithms for optimization and machine learning based loosely on several features of biological evolution shown in Fig. 5. They need five components:

- Chromosomes encoding solutions way
- A chromosome evaluation function
- A population initializing way

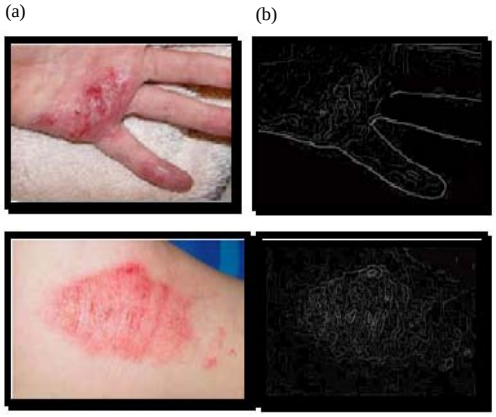

Fig. 4: Hand eczema image: a) Before applied Canny edge detection; b) After applied Canny edge detection

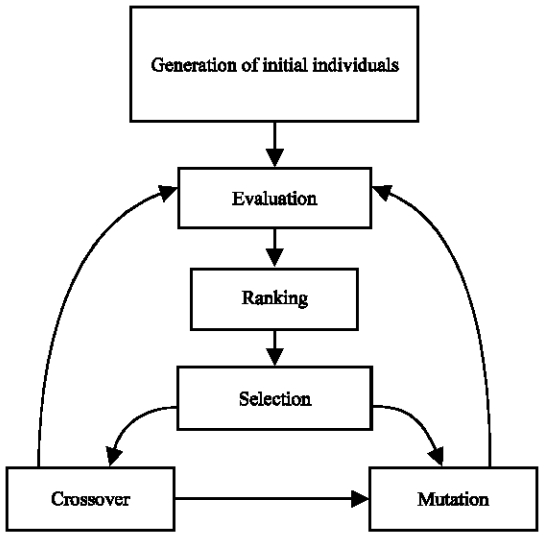

Fig. 5: The basic structure of a GA

- GA operators
- Settings of an algorithm parameter (Goldberg, 2002; Michel and Charles, 1999)

The general procedure of GA can be described as:

- Evaluate fitness of the population
- While (stopping criterion not met)
- Forming new population
- Select sites for search area
- Random iteration selected sites and evaluate fitness
- Select the fittest population (PE or iteration) from each patch
- Assign remaining iteration to search
- Randomly and evaluate their fitness
- End while

GA is based on natural selection and genetic recombination. The algorithm works by choosing solutions from the current population and then applying genetic operators such as mutation and crossover to create a new population. The algorithm efficiently exploits historical information to speculate on new search areas with improved performance. When applied to optimization problems, GA has the advantage of performing global search. The GA may be hybridized with domain-dependent heuristics for improved results (Ho *et al*., 2000).

Diagnosis eczema disease using GA: GA is used in both designing the structure and training the network. We consider two kinds of genetic operations: selection and mutation. Since, the length of the chromosome is variable we do not take crossover into account. GA consists of mainly three stages: selection, crossover and mutation. The purpose of selection is to determine the genes to retain or delete for each generation based on their degree of adaptation. There are two types of determination Roulette-Wheel selection and tournament selection. The study adopted tournament selection. Reproduction is a process to exchange chromosomes to create the next generation according to distribution rule. The fittest survives. The fitness function, therefore, should depend on not only the output errors but also on the simpleness in the structure of the network. The way of crossover is different from mutation .There are one-point mutation and two-point mutation. Mutation process depends on conditions; mutation can start as adaptation function and stop changing after several generations. Mutation rate cannot be too high. Otherwise, convergence will not occur (Saridakis *et al*., 2008). The algorithm works by choosing solutions from the current population and applying genetic operators such as mutation and crossover to create a new population. The algorithm efficiently exploits historical information to speculate on new search areas with better performance. Applied to optimization problems, the GA has the advantage of performing a global search. The GA can hybridize with the heuristic dependent domain for better results. Genes can be bits or other integers from which one can derive a specific solution. Required that all solution points can be represented by at least one string. In addition, a series of specific genes leads to a unique solution. A set of a constant number of gene chains, each of which characterizes an individual is called generation. Since, the different components must be evaluated and compared, the concept of fitness is introduced. The fitness value correlates with the quality of a particular solution. Given these five components, a GA operates according to the following two steps:

- Initialize the population using the initialization procedure and evaluate each member of the initial population
- Reproduce until a stopping criterion is met. Reproduction consists of iterations of the following three steps
    - Choose one or more parents to reproduce. Selection is stochastic but the individuals with the highest evaluations are favored in the selection
    - Choose a genetic operator and apply it to the parents. Evaluate the children and accumulate them into a generation
    - After accumulating enough individuals, insert them into the population, replacing the worst current members of the population

Artificial neural network

BPNN (Back Propagation Neural Network): BpNN shown in Fig. 6 is a supervised learning technique used for training artificial neural networks (Eq. 1). It was first described by Paul Werbos in 1974 and further developed by David E. Rumelhart, Geoffrey E. Hinton and Ronald J. Williams in 1986. It is most useful for feed-forward networks (networks that have no feedback or simply that have no connections that loop). The term is an abbreviation for "backwards propagation of errors":

$$net_{pj}^{h} = \sum_{i=1}^{N} w_{ji}^{h} x_{pi} + \phi_{j}^{h} \quad (1)$$

The basic BP procedure for training the network is embodied in the following description:

- Apply an input vector to the network and calculate the corresponding output values
- Compare the actual outputs with the correct outputs and determine a measure of the error
- Determine in which direction (+ or -) to change each weight in order to reduce the error
- Determine the amount by which to change each weight
- Apply the corrections to the weights
- Repeat items 1 through 5 with all the training vectors until the error for all vectors in the training set is reduced to an acceptable value

Artificial neural networks generally consist of main five components: a directed graph known as the network topology whose nodes represent the PE and whose arcs represent the connections; a state variable associated with each PE; a real-valued weight associated with each connection; a real-valued bias associated with each PE; A transfer function for each PE.

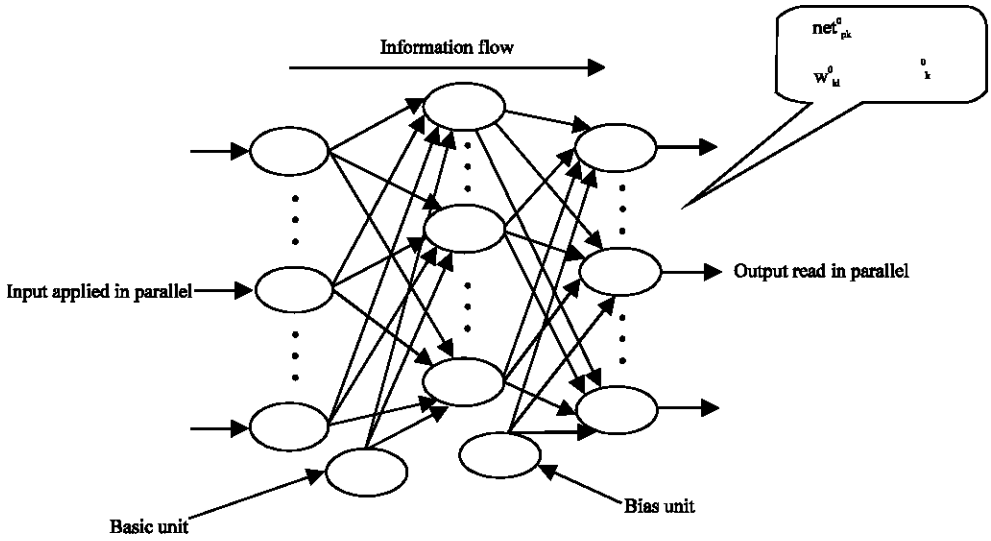

Fig. 6: A simple Bp neural networks

To begin with the network learns a predefined set of input-output example pairs by using a two-phase propagate-adapt cycle. After an input pattern has been applied as a stimulus to the first layer of network units, it is propagated through each upper layer until an output is generated. This output pattern is then compared to the desired output and an error signal is computed for each output unit. The error signals are then transmitted backward from the output layer to each node in the intermediate layer that contributes directly to the output. However, each unit in the intermediate layer receives only a portion of the total error signal, based roughly on the relative contribution the unit made to the original output. This process repeats, layer by layer, until each node in the network has received an error signal that describes its relative contribution to the total error. Based on the error signal received, connection weights are then updated by each unit to cause the network to converge toward a state that allows all the training patterns to be encoded. In a proposed artificial network, the information moves in only one direction, forward from the input nodes, through the hidden nodes and to the output nodes. There are no cycles or loops in the network. If any error found, the weights must be adjusted and the neural networks learn by changing these weights (Bp) to go on to complete training to getting the desired output (Schalkoff, 199).

Diagnosis eczema disease using BpNNs: In the artificial neural networks, all the tasks are performed intelligently like those performed by the human brain. The proposed neural networks consist of three sets of neurons, input layers, hidden layers and output layers. The input layers (input values) are concern with patient's information (name, age and sex). The middle layers called hidden layer (hidden values), these values are concerned with using the patient data to make diagnoses. The output layers are called (output values), this layer produces the outputs of the learned network (the values processing) (Moein *et al*., 2008).

Training and learning using proposed technique: BpNN is one of the most effective technique to machine learning algorithm information flows from the direction of the input layer (input values) towards the output layer (output values). This network is trained and learning in BpNN and typically accomplished by using examples. This is also called "training" in BpNNs because the learning is achieved by adjusting the connection weights in BpNNs iteratively, so that, trained (or learned). The performance of learning systems on the training data often does not reflect the performance on unknown data. This is due to the fact that the system often adjusts well on training to the particularities of the training data. If we have initially a bias in the training data you will encounter performance problems for the test data later. The number of iterations of the training algorithm and the convergence time will vary depending on the weight initialization. The processing of artificial neural network has been trained once has been structured and initial weights are chosen randomly to begin learning and the training data should be randomly chosen from all available data. The networks are trained by series of existing data (based on the follow up history of eczema patients) where the outcome is known. Learning techniques is often divided into

supervised, unsupervised and reinforcement learning. In order to test the real abilities of the presumed network to unknown data, it must be tested by classified, the tested data that should be general samples coming from eczema patients of the training data (name, age and sex). In fact, the patient's information (name, age and sex) is dealed with same patient not another patient and this information (in system view) is very difficult to generalize to another patient. The system outputs are worked better and could practically achieve when the input system gets the real information.

The procedure of proposed system

Skin eczema behavior: The origin of skin eczema was used in the proposed model. The eczema and the patient's information are described for training set and for the test set. The histological diagnoses are made in diagnostic laboratories in the hospitals with exhaustive experience in the skin eczema diagnosis.

Histology of eczema: Eczema is a common disease, the spongiotic tissue reaction pattern is characterized by intercellular oedema within the spongiosis (epidermis). Further, accumulation of fluid leads to formation of intraepidermal vesicles. Spongiotic dermatitis is a dynamic pathological process; vesicles come and go and can be situated at different levels of the epidermis.

RESULTS AND DISCUSSION

Diagnosis eczema disease using cloud computing: In the proposed scenario, we are going to introduce a platform built of eczema patient treatment in cloud computing after applying hybrid model (Bp neural networks and genetic algorithms). There is no platform built to target medical or healthcare area under the classification of SaaS. Most of applications and services are classified under SaaS. The research based of cloud computing model is performed by "intelligent" functions similar to those performed by the human brain. There are some problems related with the security of healthcare information, privacy and the way of retrieval in cloud computing. The programmer must build a service platform to ensure information security. The doctor holds a primary medical examination for the eczema patients. After doctor detecting the type of eczema he writes down his medical examinations report electronically (test result, medicines, the dosage and guides to the doctors on the other side), sends it to the cloud through specific tools. This procedure is performed by a specialist doctor to the eczema patient if the patient or the doctor is traveling and does not exist in the same place to take the treatment. This is important to enable the doctor located on the other side of giving the appropriate treatment for the patient. If doctors did not use any cloud to inform about disease and medicines, it is very difficult and they do not know how to cure patients. By sharing the information on cloud, this can be achieved, the reputation of hospital and doctor will increase globally. The main reasons that doctors sent patient's information to the cloud are: to get other doctor's help if experiencing intractable condition; easy access to patient's tests anywhere; keep medical information pertaining to the doctor and the patient; high-security, manageable and reliable cloud computing; ability to share patients cases between doctors everywhere and anywhere to get to the best treatment; the doctors document the difficult cases and share the details with the rest of the doctors; the cloud can be seen as a medical reference various pathological situations.

CONCLUSION

In this study, eczema infection detection system using artificial neural networks and cloud computing is proposed. The proposed model is effectively used in diagnosis other skin infections. Objects recognition has drawn considerable interest and attention from many researchers for the last two decades because of its potential applications in different fields. Thus, the following criteria are imposed on formulating a fitness function. The more correct outputs given by the network, the larger the fitness. The more hidden neurons, the smaller the fitness. The more connections, the smaller the fitness.

RECOMMENDATIONS

The suggestion of the future research is building RSS (Rich Site Summary) cloud computing which specializes exclusively with medical news and latest medical developments and medicines.

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REFERENCES

Abbadi, N.K.A., N.S. Dahir and Z.A. Alkareem, 2008. Skin texture recognition using neural network. Proceedings of the International Arab Conference on Information Technology, December 22-24, 2008, Sfax University, Sfax, Tunisia, pp: 1-5.

Amarathunga, A., E.E. Ala, G.A. Beysekara and C. Amalraj, 2015. Expert system for diagnosis of skin diseases. Intl. J. Sci. Technol. Res., 4: 174-178.

Anonymous, 2010. Introduction to cloud computing. Dialogic Corporation, Milpitas, California.

Bourouis, A., A. Zerdazi, M. Feham and A. Bouchachia, 2013. M-health: Skin disease analysis system using smartphone's camera. Procedia Comput. Sci., 19: 1116-1120.

Canny, J., 1986. A computational approach to edge detection. IEEE Trans. Pattern Anal. Mach. Intell., 8: 679-698.

Goldberg, D.E., 2002. Genetic Algorithms in Search, Optimization and Machine Learning. Pearson Singapore,.

Grossman, R.L., 2009. The case for cloud computing. IT. Prof., 11: 23-27.

Ho, E., S. Sah and S. Raj, 2000. Computer Algorithms Fundamental. Publications of Galgotia, Delhi, India,.

Luo, Y. and R. Duraiswami, 2008. Canny edge detection on NVIDIA CUDA. Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops, June 23-28, 2008, Anchorage, AK., USA., pp: 1-8.

Maithili, A., R.V. Kumari and S. Rajamanickam, 2012. Neural networks cum cloud computing approach diagnoses of cancer. Intl. J. Eng. Res. Appl., 2: 428-435.

Michel, F. and L.K. Charles, 1999. Industrial Applications of Genetic Algorithms. CRC Press, Boca Raton, Florida, ISBN:0-8493-9801-0, Pages: 339.

Moein, S., S.A. Monadjemi, and P. Moallem, 2008. A novel fuzzy-neural based medical diagnosis system. Proc. World Acad. Sci. Eng. Technol., 27: 157-161.

Pawar, M., D.K. Sharma and R. Giri, 2014. Multiclass skin disease classification using neural network. Intl. J. Comput. Sci. Inf. Technol. Res., 2: 189-193.

Rajkumar, B., T. Gopikiran and S. Satyanarayana, 2013. Neural network design in cloud computing. Int. J. Comput. Trends Technol., 4: 63-67.

Saridakis, K.M., A.C. Chasalevris, C.A. Papadopoulos and A.J. Dentsoras, 2008. Applying neural networks, genetic algorithms and fuzzy logic for the identification of cracks in shafts by using coupled response measurements. Comput. Struct., 86: 1318-1338.

Schalkoff, R.J., 1997. Artificial Neural Networks. McGraw-Hill, New York, USA., ISBN:9780070571181, Pages: 422.

Soman, A.K., 2011. Cloud-Based Solution for Healthcare IT. 3rd Edn., Science Publishers, New York, USA.,.

Wayne, J. and G. Timothy, 2011. Guidelines on security and privacy in public cloud computing. National Institute of Standards and Technology, Gaithersburg, Maryland.

William, D.J., G.B.T. Imothy and M.E. Dirk, 2005. Andrews' Diseases of the Skin: Clinical Dermatology. 10th Edn., Saunders Publisher, Philadelphia, Pennsylvania, ISBN-13:9780721629216,.