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HealthScan AI: An Intelligent Health Insight Using CNN

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Project Guide
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Outline

- Introduction
- Literature Survey of the existing systems
- Limitations of the existing systems
- Problem statement
- System Design
- Technologies and methodologies
- Implementation
- Conclusion
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Introduction

- Motivation :

  - In the realm of healthcare, the constant pursuit of innovative solutions for disease diagnosis is paramount to improving patient outcomes and overall healthcare efficiency, thus one such revolutionary approach is the utilization of Convolutional Neural Networks for medical image classification.

  - The motivation behind research in CNN-based image classification promises enhancing the precision and speed of disease diagnosis.

  - To Develop a user friendly disease scanning tool where user inputs image of the symptom. The algorithm will classify the image and predict the particular disease respectively.

Introduction

- Objectives:

- To develop AI systems that can accurately detect brain tumors at an early stage using medical imaging techniques such as MRI scan.

- To analyze images of the skin and detect early signs of certain skin conditions

- To predict the likelihood of pneumonia in patients. Early prediction reducing the risk of complications and improving prognosis.

- To analyze retinal images and detect signs of diabetic retinopathy, a common complication of diabetes that can lead to vision loss if untreated.

Literature Survey

Authors	Year	Imaging Modality	Classification Target	Precision/ Accuracy	Models/ Techniques
Salehi, A.W.; Khan, S.; Gupta	2023	Ultrasound, X-ray, CT	Normal Control (NC) and Pneumonia	Ultrasound: 100% Precision; X-ray and CT: 93%	Pre-trained VGG-19 performed best on ultrasound images, demonstrating effectiveness on noisy data
Sarvamangala DR, Kulkarni RV.	2021	CT	Lung Nodule Detection	97.17% Accuracy	Used gradient class activation for visualizing internal CT structure; Outperformed AlexNet 2D-CNN and AlexNet 3D-CNN

Literature Survey

Authors	Year	Imaging Modality	Classification Target	Precision/ Accuracy	Models/ Techniques
Yadav, S.S., Jadhav, S.M.	2019	Lung Image Patches	Interstitial Lung Disease (ILD)	95% Accuracy	Compared results with LBP, SIFT, and unsupervised RBM feature extraction methods
Abdar M, Yen N, Hung J	2018	MRI, Diffusion-Tensor Imaging (DIO)	Alzheimer's Disease (AD)	96.7% Accuracy	Used a six-layered CNN with data fusion model; Emphasized ROI size's minimal impact on classification

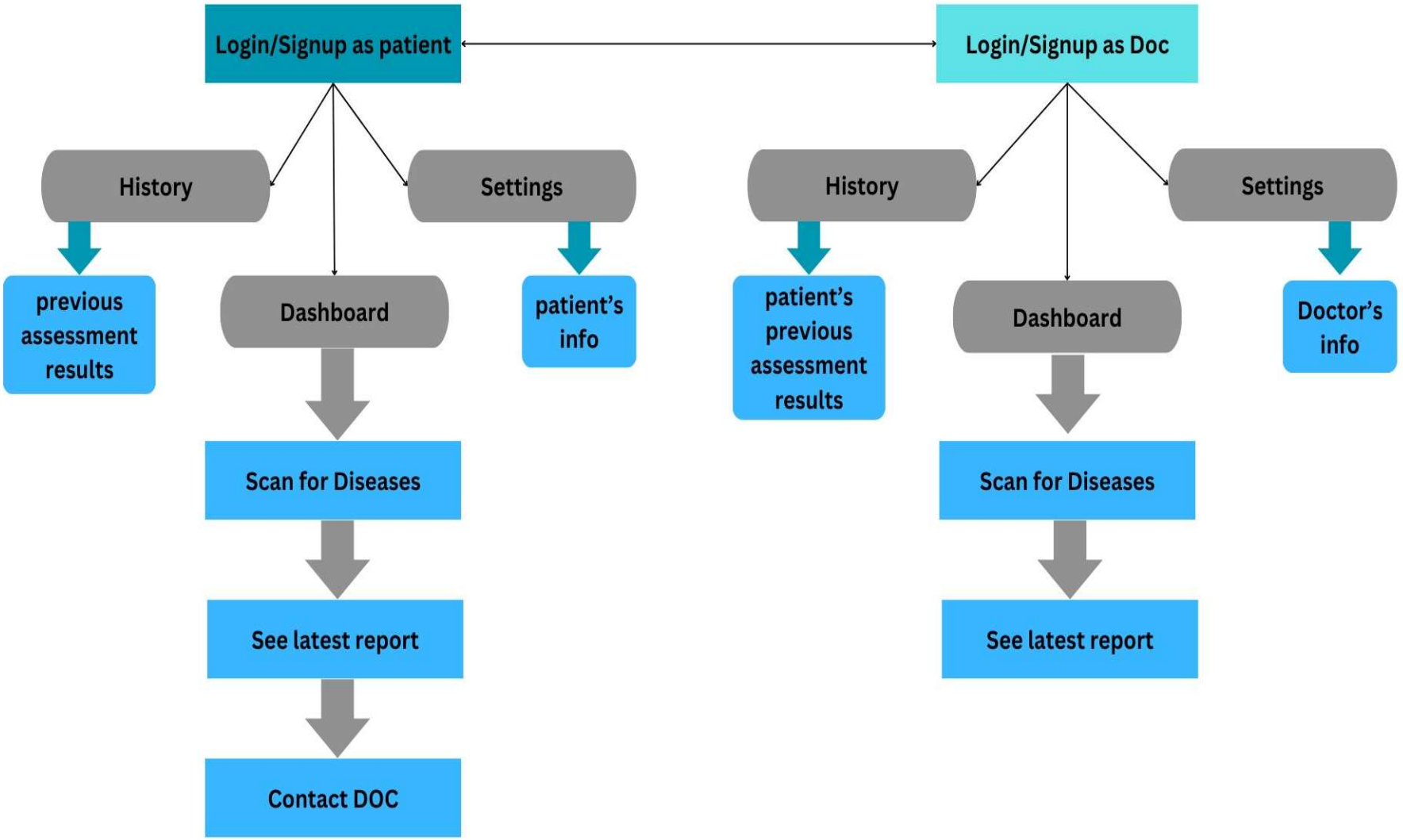
Limitations of existing systems

- **Explainability:** We found out Some AI models lack interpretability. This makes it challenging for healthcare professionals to understand the rationale behind the model's predictions, hindering trust and acceptance in clinical practice.
- **Data Quality:** Many health scan AI systems rely on large datasets for training and validation. However, these datasets may suffer from issues such as incomplete or biased data, leading performance and generalization problems.
- **Legal Concerns:** We analyzed that Health scan AI raises various ethical and legal considerations, including patient privacy, data security, and liability issues it is crucial to safeguarding patient confidentiality and preventing unauthorized access or misuse of sensitive medical Information.
- **Reliability:** Some models involve complex and often opaque algorithms that may not be easily understood by humans. This raises questions about the responsibility, and transparency of AI decisions, For instance, who is liable if an AI model makes a wrong diagnosis or misses a critical finding, How can the privacy and security of the data used by AI be protected

Problem Statement

- **Diagnostic Delays and Inefficiencies**: Traditional diagnostic processes often involve manual interpretation of medical images and clinical data, which can be time-consuming and prone to human error. Delays in diagnosis can lead to delayed treatment initiation, disease progression, and poorer patient outcomes
- **Rising Healthcare Costs and Resource Constraints**: The increasing diseases and age-related conditions, has led to rising healthcare costs, traditional diagnostic approaches may not be cost-effective or scalable, further straining healthcare budgets and limiting access to timely diagnostics
- **Limitations in Availability**: Rural and underserved areas, lack access to specialized healthcare services and expert medical professionals. As a result, patients in these areas may experience delays in receiving diagnostic evaluations and appropriate care, exacerbating health disparities.

System Design



Technologies and Methodologies

[1] Convert the Image into Numpy array ; Image shape = Height , Width , Color channel.

For Eg : [array([True, False, False, False]), array([True, False, False, False])]

[2] All values are pixel brightness values between 0 and 255 , Hence arrays are turned into tensor values :

```
<tf.Tensor: shape=(2, 512, 3), dtype=uint8, numpy=
array([[[0, 0, 0],
        [0, 0, 0],
        [0, 0, 0],
        ...,
        [1, 1, 1],
        [1, 1, 1],
        [1, 1, 1]],

       [[0, 0, 0],
        [0, 0, 0],
        [0, 0, 0],
        ...,
        [1, 1, 1],
        [1, 1, 1],
        [1, 1, 1]]], dtype=uint8)>
```

[3] The top highest prediction confidences along with the truth label for sample are plotted .

For Eg : array ([0.2, 0.6, 0.1, 0.1]) , array ([False, True, False , False]) .

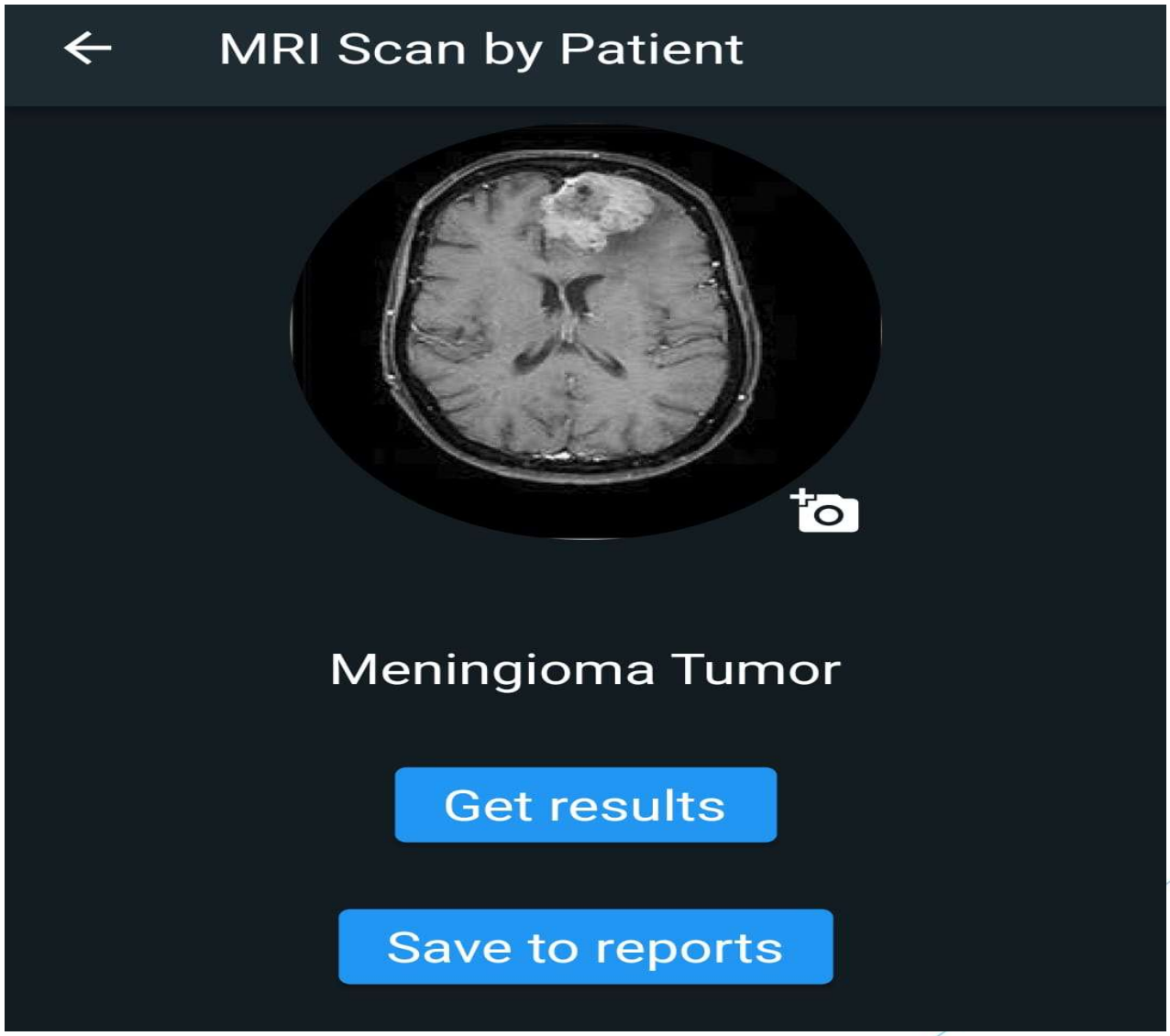
[4] Number of Labels will be Directly Proportional to Dimensions of Array .

Technologies and Methodologies

1. Convolution Neural Network [Image Classification using Supervised Learning]
2. Google Colab notebook
3. Python 3.11.5
4. Tensor Flow hub 0.14. 0
5. Tensor flow 2.13.0
6. Flutter 3.3.1 (GUI)
7. Fire Base 13.1.0 (Database)

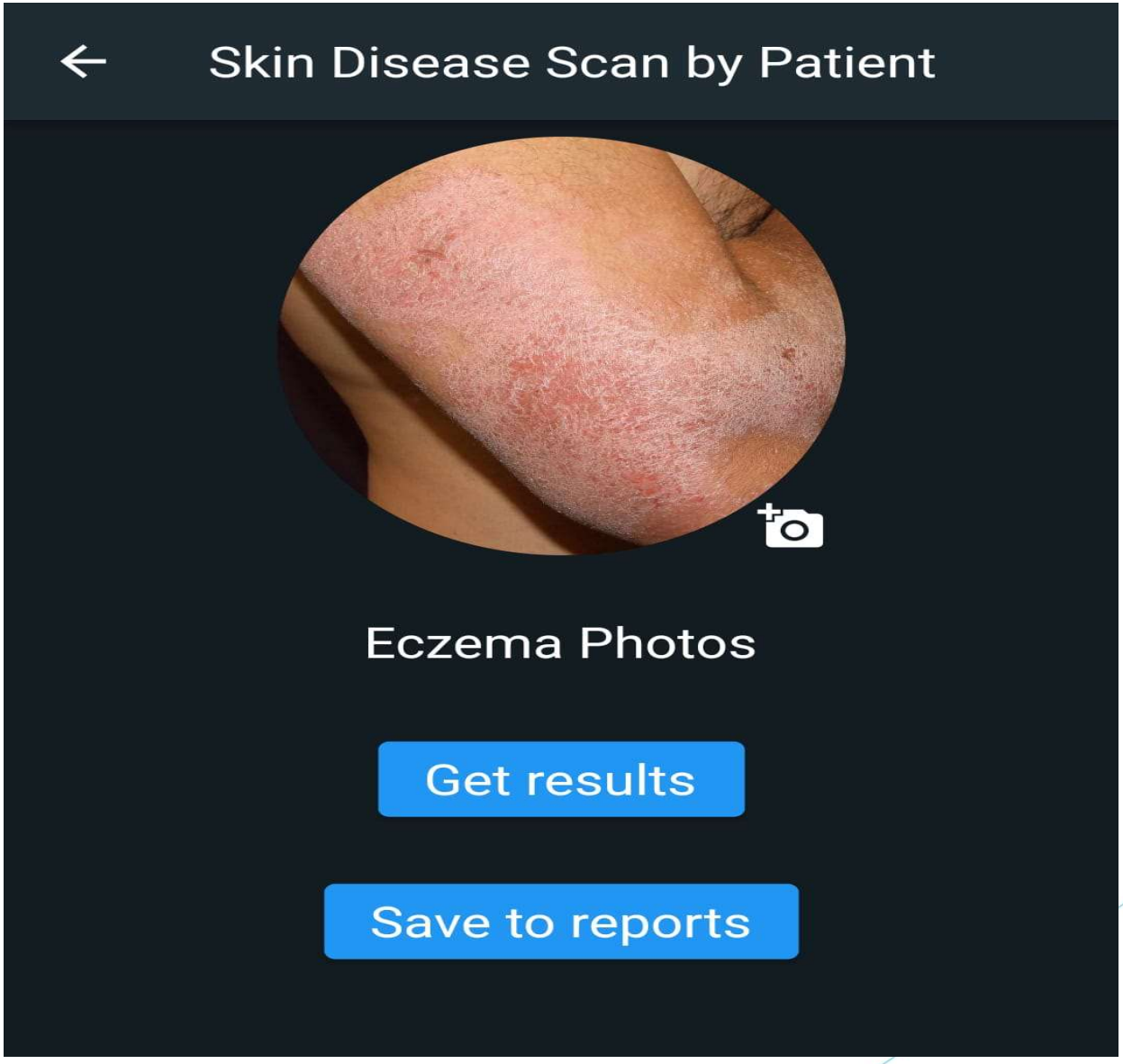
Implementation

Brain Scan Prediction:



Implementation

Skin Care Scan Prediction:



Conclusion

For the 1st part of the project, we have succesfully implemented as well as integrated the Brain Scan and Skin Care Scan models with an accuracy of 93% and 91% respectively.

Along with other two models , we have also started working on the feature like chat page between the Doctor and Patient.

References

[1] Salehi, A.W.; Khan, S.; Gupta, G.; Alabduallah, B.I.; Almjally, A.; Alsolai, H.; Siddiqui, T.; Mellit, A. “A Study of CNN and Transfer Learning in Medical Imaging: Advantages, Challenges, Future Scope.” Sustainability 2023, 15, 5930. https://www.mdpi.com/journal/sustainability

[2] Sarvamangala DR, Kulkarni RV. “Convolutional neural networks in medical image understanding: a survey”. Evol Intell. 2022;15(1):1-22. doi: 10.1007/s12065-020-00540-3. Epub 2021 Jan 3. PMID: 33425040; PMCID: PMC7778711. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7778711/

[3] Yadav, S.S., Jadhav, S.M. “Deep convolutional neural network based medical image classification for disease diagnosis.” J Big Data 6, 113 (2019). https://doi.org/10.1186/s40537-019-0276-2

[4] Abdar M, Yen N, Hung J (2018) “Improving the diagnosis of liver disease using multilayer perceptron neural network and boosted decision tree.” J Med Biol Eng 38:953–965. https://doi.org/10.1007/s12652-021-03612-z

Thank You...!!