**Projects in Machine Learning**

**Group 5**

**Team Members:**

* Praiselin Lydia Gladston
* Sudharsan Tirumal
* ShireeshaThyaranahalli Narayana
* Deepti More
* Abdul Quader Mohammed
* Nagaraju Medaraboina

**Project Title: AI-Powered Skin Disease Detection**

**a. Description:**

Develop an AI-powered system that uses machine learning to detect skin diseases from images provided by users. The system will analyze the images, provide a description of the potential disease, offer recommendations for nearby dermatologists, and suggest if the disease requires isolation or special care measures.

Skin diseases are among the most common health issues in Canada. According to the Canadian Dermatology Association, 1 in 3 Canadians will suffer from a skin condition at some point in their lives.Common conditions include eczema, psoriasis, acne, and skin cancer. Skin cancer is particularly concerning, with approximately 80,000 new cases diagnosed annually in Canada. Using this application, through early detection, the number of cases per year could drastically reduce.

**b. Use Cases:**

**1. Early Detection of Skin Diseases**

The system will analyze images of skin conditions (e.g., rashes, moles, lesions) to detect and diagnose potential skin diseases. It will provide a description of the detected condition and recommend dermatologists nearby. Enables early detection and treatment of skin diseases. Provides users with quick access to professional healthcare. Reduces the need for initial physical consultations.

**Implementation:**

* Utilize CNNs such as EfficientNet or InceptionV3 trained on dermatology datasets to classify skin conditions. Eg: HAM10000 - <https://www.kaggle.com/datasets/kmader/skin-cancer-mnist-ham10000>
* Generate a textual description of the detected condition using natural language processing (NLP) techniques.
* Integrate services to suggest nearby dermatologists.

**2. Monitoring Chronic Skin Conditions**

The system will help patients with chronic skin conditions (e.g., eczema, psoriasis) monitor their condition by regularly analyzing images and providing feedback on disease progression or improvement. Assists in effective management of chronic skin conditions. Provides continuous monitoring and early intervention.

**Implementation:**

* Implement models to track changes over time by comparing current and previous images.
* Use NLP to generate detailed reports on the condition’s progression.
* Recommend follow-up visits with dermatologists based on changes detected.

**3. Identifying Highly Contagious Skin Diseases**

The system will detect highly contagious skin diseases (e.g., impetigo, scabies) and provide guidance on necessary isolation measures and immediate medical consultation. Prevents the spread of contagious skin diseases. Ensures users take appropriate precautions and seek timely medical help. Reduces the risk of outbreaks in communities.

* Train models on datasets of contagious skin diseases.
* Use NLP to provide clear instructions on isolation and hygiene measures if a contagious disease is detected.
* Highlight the urgency and recommend immediate consultation with dermatologists or primary care providers.

**c. Related paper:**

**1. A Web-Based Skin Disease Diagnosis Using Convolutional Neural Networks -** [(PDF) A Web-Based Skin Disease Diagnosis Using Convolutional Neural Networks (researchgate.net)](https://www.researchgate.net/publication/337171348_A_Web-Based_Skin_Disease_Diagnosis_Using_Convolutional_Neural_Networks)

**Inference:**

Authors have suggested to research performance using hybrid 8machine learning models for this project since the model they used in the paper had just 60% of accuracy for the validation set and 80% of accuracy for the training set.

**d. Challenges and Solutions:**

**Data Privacy:** Ensure user data is securely stored and complies with regulations (e.g., GDPR, HIPAA).

**Model Accuracy:** Continuous improvement through regular updates and retraining with new data.

**User Engagement:** Educate users on how to take clear and accurate images for better analysis.

**e. Future Directions:**

**Expanded Dataset:** Incorporate more diverse images to improve model accuracy across different skin types.

**Integration with Wearables:** Connect with smart devices to monitor skin health continuously.

**Real-Time Diagnosis:** Develop a mobile app for instant analysis and feedback.

**f. Literature Survey:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NO.** | **TITLE** | **AUTHOR AND YEAR** | **ALGORITHM AND TECHNIQUE** | **APPLICATIONS** |
| **1.** | **AI-Powered Diagnosis of Skin Cancer: A Contemporary Review, Open Challenges and Future Research Directions** | Navneet Melarkod, Kathiravan Srinivasan, Saeed Mian Qaisar, Pawel Plawiak  **YEAR - 2023** | Machine learning models, SVM, Navies Bais, Models, Long Short-Term Memory ,Deep Belief Network , CNN, RNN, man-machine systems; skin cancer; skin neoplasms.  Skin cancer diagnosis remains a significant global health concern, necessitating early detection for effective treatment. AI-based methods, particularly machine learning and deep learning, offer promise in automating diagnosis processes, potentially reducing morbidity and mortality rates associated with skin cancer. | AI healthcare for skin cancer diagnosis offers potential, but it must address prerequisites and biases.  Dermatologists should embrace AI as a complimentary tool while working to enhance lesion identification accuracy. |
| **2.** | **Artificial intelligence for skin cancer detection and classification for clinical environment: a systematic review** | Brunna C. R. S. Furriel Bruno D. Oliveira , Renata Prôa1 , Joselisa Q. Paiva , Rafael M. Loureiro , Wesley P. Calixto , Márcio R. C. Reis and Mara Giavina-Bianchi  **YEAR- 2024** | Research identification, selection, eligibility, data extraction, and data synthesis. Descriptive Analysis.  This systematic review focuses on the detection, categorization, and assessment of skin cancer pictures in clinical settings. | Artificial intelligence shows great promise for improving skin lesion detection, notably for melanoma. While advances in image processing and deep learning offer promise for real-time diagnostics, clinical validation and collaboration with healthcare experts are critical to ensuring efficacy and patient-centric care. |
| **3.** | **A Study on the Application of Machine Learning and Deep Learning Techniques for Skin Cancer Detection** | Hritwik Ghosh, Irfan Sadiq Rahat, Sachi Nandan Mohanty, J. V. R. Ravindra, Abdus Sobur  **YEAR - 2024** | Skin cancer diagnosis relies on precise detection, which is sometimes hampered by invasive and time-consuming procedures. Leveraging AI, particularly Deep Learning (DL), has promise for effective categorization using neural network simulations. This paper presents a hybrid deep learning model that combines VGG16 and ResNet50 to address class imbalances and improve classification performance, enhancing the potential for precise skin cancer diagnosis. | The study demonstrated the effectiveness of various DL architectures, such as DenseNet121 and ResNet50, in skin cancer identification, achieving high accuracy and precision scores. However, while these models offer promising support to dermatologists, they are not substitutes for professional medical diagnoses, highlighting the need for ongoing research and enhancements to ensure reliability in real-world clinical settings. |

**REFERENCE :**

Melarkode, N., Srinivasan, K., Qaisar, S. M., & Plawiak, P. (2023). AI-powered diagnosis of skin cancer: a contemporary review, open challenges and future research directions. Cancers, 15(4), 1183.

Furriel, B. C., Oliveira, B. D., Prôa, R., Paiva, J. Q., Loureiro, R. M., Calixto, W. P., ... & Giavina-Bianchi, M. (2024). Artificial intelligence for skin cancer detection and classification for clinical environment: a systematic review. Frontiers in Medicine, 10, 1305954.

Ghosh, H., Rahat, I. S., Mohanty, S. N., Ravindra, J. V. R., & Sobur, A. (2024). A Study on the Application of Machine Learning and Deep Learning Techniques for Skin Cancer Detection. International Journal of Computer and Systems Engineering, 18(1), 51-59.