anveshan

ANVESHAN 2024 FELLOWSHIP

Team Name: MedVision Innovators

Project Theme:

Medical image recognition（Identify the presence of tumors, bleeding, or health based on ultrasound /CT/MR Images)

Drive Link for the video:

https://drive.google.com/file/d/1a2wvaAhOCKm-CCzpWIBKd_kgmG3NT_19/view?usp=drive_link

1) Project Title

MediScan: AI-Driven Medical Imaging and Documentation

2) Introduction

Our innovation focuses on using machine learning (ML) techniques to improve the precision and effectiveness of medical imaging for the diagnosis of lung cancer via CT scans and brain tumours using MRIs in response to the changing healthcare landscape in India. Our objective is to create strong machine learning models that can efficiently analyse and categorise medical pictures, facilitating accurate diagnosis, its parameters and treatment planning.

Our approach, which is in line with India's Digital India and Smart City programmes, uses AI-driven model predicted image analysis to diagnose the specific disease. For clinical research and detailed investigations, we provide scalable data management by containerising anticipated and labelled pictures into a structured database.

In addition to above, automated voice-to-text technology also makes it easier to record and retrieve clinical notes, which improves both operational effectiveness and the standard of patient care.

3) Detailed Problem Statement and Prescribed Solution

Problem Statement: The primary goal of our project is to solve the crucial problem of correctly identifying and categorising medical disorders from ultrasound, CT, and MRI images, including tumours, bleeding, and abnormalities in health. The field of medical imaging is complicated and has several different modalities; correct interpretation of each requires unique algorithms and approaches. The work becomes more complex due to variations in picture quality, resolution, noise levels, and anatomical variances. To guarantee data consistency and clarity, strong preprocessing techniques are required. For clinical applications, where a correct diagnosis directly affects patient treatment and results, achieving high accuracy and recall rates is critical. In order to help healthcare professionals in their decision-making processes, integrating these capabilities into clinical workflows presents new problems that call for safe data handling, real-time analysis, and its seamless integration.

Prescribed Solution: The project offers a comprehensive solution that makes use of new-age machine learning algorithms specifically designed for medical image identification & recognition in order to efficiently handle these problems. The process starts with data collecting, putting together a varied and annotated dataset of MRI, CT, and ultrasound pictures that reflect different medical problems. Thorough preparation procedures guarantee consistency between datasets, standardise image formats, and improve quality through noise reduction & pixel augmentation. Transfer learning from pretrained architectures such as VGG16 & Resnet101 is used to choose and fine-tune machine learning models, in particular convolutional neural networks CNNs for each imaging modality. The main goal of training is to maximise the models' sensitivity, specificity, and accuracy. To guarantee reliable performance, these models are cross-validated. The models that have been deployed will be incorporated into intuitive interfaces that allow doctors to input photos, obtain real-time diagnostic insights, and safely save the results. These interfaces will be containerised for scalability and security. Voice-to-text technology, which automates clinical recording, improves workflow efficiency and supports complete patient care while also advancing digital health technology.

4) Uniqueness of the project

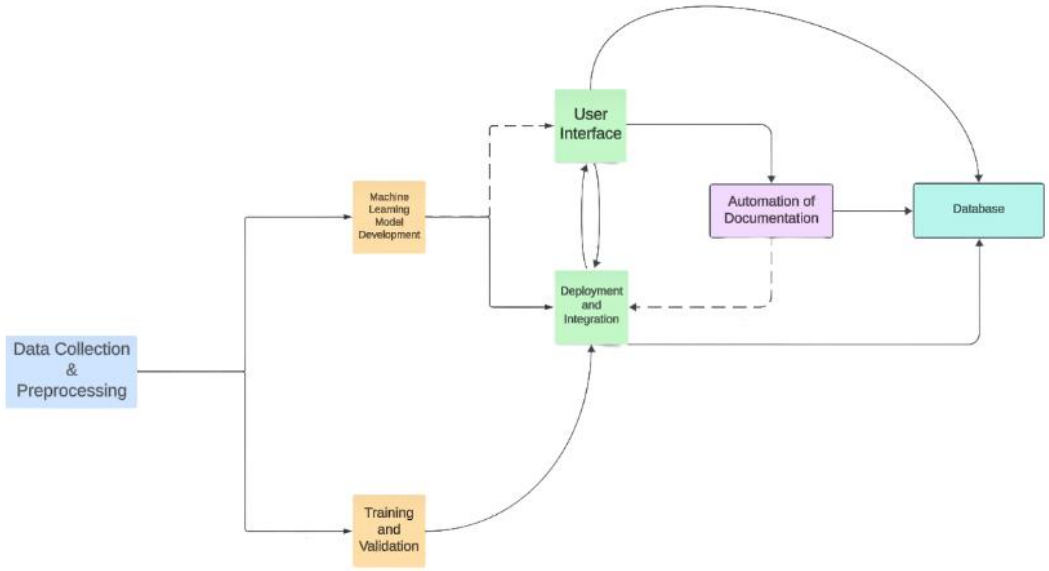
Our project is distinct from other medical image recognition systems because of a number of special features. First off, while there are various products and solutions available in the market that concentrate on AI-driven diagnosis from medical pictures, our proposal aims to provide a thorough method that covers a variety of modalities, including MRI, CT, and ultrasound. Our comprehensive approach makes it possible to have a single platform that can handle many imaging modalities, something that is less typical in existing products that frequently focus on only one modality, and it is something which is easy to use & operate.

Additionally, we leverage cutting edge neural network topologies and sophisticated machine learning techniques, such as transfer learning & models such as VGG16, to highlight resilience in our project. In comparison to conventional approaches, this strategy may result in lower processing costs by optimising computing efficiency and improving accuracy in the diagnosis of medical conditions.

In terms of innovation, our system is easy to include into clinical workflows and provides automatic voice-to-text documentation together with real-time diagnostic findings. By enabling faster decision-making and more precise treatment plans, this integration not only improves patient care results but also increases operational efficiency for healthcare professionals.

Our approach intends to make advanced medical picture recognition realistic and accessible for healthcare professionals by emphasising scalability, security, and user-friendliness interfaces. This would eventually improve diagnostic capabilities and further breakthroughs in digital health technology.

5) System or Concept level Block Diagram



6) What do you want to achieve on the project if you are selected?

Our main objective throughout the course of the six-month development period, if we were chosen for Anveshan, would be to complete a working prototype of the Medical Image Recognition System (MIRS). This involves creating and optimising machine learning models to reliably identify cancer, bleeding, and abnormalities in health using ultrasound, CT, and MRI scans. In addition to thorough testing and validation, integration into a proper user interface for medical practitioners & doctors would ensure the correctness and dependability of the system. Our goal is to test the prototype in the field and get valuable input to improve its usability and performance. Workflow efficiency and usability would also be improved by putting secure data management procedures into place and automating clinical documentation using voice-to-text technology. The prototype's suitability for future scaling and real-world application will be ensured by ongoing iteration based on user input and technology improvements, highlighting its potential influence on enhancing diagnostic capabilities in healthcare settings, and we would like to work in this specified direction.

7) What are your long-term plans to take this project forward?

Our team is passionate about developing our medical image recognition technology into a long-lasting and productive tool in healthcare, looking beyond the first six months of development. After prototyping, we want to scale our system across many healthcare institutions and continue to work with medical professionals to improve its usability and efficacy. Our long-term plan calls for developing machine learning models continuously, forming strategic alliances to increase market penetration, after obtaining necessary regulatory compliance to enable broad acceptance. Our goal is to equip medical professionals with cutting-edge real time diagnostic tools so they may better serve patients and raise the bar for medical imaging technology.

8) What would be the possible Limitations of your proposed solution to the problem?

We may encounter constraints in the diversity of data quality that affect the generalizability and accuracy of our Medical Image Recognition System(MIRS). Differences across CT, MRI, and ultrasound modalities make interpretation and performance consistency difficult. Continuous improvement is necessary to handle complicated or uncommon medical problems that are not well represented in training data. Important factors to consider include ethical issues such patient data protection and regulatory compliance. Optimising our solution's dependability and efficacy in actual healthcare settings requires addressing these issues via ongoing assessment, modification, and cooperation with medical experts.

9) What Hardware, Software and Cloud platforms would you plan to use?

Hardware:

1. ARM-based microcontrollers
2. Sensors for data acquisition
3. High-performance computing platforms for deep learning tasks

Software:

1. TensorFlow or PyTorch for developing and training deep learning models
2. Python programming language for scripting, data manipulation, and integration
3. OpenCV for image processing and computer vision tasks
4. Flask or Django for developing web-based user interfaces

Cloud Platforms:

1. AWS (Amazon Web Services) or Azure for additional cloud computing resources
2. Docker for containerization of our application
3. PostgreSQL or MongoDB for database management

10) References

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