AN EXAMINING DATA MINING'S POTENTIAL USE IN PATIENT HEALTH MANAGEMENT AND SKIN CANCER DETECTION

Sarifta Bano,
Research Scholar
Dr. Divyarth Rai
Assistant Professor
Department of Computer Science Engineering,
LNCT University, Bhopal, Madhya Pradesh, India
shariftabano@gmail.com

Abstract

This project aims to explore the potential uses of data mining and image processing techniques in patient health management, particularly in the area of skin cancer early detection. Skin cancer is one of the most common cancers worldwide. Focusing on critical variables such as asymmetry, borders, pigment, and diameter, this work aims to evaluate skin lesion photos using an Enhanced Image Analysis Technique (EIAT) to successfully identify lesions. The proposed method enhances the accuracy of skin cancer diagnoses by integrating methods for edge detection, picture segmentation, feature extraction, and deep learning. This comprehensive methodology uses state-of-the-art data mining methods to surpass traditional diagnostic approaches. We compared DSSD, MCSDC, and SLCNN—a Convolutional Neural Network–based skin lesion classification system—with other approaches that are already in use. When it came to screening for and keeping tabs on early skin changes, the EIAT proved to be the best. When compared to traditional models, the Enhanced Image Analysis Technique demonstrates significantly higher accuracy and reliability in the early detection of skin cancer. Combining state-of-the-art data mining technology with conventional diagnostic approaches is crucial for improving patient care and outcomes, since it increases the accuracy of skin cancer detection.

Keywords: Data Mining, Patient Health Management, Skin Cancer Detection, Predictive Analytics, Medical Diagnosis Tools

1. INTRODUCTION

Particularly in the areas of disease identification and patient health management, data mining has become an extremely useful tool in the healthcare industry. Healthcare workers can find patterns and trends that improve patient care and help with early diagnosis of diseases like skin cancer by analyzing enormous amounts of data connected to health. Enhancing treatment plans, providing individualized

ISBN Number: 978-93-95305-66-2

care, and enhancing patient monitoring are all possible outcomes of applying data mining tools. By identifying risk factors and streamlining screening procedures, these approaches can help diagnose skin cancer and improve patient outcomes in the process. The revolutionary potential of data mining in improving healthcare practices is highlighted by this investigation.

1.1. Overview of Data Mining in Healthcare

The act of examining enormous collections of medical data to find patterns, correlations, and trends that might not be immediately apparent is known as "data mining" in the healthcare industry. Healthcare professionals can enhance patient outcomes and make better clinical decisions by utilizing advanced analytical techniques including clustering, classification, and association. Based on the information gathered, data mining assists in forecasting patient risk factors, recognizing illness trends, and creating personalized treatment regimens. Data mining has become more well-known as a potent technique to manage the enormous volumes of medical data generated every day with the introduction of electronic health records (EHRs).

1.2. Significance of Early Skin Cancer Detection

Early identification is essential for the best chance of survival and a successful course of treatment for skin cancer. The deadliest type of skin cancer, melanoma, has a high cure rate if caught early. However, cancer frequently spreads to other parts of the body as a result of diagnostic delays, which decreases the efficacy of treatment. Healthcare professionals can lower death rates from skin cancer by preventing the disease's progression through early detection techniques. Data mining and other technological developments can be crucial in creating earlier and more accurate diagnosis methods, which will improve the management of skin cancer by healthcare systems.

1.3. Data Mining Techniques in Medical Diagnostics

To aid in clinical decision-making, a number of data mining approaches are used in medical diagnostics. Decision trees and neural networks are two classification algorithms that are used to help patients be categorized according to their symptoms or medical issues. In order to find patterns among patients who share similar characteristics, clustering algorithms put comparable data points together. In order to improve diagnosis accuracy and assist dermatologists in the early detection of skin cancer, machine learning algorithms for image analysis can be used to identify possibly malignant lesions from medical imaging data.

ISBN Number: 978-93-95305-66-2

1.4. Challenges in Patient Health Data Management

The management of patient health data presents a number of difficulties, such as concerns about data security and privacy as well as the difficulty of integrating data from various sources. Data mining applications may be less effective as a result of inadequate and inconsistent records resulting from the fragmentation of patient data among different healthcare providers. Ensuring adherence to data protection laws, such the GDPR in Europe or the HIPAA (Health Insurance Portability and Accountability Act) in the United States, is also a top priority. Technical difficulties also arise, including the requirement for data cleaning, standardization of data formats, and managing substantial amounts of unstructured data.

2. LITERATURE REVIEW

Wolf et al. (2013) examined the accuracy of smartphone apps for melanoma diagnosis, a potentially life-saving feature given the increased global incidence of skin cancer. Mobile apps are tested for their capacity to distinguish benign from malignant skin lesions. Their findings show that many of these apps fail to give accurate results, delaying physician consultation. The review warns against technology-based self-diagnosis and stresses the need for medical examination. Given their rising public use, it raises questions regarding regulatory monitoring of health-related apps. The research emphasizes the need for better algorithms and stronger validation techniques to assure mobile melanoma detection safety and performance.

Delen et al. (2005) examined numerous breast cancer survivorship prediction models using a large dataset and 10-fold cross-validation to compare data mining methodologies. Several linked topics have advanced since early studies. Innovative biomedical technologies measure and record better explanatory prognostic factors, low-cost computer hardware and software automatically collect and store high-volume, high-quality data, and better analytical methods process voluminous data efficiently. Thus, this publication describes a research initiative that used technology advances to construct breast cancer survivability prediction models. The decision tree (C5) had the highest prediction accuracy on the holdout sample (93.6%), followed by artificial neural networks (91.2%), and logistic regression models (89.2%). Sensitivity research on neural network models helped us highlight this review's prognostic elements.

ISBN Number: 978-93-95305-66-2

Chao et al. (2017) included a full analysis of smartphone-based skin monitoring and melanoma detection apps. Smartphone technology is making these digital tools more common in dermatology, according to the authors. These apps can take high-quality skin lesion photographs, assess risk, and follow changes. These apps may help detect melanoma early and involve patients in skin health monitoring, according to the review. However, app accuracy variability, the lack of established validation processes, and patient self-diagnosis without medical advice are additional issues. The review emphasizes the need for more research to confirm these apps' clinical efficacy and create dermatological standards.

Chang and Chen (2009) studied six major skin disorders in five studies. Children and adults get skin disorders. These disorders start for many reasons, and each age group has varied symptoms. In Taiwan's humid, moist, and hot weather, bacteria and molds flourish fastest. UV radiation from the sun can also make skin sensitive, inflamed, and problematic. Internal sebaceous glands, dead skin, perspiration, dust, and other fluids can cause significant skin illnesses in addition to external infections. Many people overlook skin disorders, even though they are easier to detect and cure than inside ailments. Even a little area might cause skin cancer. It creates the best dermatological predictive model using decision tree data mining and neural network classification. The neural network model predicted the most accurately, 92.62%. The least accurate method is sensitivity analysis with decision tree model, at 80.33%. This suggests that AI categorization technology can help doctors diagnose patients and reduce medical waste and improve treatment.

3. RESEARCH METHODOLOGY

Skin cancer detection utilizing image processing was the focal point of this examination. This approach utilizes best in class image processing to distinguish skin cancer in images of skin sores. To distinguish cancer standards such lopsidedness, lines, shade, and measurement, injury image analysis approaches utilize size, surface, and developmental assessment during the feature period of image division. Ordinary endlessly skin cancer sore are both ordered by the produced feature boundaries.

A skin test can be utilized by a dermatologist to analyze skin cancer. Generally speaking, skin cancer might be analyzed and treated dependent just upon appearance. Cancer tracked down through skin biopsy. To make the cancer and biopsy less difficult, lidocaine is used. A little piece of growth is taken after sedation and shipped off a pathologist for analysis. Subsequent to eliminating the development, a

ISBN Number: 978-93-95305-66-2

pathologist inspects it under a magnifying instrument to distinguish any indications of skin cancer. Cancer still up in the air by skin biopsy. Patients with cancer can browse an assortment of skin cancer therapies after these measures are considered:

i. Cryotherapy, in which the doctor uses liquid nitrogen to freeze the growth, killing it off by causing it to disintegrate.
ii. The second option is surgical removal of the cancerous area and its surrounding healthy skin.
iii. With the help of a microscope, the cancerous growth is peeled back layer by layer using the "moss surgery" technique. This process continues until no malignant cells are visible.
iv. Curettage and Electrification: The remaining cancerous tissue is burned with an electric needle as cancer cells are removed using an extended spoon-shaped blade in this operation.
v. Chemotherapy: the destruction of cancer cells is achieved by administering drugs orally, topically, intravenously (IV), or by injection.
vi. Photodynamic therapy: a technique for eradicating cancer cells by combining targeted medicines with laser light.
vii. radiation (section seven): High-energy beams kill cancer cells.
viii. The cancer treatment is biological therapy, which involves stimulating the patient's immune system to attack cancer cells.
ix. Immunotherapy: A client with cancer has a topical cream applied to their skin in order to enhance their immune system.

The extent to which your skin cancer had metastasized to other parts of your body was evaluated by your doctor. Currently, there are five distinct stages of skin cancer.

Some cancers just affect the skin. Minor surgery or removal will cure it. Some surgeons employ Moss surgery to treat face melanoma.

The dermis may be affected by small tumors in this condition. To remove the tumor and its surrounding skin, a wide incision is made while treating stage 1 melanoma. Medical professionals may prefer sentinel lymph node biopsy. Ultrasound nodes allow the doctor to check lymph nodes for cancer on a monthly basis. When using this method, specific medications or immunoassay inhibitors.

ISBN Number: 978-93-95305-66-2

1) Set the input image initials.
2) Assess the medical database using the input photographs as a guide.
3) While (maximum number of inputs < image density).
4) For every database picture.
5) Modify the image database's values.
6) if (image class < input index).
7) If, (values of cancer < maximum image index).
8) Adjust the image's edges based on the identification.
9) If (maximum input index < cancer values).
10) Calculate the image input's cancer index.
11) Modify the picture values.
12) Verify the suggested values for the input cancer guidelines.
13) Identify the type of cancer and report the outcome.
14) Present the outcomes.
15) Finish the procedure

ALGORITHM 1: Enhanced image analysis technique (EIAT)

While the tumor cells themselves do not metastasize, they may enlarge and thicken, and exhibit other symptoms including scaling, bleeding, and shedding large incisions are the standard method of treating stage 2 melanoma. The spread of lymph node malignancy necessitates the usage of SLNB as well. Medications are included in targeted treatment as well.

Cancer can metastasize to other organs and tissues when this happens. The lymph nodes are separated. Following melanoma surgery, patients may be prescribed immunosuppressive inhibitors or undergo targeted therapy if their cancer is BRAF GM. Melanoma patients may also benefit from the BCG vaccine, interleukin-2 injection, or D-VEC immunization. Research indicates a survival percentage of 63.6%.

The stage of melanoma that is most advanced. The lymph nodes, skin, tissues, and organs are all targets of this disease's metastasis, which begins with the main tumor. Radiation, immunotherapy, and

ISBN Number: 978-93-95305-66-2

chemotherapy are administered after surgical excision of this massive tumor. There is a 22.5% chance of surviving

- **Input photos:** We used an enhanced image analysis algorithm trained from raw photos and disease labels to classify skin lesions.
- **Preprocessing:** Preprocessing removes unwanted background components and noise from skin photos to improve photo quality.
- **Module Normalization:** Normalization changes data variables to a specific scale without changing visual contrast or form.
- **Data collection:** If the feature is present, patient data can be dichotomous or discrete.
- **Extracting Features:** Melanoma, normal skin, or moles are the skin lesion types that can be identified by comparing the feature values that were extracted during feature extraction. Use the ABCDEs to remember the symptoms of melanoma in alphabetical order. Asymmetrical, bordered, colored, diameter, and evolving are the ABCDEs. The following skin damage factors are used by doctors to diagnose and classify melanomas.
- **Image Splitting:** Post-preprocessing image segmentation extracts the skin lesion.
- **Image examination:** ABCD images contrasting typical and harmful skin sores.
- **Edge detection:** The detection of cancerous skin injury edges is the subject of this review. Utilizing warm pictures, edge detection calculations have been utilized to find the lines of skin cancer injuries. The sore boundary couldn't be identified by all calculations; be that as it may, some showed guarantee and might be improved.
- **Classifying Images:** Threatening melanomas versus harmless nevi and keratinocyte carcinomas versus harmless seborrheic keratosis were twofold grouping challenges. Clinical and meatoscopic images were utilized to group.
- **Cancer detection:** Skin cancer prediction models use model-driven architecture and deep learning to improve accuracy.

4. DATA ANALYSIS

Enhanced image analysis method (EIAT) was compared to MCSDC, DSSDC, ASCD, and SLCNN skin lesion categorization. Tables 1–5 compare the accuracy of proposed and existing approaches.

ISBN Number: 978-93-95305-66-2

4.1. Early Skin Detection

The prognosis for skin cancer is better compared to other types of cancer. Early detection increases the likelihood of a successful outcome for the se cancers since they contribute to the overall cause. So, it's really important to check your skin frequently. Although dermatologists are trained to spot issues, not everyone has easy access to one, and few people are motivated to prioritize their health. Everyone should get their skin checked regularly because skin cancer can strike at any age, in any ethnic group. When doing self-skin tests, it is important to follow system-specific protocols. In Table 1, we can see how the proposed and existing methods for early detection compare.

Table 1: Early detection comparison of Skin cancer

No. of inputs	MCSDC	DSSDC	ASCD	SLCNN	EIAT
100	90.12	78.12	90.25	77.14	95.63
200	89.25	78.41	89.12	74.63	97.12
300	90.14	78.88	87.52	79.12	95.41
400	88.45	77.14	85.63	74.52	95.41
500	89.65	77.25	84.36	72.36	94.44
600	84.12	75.12	79.14	77.52	98.65
700	86.22	78.96	77.12	69.36	95.41

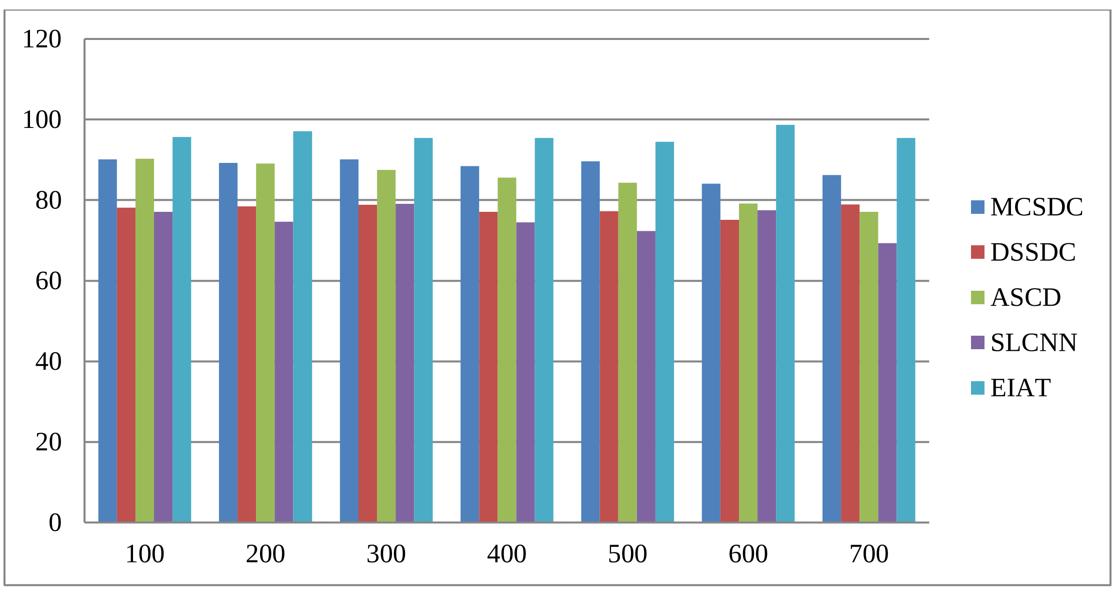

Figure 1: Early detection comparison of Skin cancer

ISBN Number: 978-93-95305-66-2

4.2. Skin Cancer Screening

Evaluating for skin cancer as a rule involves an actual check as well as training of the infection and its risk factors. The specialist will go over sun wellbeing measures, skin cancer avoidance tips, and any expected aftereffects. On the off chance that any uncovered skin patches are found during the skin cancer test, the treating doctor might take a tissue test and send it on. The subsequent stage is to set up the tissue test for infinitesimal analysis by processing and hacking it. Table 2 thinks about the skin cancer screening techniques currently utilized with those that have been proposed.

Table 2: Comparison of skin cancer screening

No. of inputs	MCSDC	DSSDC	ASCD	SLCNN	EIAT
100	90.12	79.12	87.25	75.14	94.11
200	91.25	79.85	89.36	75.12	94.52
300	90.36	74.12	88.88	74.63	95.63
400	94.14	74.12	88.45	75.55	97.41
500	80.00	77.25	84.52	70.36	94.00
600	88.26	77.63	86.25	64.12	94.63
700	89.13	76.25	84.63	65.33	94.23

4.3. Skin Changes Monitoring

Regular self-examinations are essential for detecting any changes in skin condition. Observing skin changes in a well-lit room or during the day will yield the greatest results for this purpose. Inspect your feet and the space between your toes for any unusualities. Ask a trusted family member or friend to check your back and any other areas that could be difficult to see. Moles cover almost everyone's body. Skin cancers include a broad variety of malignancies. Depending on the specific condition and kind of destroyed cell, the first stage could be very different. Table 3 below compares the current methods of early detection with the proposed ones.

Table 3: Skin changes monitoring comparison

No. of inputs	MCSDC	DSSDC	ASCD	SLCNN	EIAT
100	76.12	85.23	84.22	68.36	95.63
200	77.14	84.22	85.63	67.12	95.61
300	75.63	85.63	87.44	66.66	95.25

ISBN Number: 978-93-95305-66-2

400	75.12	87.12	85.69	65.36	94.01
500	74.63	80.00	88.23	65.36	92.30
600	79.52	79.36	80.23	60.23	90.12
700	71.13	79.33	85.66	67.11	98.06

4.4. Black and White Skin Cancer Identification

Separating among highly contrasting skin cancers is fundamental. While skin cancer is still in its beginning phases, there are various key factors that can be valuable. In the event that a fix of pigmented skin is uneven, pale, enormous (in excess of 5 mm in width), differed in variety, and has changed in the beyond 90 days, it will constantly be noticeable. Tingling in a pigmented region is in any case cause for exhaustive skin assessments. The purported white skin cancer, which is commonly tracked down on the face or hands, is a consequence of delayed openness to UV beams in old people. In the underlying stages, the impacted locale frequently gives indications of skin firmness. Table 4 beneath thinks about the present and proposed techniques for recognizing highly contrasting cancer cells.

Table 4: Comparison of black and white cancer cells detection

No. of inputs	MCSDC	DSSDC	ASCD	SLCNN	EIAT
100	74.23	79.51	80.01	65.52	90.12
200	72.30	78.12	79.23	63.12	91.25
300	71.42	77.41	78.14	63.00	90.22
400	70.21	76.25	77.63	62.51	88.52
500	64.25	77.41	76.52	61.12	87.45
600	68.25	74.63	79.12	60.36	86.67
700	63.21	77.12	78.55	68.33	86.61

4.5. UV Protection

Applying sunscreen is an important first step in sun protection, but it's not the only one. In addition to an increase in the likelihood of skin cancer since sunscreens were commercially marketed, several medical professionals now recommend using sunscreen at least ten to fifteen minutes before going outside. In addition, melanoma is the most lethal form of skin cancer, and there is no evidence that sunscreen reduces its risk. Sunscreen use is still advised, though. Table 5 below compares the proposed and existing methods for early detection.

ISBN Number: 978-93-95305-66-2

Table 5: Comparison of UV Protection.

No. of inputs	MCSDC	DSSDC	ASCD	SLCNN	EIAT
100	81.25	86.12	85.63	71.20	99.74
200	79.63	84.63	85.41	63.98	97.41
300	79.55	83.62	84.61	68.52	96.25
400	74.63	81.25	83.21	67.14	94.52
500	79.63	80.25	80.36	66.66	93.12
600	78.25	79.36	89.22	65.21	91.25
700	78.41	77.41	81.36	65.22	90.03

5. CONCLUSION

This study demonstrates the exciting possibilities of modern image processing methods and data mining in patient health management, particularly in the early diagnosis of skin cancer. The Enhanced Image Analysis Technique (EIAT) shows better accuracy in classifying skin lesions and diagnosing malignant situations, outperforming previous approaches in a number of criteria. EIAT facilitates a more accurate and efficient diagnosis by combining preprocessing, normalization, feature extraction, and segmentation, ultimately helping dermatologists make well-informed decisions. The study highlights the value of early identification in improving the prognosis of skin cancer, stressing the necessity of routine skin examinations and expert assessments for prompt management. The incorporation of these technology developments into clinical practice has the potential to improve patient outcomes, lessen the financial burden associated with advanced cancer treatments, and raise public awareness of the hazards associated with skin cancer. Data mining tools and dermatological procedures can work together to improve patient care and revolutionize the way skin cancer is managed as research advances.

REFERENCES

1. *Albahar, M. A. (2019). Skin lesion classification using convolutional neural network with novel regularizer. IEEE Access, 7, 38306–38313.*
2. *Ansari, U. B., & Sarode, T. (2017). Skin cancer detection using image processing. International Research Journal of Engineering and Technology, 4(4), 2875–2881.*
3. *Chang, C. L., & Chen, C. H. (2009). Applying decision tree and neural network to increase quality of dermatologic diagnosis. Expert Systems with Applications, 36(2), 4035-4041.*
4. *Chao, E., Meenan, C. K., & Ferris, L. K. (2017). Smartphone-based applications for skin monitoring and melanoma detection. Dermatologic Clinics, 35(4), 551-557.*

ISBN Number: 978-93-95305-66-2

5. *Chatterjee, S., Dey, D., & Munshi, S. (2015). Mathematical morphology aided shape, texture and colour feature extraction from skin lesion for identification of malignant melanoma. In Proceedings of the International Conference on Condition Assessment Techniques in Electrical Systems (CATCON) (pp. 200–203). IEEE.*

6. *Chen, H., Fuller, S. S., Friedman, C., & Hersh, W. (Eds.). (2006). Medical informatics: Knowledge management and data mining in biomedicine (Vol. 8). Springer Science & Business Media.*

7. *Codella, N. C. F., Nguyen, Q. B., Pankanti, S., et al. (2017). Deep learning ensembles for melanoma recognition in dermoscopy images. IBM Journal of Research and Development, 61(4/5), 1–5.*

8. *Delen, D., Walker, G., & Kadam, A. (2005). Predicting breast cancer survivability: A comparison of three data mining methods. Artificial Intelligence in Medicine, 34(2), 113-127.*

9. *Dhas, C. S. G., Yuvaraj, N., Kousik, N. V., & Geleto, T. D. (2022). DPPSOK clustering algorithm with data sampling for clustering big data analysis. System Assurances, 12, 503–512.*

10. *Hameed, N., Ruskin, A., Hassan, K. A., & Hossain, M. A. (2016). A comprehensive survey on image-based computer aided diagnosis systems for skin cancer. In Proceedings of the 2016 10th International Conference on Software, Knowledge, Information Management & Applications (SKIMA) (pp. 205–214). IEEE.*

11. *Hu, K., Liu, S., Zhang, Y., et al. (2020). Automatic segmentation of dermoscopy images using saliency combined with adaptive thresholding based on wavelet transform. Multimedia Tools and Applications, 79(21-22), 14625–14642.*

12. *Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). Imagenet classification with deep convolutional neural networks. Advances in Neural Information Processing Systems, 25, 1097-1105.*

13. *Ponnusamy, M., Bedi, P., Suresh, T., Alagarsamy, A., Manikandan, R., & Yuvaraj, N. (2022). Design and analysis of text document clustering using salp swarm algorithm. The Journal of Supercomputing, 78(5), 6651-6668.*

14. *Priscila, S., Kumar, C. S., Manikandan, R., Yuvaraj, N., & Ramkumar, M. (2022). Interactive artificial neural network model for UX design. In Proceedings of the International Conference on Computing, Communication, Electrical and Biomedical Systems (pp. 277–284). Springer.*

15. *Wolf, J. A., Moreau, J. F., Akilov, O., Patton, T., English, J. C., Ho, J., & Ferris, L. K. (2013). Diagnostic inaccuracy of smartphone applications for melanoma detection. JAMA Dermatology, 149(4), 422-426.*