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Taylor Water Cycle Optimization based Deep Residual Network classifier for skin cancer detection model

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ABSTRACT

In today's scenario, the skin cancer is one of the dangerous threat to the human life. It may be because, the modern lifestyle requirements are forcing the humans to make use of artificial products for livings. So, it is important to detect the skin cancer in the early stages and prevent the loss to human life. The primary aim of this research is to develop the method for skin cancer detection. There are several attempts made by the researchers by using different techniques in the different domains including machine learning. But, accuracy enhancements and computational cost are the issues, which are still not answered satisfactorily. Deep Residual network along with an optimization algorithm is core of the model classifier required for the skin cancer detection. Image based Deep Residual network classifier is used for detection of the skin cancer. The classifier will be trained using developed optimization algorithm, named Taylor Water Cycle Optimization (TWCO) algorithm. The developed TWCO approach will be newly devised by integrating the Water Cycle Optimization Algorithm (WCA) and Taylor series. The reason to use TWCO algorithm is the accuracy enhancement in detecting the skin cancer along with reducing the computational cost of the model

Keywords—accuracy, Deep Residual network, machine learning, skin cancer, Taylor Water Cycle Optimization

I. Introduction

The following variables have recently increased the number of cancer patients: lifestyle, cigarette use, alcohol use, food, physical activity, environmental change, sun and other forms of radiation, viruses, and so on. Among the various malignancies, skin cancer is one of the most frequent and hazardous [10] [1]. In comparison to other cancer forms, recent surveys reveal that the rate of people infected with skin cancer is growing every year [9]. The spread of skin cancer has accelerated in the recent decade. Sun rays, tanning, lifestyle, smoking, alcohol use, physical activity, infections, and the working environment can all cause harm to the human skin, which is the biggest bodily organ [11] [12] [2]. These elements jeopardize its integrity and have a significant, negative influence on its health. Basal cell carcinoma, Squamous cell carcinoma, Melanoma, Actinic keratosis, and Squamous cell carcinoma are among the several kinds of skin cancer. Actinic keratosis and squamous cell carcinoma are less common than actinic keratosis and squamous cell carcinoma. Melanoma is a cancer that is fatal. This form of cancer accounts for just 7% of all skin cancers, yet it is responsible for 75% of all fatalities. According to dermatologists, if melanoma is identified early on, there is a 90% chance of successfully diagnosing it [13] [4]. If no treatment is provided ahead of time then it continues to spread in other parts of the body and becomes difficult to cure. In this case, the percentage of diagnosis came down to even less than 50%. The main causes to form skin cancer are the presence of melanocytes and exposure of skin to UV radiations [14] [4].

Skin illnesses can be malignant, inflammatory, or infectious, and they can affect people of all ages, particularly the elderly and children. Skin illnesses can have serious implications, including death (in the case of melanoma), impairment of everyday activities, loss of relationships, and organ damage. Furthermore, they pose a serious risk of mental illness, which can lead to isolation, sadness, and even suicide [15] [2]. Melanoma is the most frequent type of skin cancer that affects melanocytes, the skin's surface cells. It is made up of cells that cause the skin to darken in hue. Melanoma can be black or deeper in color, but it can also be pink, red, purple, blue, or white in hue. This kind of cancer is particularly concerning because of its proclivity for metastasis, or the propensity to spread. Melanoma may form anywhere in the human body, however it is most commonly discovered on the backs of the legs [16]. Its ability to spread rapidly makes it more dangerous and fatal [1]. Skin cancer is the most common malignancy in fair skinned populations, and the incidences of melanoma and non-melanoma skin cancers are rising, resulting in high economic costs. Early melanoma diagnosis appears to improve patient outcomes, and skin cancer detection can be improved through approaches such as screening patients with focused skin symptoms using physician-directed total body skin examinations [18] [19]. Early detection of skin cancer melanoma is a challenging problem and requires attention [17].

Individuals' risk factors for skin cancer illness can be minimised if the condition is detected early enough. In general, finding skin cancer in its early stages can result in a large reduction in mortality. As a result, early detection and categorization of this condition are critical. Physicians typically employ the Asymmetry, Border, Color, and Diameter (ABCD) criterion to distinguish between nevus and melanoma [20] [1]. [22] [4] recently suggested an improved Particle Swarm Optimization technique for detecting skin cancer. This algorithm's findings were also compared to those of other optimization methods. Their method was proven to be capable of producing a superior result for feature selection, assisting in the development of an optimal skin cancer detection system. In [12] [4], the author proposed a novel genetic technique for skin cancer screening. Numerous strategies, such as genetic algorithms, artificial neural networks (ANNs), Convolutional Neural Network (CNN), ABCD rule, and support vector machines (SVMs), have been developed in [23] to analyse skin pain and categorise it as melanoma or benign. Using dermoscopy pictures and forming the job as a binary image classification issue, i.e., benign and malignant classes of images, is a strong technique to achieve skin cancer diagnosis through computer vision.

II. related work

This section is a review of several skin cancer detection methods that are now available. These research articles on skin cancer detection are selected and reviewed based on the most recent published years.

In [1] Ashraf R et al. have presented the skin cancer detection model using Region of Interest (ROI)-based Transfer Learning Assisted Framework. The advantage provided by this technique is that, it effectively solves class imbalance issues. The technique has a disadvantage of higher computational cost. Hence, the effective revision is required to reduce the computational cost of the model.

In [2] Hameed N et al. have stated the Multi Class Multi Level (MCML) classification algorithm based skin cancer detection system. The system is successful in achieving the better accuracy results for the detection. The system is taking longer time for classifying the input data into labels. The computational cost is high and also is not suitable at the places where the diagnosis facilities are limited.

In [3] Khan M A et al. have stated the skin cancer detection model using Newton Raphson-based Deep Features Selection Framework. The advantage of the system is its computation time, which is very less as compared to other existing approaches. But, the system failed to detect positive cases more accurately and false negatives are high in the results.

In [4] Kumar M et al. have presented the skin cancer detection model using Fuzzy C-Means Clustering. The results discussed by the authors are showing that, the accuracy of the model is better. The computation time of the model is high and accuracy can be enhanced.

In [5] Thurnhofer-Hemsi K and Domínguez E have proposed the skin cancer detection model using the deep learning approach. The authors have used the Convolutional Neural Network (CNN) technique in designing the model. This approach reduces the over-fitting problem. But, as the model does not use any probabilistic module in the design, it fails to provide the desired accurate results.

In [6], Zhang N et al. have presented the system for skin cancer detection using deep learning technique. Instead of conventional CNN, authors have used the optimized CNN to improve the accuracy results in skin cancer detection. The results presented are showing the high detection accuracy. But, data samples used for training and testing are not different and less in numbers. Hence, more training iterations are required along with more rigorous testing with unknown samples.

In [7], Amin J et al. have presented the Integrated Design of Deep Features Fusion for skin cancer detection model. This integrated design provides better discrimination ability. Hence, system could identify the malicious and normal skin

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samples separately with higher TPR and TNR's. But, the higher accuracy comes with high computational cost, which is the disadvantage of the model.

In [8], Chaturvedi S S et al. have designed the skin cancer detection model using the deep learning technique i.e. deep CNN. This method increases the accuracy in the classification task. This algorithm increases the architectural complexity and training time.

From the presented literature survey, the problems in the existing systems have been recognized as follows:

1. The MCML classification method was developed for skin cancer classification in [2], but because to the similarities in melanocytic and non-melanocytic skin lesions, identifying skin cancer at an early stage is difficult.

2. For skin cancer classification, the Newton Raphson-based Deep Features Selection Framework was presented in [3]. This approach, however, was not tested on huge datasets such as ISBI 2018 and HAM10000.

3. The Fuzzy C-Means Clustering method for identifying skin cancer was developed in [4]. Although, employing deep learning-based methodologies, this methodology was not extended to other forms of skin cancer disorders other than Melanoma Cancer, Benign Keratosis-Like Lesions, and Melanocytic Nevi.

4. For skin cancer categorization, the Deep CNN structure was developed in [8]. Although, powerful deep learning computer assisted systems for skin cancer diagnosis by adding clinical photos by expanding the notion of saliency objects or features identification was not included in this method.

5. The accurate skin cancer classification is highly essential in medical field. However, melanoma histology is highly heterogeneous, posing a number of challenges to machine learning, such as class imbalance, intra-class diversity, and ambiguous tumor component boundaries.

III. proposed methodology and techniques

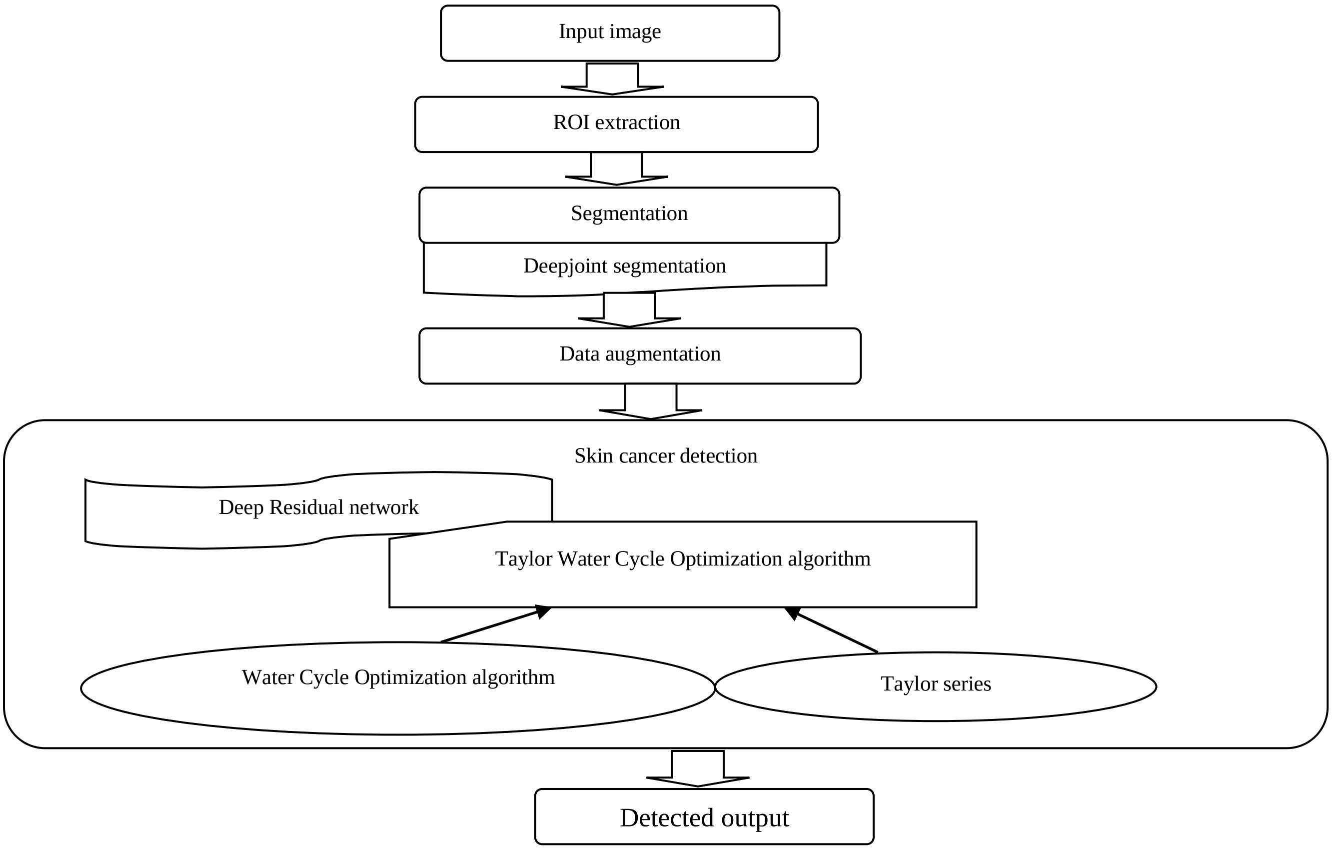

Figure 1. Block diagram of skin cancer detection using the proposed TWCO-based Deep Residual Network

The major goal of this study is to design and develop a skin cancer detection tool. The research's key contribution will be the creation of a skin cancer detection tool that employs a Deep Residual Network [24] and an optimization algorithm. Name ROI extraction, segmentation, data augmentation, and skin cancer detection are the four steps of the developed skin cancer detection technique. The input picture is first obtained from the database and then processed to the ROI extraction step, where ROI areas are extracted. After the ROI has been extracted, the segmentation procedure will be carried out using Deep joint segmentation [25]. The data augmentation will be handled when the segmentation is completed. Finally, the Deep Residual Network classifier [24] will be used to classify the skin data. Furthermore, a newly designed optimization approach known as the Taylor Water Cycle Optimization (TWCO) algorithm will be used to train the classifier. By combining the Water Cycle Optimization Algorithm (WCA) [26] with the Taylor series [27], a novel TWCO technique will be constructed. Figure 1 shows a block diagram of skin cancer detection utilising the proposed TWCO-based Deep Residual Network network. The suggested skin cancer detection system will be implemented using the PYTHON programming language. Furthermore, using the ISIC 2019 Dataset [28], a skin cancer detection approach will be implemented. Furthermore, the proposed skin cancer detection method's performance will be evaluated using three performance metrics: accuracy, True Positive Rate (TPR), and True Negative Rate (TNR), with the findings being compared to those of previous studies [1], and [2].

IV. conclusion

So, herewith the researchers have proposed the effective and efficient, accuracy based deep learning based skin cancer detection system. The architecture of the system is proposed using Deep Residual Network which will be trained using the combination of two algorithms as Taylor Water Cycle Optimization Algorithm comprising of Water Cycle Optimization Algorithm and Taylor Series. Various problems in the existing skin cancer detection models are observed and proposed the effective model for overcoming these problems. The two most significant variables evaluated for improvement are accuracy and timeliness, and a technique is given for filling the research gap found in the survey. The next step is to put the hypothesis into action and test it to see if the suggested design actually produces the intended results.

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