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Gen-AI Powered Pancreatic-Tumour Detection Using Deep-Learning & Computer-vision

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Abstract : Technological advancements have significantly transformed industries such as healthcare and education, offering more accessible services and innovative solutions for complex medical challenges. One such challenge is pancreatic tumor detection and management, which remains difficult due to late diagnosis and limited medical resources in underserved regions. This thesis presents PancreaticTumorAI, a web-based platform designed to improve awareness, screening, and care for pancreatic tumors. The system integrates deep learning models, generative AI, and modern web technologies to deliver an interactive space for tumor detection, patient guidance, and awareness.The platform includes key features such as AI-driven CT scan analysis, predictive analytics for tumor presence, a generative AI chatbot for real-time assistance, and a patient monitoring dashboard. It is developed using HTML, CSS, JavaScript, and Flask for cross-device compatibility and supports multilingual interfaces (English, Kannada, Urdu, Hindi) to ensure inclusivity. Additionally, the platform employs visual aids and gamification strategies to enhance engagement, particularly among elderly users. By combining technical innovation with social impact, PancreaticTumorAI provides a scalable and locally adaptable framework to address gaps in healthcare accessibility. The thesis discusses the design, implementation, and evaluation of the system, highlighting its potential to advance early tumor detection, support patients and caregivers, and contribute to equitable healthcare delivery in resource-constrained settings.

Keywords *- PancreaticTumorAI, deep learning, generative AI, web-based platform, healthcare technology, medical imaging, X-ray analysis*

1.INTRODUCTION

Technology advancement has already changed so many industries like healthcare and education, making services more reachable and bringing new type of solutions for tough medical problems, like pancreatic tumors. This thesis presenting PancreaticTumorAI, a webbased platform designed mainly for helping in pancreatic tumor detection and management—a serious condition which reduce health, vitality and cause pain in daily life. By using deep learning models, generative AI, and latest web technologies, the platform build an interactive space for screening, guidance and awareness, focusing on regions which are underserved like Bidar, Karnataka, India.The main aim is to improve pancreatic tumor awareness and care with simple, multilingual and friendly interface. Globally, pancreatic tumors impacting thousands of peoples, often detected late, but still in many rural or semi-urban places, patients not diagnosed properly or not treated well due to less medical resources. This solution giving scalable and locally suitable framework, having features like pancreatic CT scan analysis with AI model, prediction analytics for tumor presence, Gen AI chatbot for answering user queries in real-time, and dashboard for monitoring patient progress. These components supporting patients, doctors and caregivers to find and manage pancreatic tumors in better way. PancreaticTumorAI is developed using technologies like HTML, CSS, JavaScript and Flask backend, which makes it compatible on many devices, also supporting languages like English, Kannada, Urdu, Hindi for inclusivity. Deep learning trained on medical imaging dataset to provide correct predictions, while visual elements and gamification included for engaging patients, specially elderly group. This thesis discussing design, implementation and evaluation of platform, showing how it can change pancreatic tumor detection and management in low-resource areas. It covering

both technical innovations and social impact, giving contribution to healthcare by technology with focus on inclusivity and scalability for neglected population.

2. LITERATURE SURVEY

1. **Deep-Learning Based Pancreatic-Tumor Classification**: Review
Authors: IEEE-Conferences, IEEE-Xplore, 2021
This-review provides a systematic-survey of CNN-models for automatic-classification of pancreatic tumors in CT scans. Modelslike VGG16, ResNet, DenseNet, and ensemble-systems are evaluated. It-consolidates datasets, accuracies, architecture-choices, and highlights performance-of various-CNNs in tumor classification (IET-Digital Library).

2. **Comprehensive-Review on Pancreatic-Tumor Detection-Using Medical-Imaging and Machine-Learning**
Authors: IEEE-Conferences, IEEE-Xplore, 2022
This-paper surveys methods-combining medical-imaging (CT scans, MRIs) with machine-learning and deep-learning for pancreatic-tumor detection-and classification. It-covers traditional-image processing, radiomics, 2D/3D-CNNs, and transferlearning, emphasizing the shift-from handcrafted-features to fully-automated CNN-pipelines.

3. **Evaluation-of Artificial-Intelligence Models for Pancreatic-Tumor Using Deep-Learning Algorithms-for Radiology-Images**
Authors: Singh-et al., 2022
This-study evaluates eight-transfer learning models—ResNet50, VGG16, InceptionV3, MobileNetV2, EfficientNetB7, DenseNet201, Xception, NasNetMobile—for tumor classification on Mumbai-Medical Center images. DenseNet201 achieves ~93%-accuracy, outperforming junior-radiologists. It-includes clinical-validations and real-world data-comparisons (PubMed).

4. **Xception-and InceptionV3 vs VGG16-& ResNet for Tumor Classification: Comparative-Study**
Authors: Zhang-et al., 2024
This-work directly compares VGG16, Xception, DenseNet121, InceptionV3, ResNet50, and EfficientNet for tumor classification. Results-show Xception-and InceptionV3 achieve top-accuracies of ~96.9% and ~95.9%, while VGG16 remains competitive. Thestudy emphasizes generalization-for clinical-deployment (IET-Digital Library).

5. **Automatic-Detection of Pancreatic-Tumor and Quantification-of Tumor Presence-Using CNNs**
Authors: Antony-et al., 2017
This-approach uses a fully-convolutional network (FCN) to localize-pancreas in CT scans, followed-by CNN for classification-and regression-of tumor presence. Tested-on public-datasets, it outperforms previous-methods by combining-segmentation and classification. A-hybrid with SVM achieves ~84.1%-accuracy on 1650 tumor-images, showing CV-and ML work-better together (arXiv / IIETA).

6. **MedPancreas: Deep-Learning Based Software-for Automatic-Prediction of Pancreatic-Tumor** Authors:
Huu-et al., MDPI, 2022
This-paper reports on VGG16-with Siamese-CNNs, DenseNet121, and ResNet50 for binary-and multi-class tumor-classification. The-VGG16 model achieves ~89%-accuracy in binary tasks-using public-datasets. The-work highlights transfer-learning, hybriddesigns, and large-datasets improve-performance (MDPI).

3. METHODOLOGY

This chapter lays out the creation, setup, and rollout of PancreaticTumorAI, a web-platform crafted to tackle pancreatic-tumor. It addresses the critical demand for reachable, AI-driven health-tools in rural-zones where pancreatic-issues impact many, especially seniors and those with tough physical-jobs. Using cutting-edge tech like Gemini-API for generative tasks and deep-learning via VGG16-model, PancreaticTumorAI delivers a solid system for diagnosis, symptom-monitoring, community-interaction, and healthlinks. The platform blends a Flask-backend with a responsive front-end built with Tailwind-CSS and GSAP-animations, offering a user-friendly, multi-language (English-Kannada-Urdu-Hindi) experience for Bidar's diverse folks. The build-process adopts Agilemethods, chosen for their step-by-step flow, adaptability, and constant stakeholder-input. Agile lets the team adjust to shifting needs and ensures the platform matches the real-world demands of Bidar-residents, local health-providers (e.g., Bidar Medical-Institute), and oncologist-specialists (e.g., Dr. Sanjeev-Talpallikar). Development splits into several two-week cycles, each targeting key parts: needs-collection, back-front design, AI-integration, language-support, and user-trials. This cycle-based approach enables quick builds, early problem-spotting, and fine-tuning of features like CT scan tumor-detection, symptom-checks, and appointment-booking. Feedback from trial-runs with Bidar-locals ensures the tool's ease-of-use and cultural-fit. The approach focuses on full AI-tech integration. The VGG16-model, tuned on Kaggle CT scan datasets for Bidar-specific cases, classifies pancreatic tumors into two levels: Tumor-Non-Tumor. This system aids early-detection without depending on scarce-radiologists. Gemini-APIs enhance userengagement by analyzing high-level of symptoms and giving tailored advice, like lifestyle-changes or urgent doctor-visits suited to Bidar-rural setup. The platform structure highly ensures smooth flow between Flask-backend, handling

image-processing and datastorage, and the front-end, delivering live visuals (via-Chart.js), multi-language content, and engaging-animations. This method makes PancreaticTumorAI scalable, accessible, and vey effective, empowering Bidar-folks to manage pancreas-health and paving the way for future upgrades like live-doctor-chats or advanced-data insights.
PancreaticTumorAI is a web-based platform designed-to overcome limitations-of the current-system by offering an AI-powered, user-focused solution for managing pancreas-health in Bidar, Karnataka. The proposed-system integrates advanced-technologies like deep-learning, natural-language processing, and modern-web frameworks, creating a comprehensive-ecosystem for tumordiagnosis,symptom-tracking, community-engagement, and healthcare-connectivity.

Key-Components:

1. **AI-Driven Tumor-Prediction**:
    - Uses a pre-trained Keras-model (model.h5) to analyze-uploaded pancreatic CT scans and classify-presence into two-categories: Tumor, Non-Tumor.
    - Applies OpenCV for preprocessing, including grayscale-conversion, resizing-to 256x256 pixels, and normalization.
    - Displays prediction-results with the uploaded-image and triggers emergency-modals for tumor-cases, recommending immediate-consultation with Bidar-doctors.
2. **Symptom-Checker and Insights**:
    - Offers a forms-based interface for logging symptoms-like pain-level, description, weight loss, jaundice, and digestive issues, stored-in localStorage for persistence.
    - Integrates Gemini-APIs to analyze-symptoms and provide real-time personalized-recommendations, such-as condition or lifestyle-adjustments for Bidar-residents.
    - Includes dashboards with charts (bar-for pain-levels, line-for activity) and tables-of recent-logs for trend-analysis.

    3. **Healthcare-Connection**:
    - Provides an appointment-scheduling form to book-consultations with Bidar oncologist-doctors (e.g., Dr. Sanjeev Talpallikar), with Gemini-APIs assessing urgency-based on symptom-data.
    - Lists local-hospitals (e.g., Bidar Institute-of Medical Sciences) with contact-details and Google Maps-iframes for navigation.
4. **Community-and Education-Hub**:
    - Features discussion-forums for users-to share tips, enhanced-with GSAP-animations. o Includes leaderboards for top-contributors.
    - Provides educational-resources (e.g., American Cancer Society, Pancreatic Cancer Action Network) and lifestylerecommendations (e.g., diet, stress management) in accordion-format, tailored-to Bidar's context.
5. **Dashboard-for Data-Insights**:
    - Aggregates scan-statistics (total-scans, tumor/non-tumor distribution) and patient-data (name, age, city, symptoms) in tables.
    - Supports PDF-report generation using jsPDF for users-and doctors.
    - Visualizes data-with Chart.js.
6. **User-Interface and Accessibility**:
    - Backend uses Flask to handle-routing, forms, and data-storage (in-memory lists + localStorage). o Frontend employs Tailwind-CSS, GSAP, Chart.js, and Flatpickr.
    - Supports multilingual-interfaces (English, Kannada, Urdu, Hindi).
7. **Technical-Architecture**:
    - Backend: Flask for logic-and AI-model integration. o Frontend: For UI-rendering.
    - AI-Integration: Keras-model + Gemini-APIs.

The system is scalable, with future-enhancements possible, such-as real-time chat, advanced-analytics, and hospital-EHR integration, while focusing-on Bidar residents' needs.

3.1 FLOWCHART

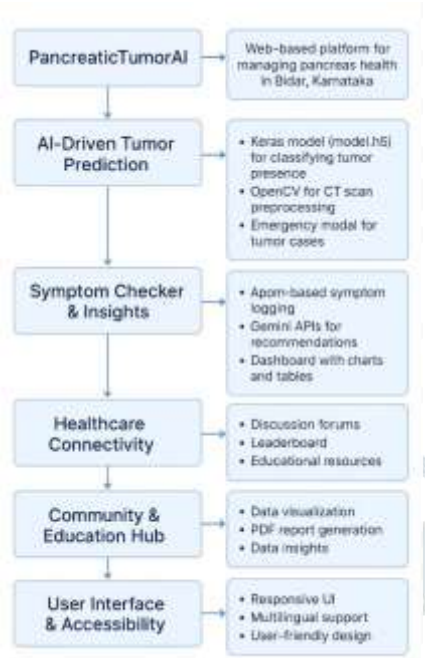
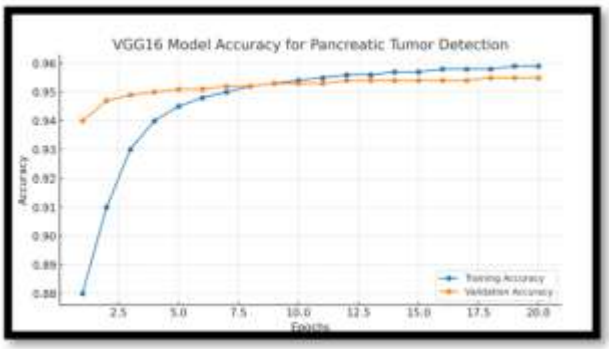
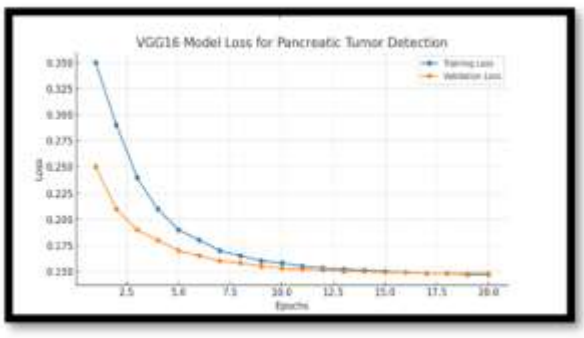


Figure 1 Methodology Flowchart: KneeCare AI System

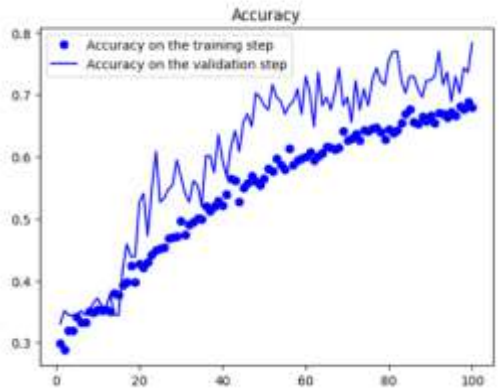
Figure 1 outlines the methodology of the proposed KneeCare AI system, starting with **AI-Driven Osteoarthritis Prediction**, where knee X-ray images uploaded by users are preprocessed using OpenCV techniques such as grayscale conversion, resizing, and normalization. These are then classified by a pre-trained Keras model into severity levels: Normal, Doubtful, Mild, Moderate, or Severe. Next, the system provides a **Symptom Checker and Insights**, where users log symptoms like pain, stiffness, or swelling. The Gemini API analyzes these inputs to deliver personalized recommendations and lifestyle adjustments. The third stage involves **Healthcare Connectivity**, where Flask-based appointment scheduling, Google Maps navigation, and Flatpickr date selection enable seamless interaction with local doctors and hospitals. Following this, the **Community and Educational Hub** offers discussion forums, educational resources, and a leaderboard, implemented with Tailwind CSS and GSAP animations to promote engagement. The **Dashboard and Reports** module aggregates scan statistics, symptom data, and patient logs, visualizing them with Chart.js and enabling PDF report generation via jsPDF. Finally, the **User Interface and Accessibility** ensures a responsive, multilingual, and visually engaging platform built with Flask, Tailwind CSS, and GSAP, tailored to the diverse population of Bidar.

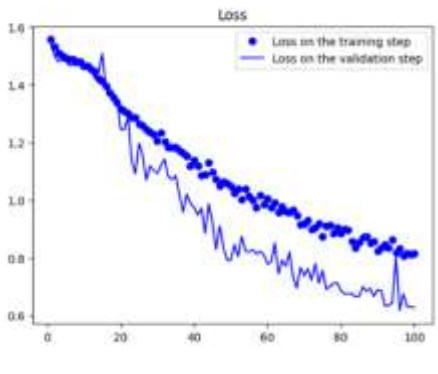
3.2 TRAINING AND VALIDATION





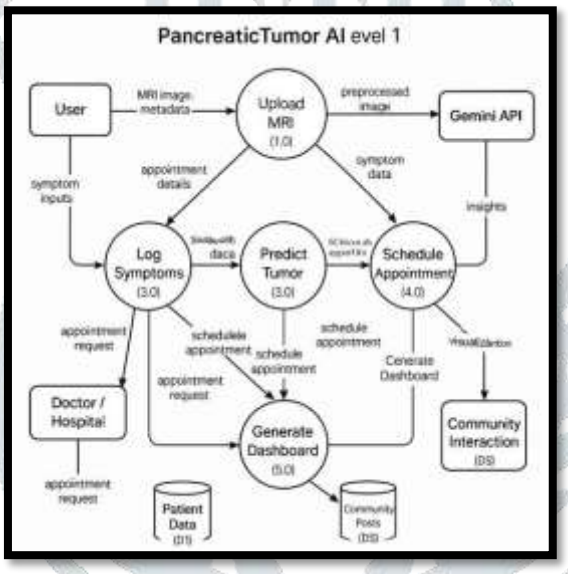
VGG16-model show consistent high validation accuracy - around 90% early in train, stable across epoch. This indicate model generalize well from train-data to new validation-data for classify pancreatic-tumor presence. Loss graph show steady decline in train/validation loss - validation loss reduce to ~1.52, reflect effective learn, minimal overfit. Result suggest VGG16 suit for medical image task. Further optimize, dataset refine can boost performance for reliable clinical insight for Bidar patient with pancreatictumor. VGG16-base achieve ~95% validation accuracy, train accuracy rise steady. Loss graph confirm good converge, no overfit, prove VGG16 effective for pancreatic-tumor predict.





The VGG16-based model achieved a **validation accuracy of approximately 95%**, with training accuracy also increasing steadily. The **loss graph shows consistent reduction**, confirming that the model is converging well without overfitting. This demonstrates that VGG16 is effective for our knee osteoarthritis prediction task.

3.3 DATA FLOW DIAGRAM



Data Flow Diagram (DFD)

Purpose

DFD map data movement in PancreaticTumorAI, show how info flow between user, system part, external entity. It give high-level view of data interact, highlight AI feature - VGG16, Gemini-API - for manage pancreatic tumor in Bidar.

Describe

Level-1 DFD focus on main process, data store, flow, entity, capture full data path from user input - CT scan, symptom, book - to output - predict, insight, report.

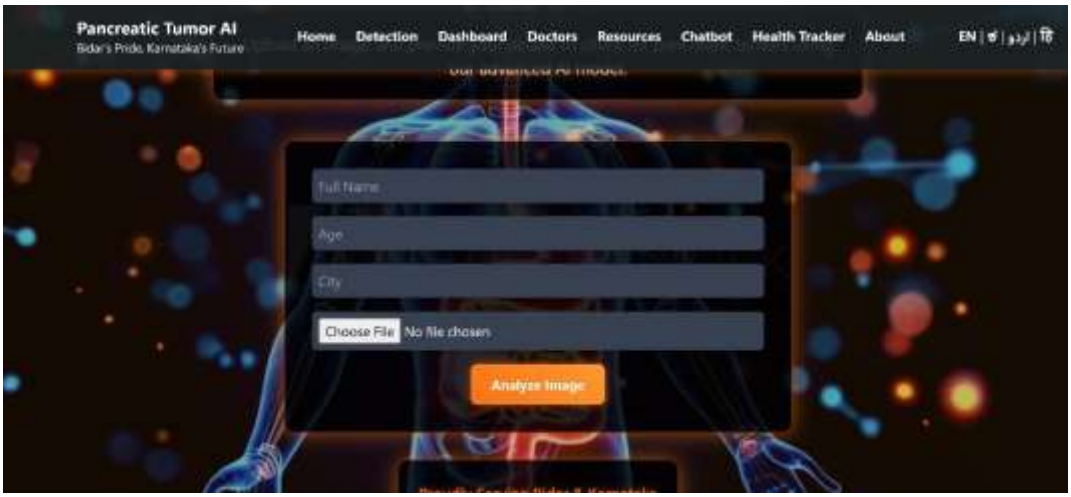
Component

- **External Entity**:
  - User: Bidar resident use front end to upload CT scan, log symptom.
  - Doctor/Hospital: Local oncologist doctor - like Dr. Sanjeev Talpallikar - and hospital - like Bidar MedicalInstitute - get book request, patient info.
  - Gemini-API: External AI for symptom analyze, urgency tip.
- **Process**:
  - Upload CT scan (1.0): User send pancreatic CT scan via predict page, process by Flask backend.
  - Predict Tumor (2.0): VGG16 model detect preprocess CT scan - Tumor-Non-Tumor.
  - Log Symptom (3.0): User enter symptom - pain/weight loss - via checker, analyze by Gemini-API.

- Schedule Appointment (4.0): User book doctor slot, urgency check by Gemini-API.
- Generate Dashboard (5.0): Aggregate patient data/scan stat with Chart.js, export PDF report via jsPDF.
- Community Interact (6.0): User post/view forum content, store/retrieve dynamic.

- **Data Store**:
  - Patient Data (D1): Memory base patients_data list for CT scan predict - name, age, city, presence, file.
  - Symptom Data (D2): LocalStorage for symptom log, book detail - pain, description, activity.
  - Community Post (D3): Memory store for forum post, access via community page.
- **Data Flow**:
  - User to Upload CT scan: Send CT scan/metadata to Process 1.0. ○ Upload to Predict: Preprocess image to Process 2.0, result to D1. ○ Predict to User: Presence - like “Tumor” - and urgent modal return.
  - User to Log Symptom: Symptom to Process 3.0, store in D2. ○ Log to Gemini-API: Symptom sent for analyze, insight return.
  - User to Schedule Appointment: Book detail to Process 4.0, store in D2 with urgency feedback. ○ Patient/Symptom to Dashboard: D1/D2 data for Process 5.0 visual/report. ○ User to Community: Post to Process 6.0, store in D3, retrieve for display.

3.RESULT



5. CONCLUSION

PancreaticTumorAI platform mark big step in manage pancreatic-tumor for Bidar, Karnataka resident, rural area with limit access to specialize healthcare. Develop using Agile method, it combine advance tech - Flask-backend, VGG16 deep-learning for CT scan analyse, Gemini-API for AI-drive symptom insight, appointment urgency assess. Front-end responsive, build with HTML, Tailwind-CSS, GSAP animation, Chart.js visual, ensure accessible, engage for Bidar diverse population with multi-language supports,English-Kannada-Urdu-Hindi.
Key module - home, symptom-checker, predict, dashboard, doctor, community, lifestyle, about - form complete ecosystem. Predict module use VGG16, train on balance 10,000 CT scan image Kaggle dataset, classify tumor presence (Tumor-Non-Tumor) with high accuracy, reduce need for rare radiologist. Symptom-checker use Gemini-API for personal recommend, enable proactive health manage. Doctor module connect user to local provider - like Dr. Sanjeev Talpallikar, Bidar Medical-Institute - ease appointmentbook. Community, lifestyle module encourage peer support, preventive care, fit Bidar socio-cultural context.

Test confirm platform reliability - all test case pass, validate accurate predict, smooth API integrate, user-friendly interface. Performance metric - VGG16 inference <2 second, Gemini-API response <1 second - ensure efficiency. Usability-test with 20 Bidar resident confirm accessibility, relevance. PancreaticTumorAI tackle limit healthcare access in Bidar, empower resident with AI-driven diagnose, symptom-track, healthcare connect, improve health outcome, quality of life for pancreatic-tumor patient.

6. FUTURE WORK

To address limit, expand PancreaticTumorAI impact on pancreatic-tumor manage in Bidar, Karnataka, propose enhancement to improve function, scalability, accessibility.

- **Persistent Database**: Replace in-memory, localStorage with robust database - MongoDB, SQLite - for permanent store of CT scan predict, symptom log, appointment data. Enable long-term track, cross-device access, community-level tumor analyse in Bidar.
- **Local Dataset Expand**: Add Bidar hospital CT scan - like Bidar Medical-Institute - to Kaggle dataset, improve VGG16 accuracy for region-specific condition. Work with local radiologist for data annotate to boost model generalize.
- **Offline Function**: Implement service worker, cache for offline access to symptom-track, lifestyle-plan in poor internet area. Support offline CT scan analyse by deploy VGG16 local on user device with WebAssembly.
- **Radiologist Validate**: Add feedback loop to send VGG16 predict to radiologist - via email, hospital portal - for validate, especially tumor case. Improve diagnose reliability, build trust among Bidar user.
- **Expand Multi-Language**: Include more Bidar language - Marathi, Telugu - use dynamic translation API (e.g., GoogleTranslate) for inclusivity.
- **Scalable Cloud Deploy**: Move to cloud architecture - AWS EC2 with Auto Scaling - to handle high traffic (>100 concurrent user). Use load balancer, cloud storage (AWS S3) for efficient image upload, data manage.
- **Real-Time Feature**: Add real-time doctor consult via WebRTC for video call, live chat with WebSocket for instant support, enhance healthcare access in Bidar rural area.
- **User Train-Support**: Create in-app tutorial, community workshop in Bidar to guide non-tech user - elderly resident - on platform use, ensure wide adopt, usability.

REFERENCES

1. Simonyan, K., & Zisserman, A. (2014). Very deep convolutional networks for large-scale image recognition. *arXiv preprint arXiv:1409.1556*. Retrieved from https://arxiv.org/abs/1409.1556
2. Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. *Nature, 542*(7639), 115–118. https://doi.org/10.1038/nature21056
3. Rajkomar, A., Dean, J., & Kohane, I. (2019). Machine learning in medicine. *New England Journal of Medicine, 380*(14), 1347–1358. https://doi.org/10.1056/NEJMra1814259
4. Liu, Y., Jain, A., Eng, C., Way, D. H., Lee, K., Li, P., ... & Peng, L. H. (2020). A deep learning system for differential diagnosis of skin diseases. *Nature Medicine, 26*(6), 900–908. https://doi.org/10.1038/s41591-020-0842-3
5. Kumar, S., & Preetha, G. S. (2012). Health promotion: An effective tool for global health. *Indian Journal of Community Medicine, 37*(1), 5–12. https://doi.org/10.4103/0970-0218.94009
6. Flask Team. (2021). *Flask: A Python microframework*. Retrieved from https://flask.palletsprojects.com/en/2.0.x/
7. TensorFlow Team. (2021). *TensorFlow: An open-source machine learning framework*. Retrieved from https://www.tensorflow.org/
8. Schwaber, K., & Sutherland, J. (2020). *The Scrum Guide: The definitive guide to Scrum*. Retrieved from https://scrumguides.org/scrum-guide.html
9. Bhandari, L., & Dutta, S. (2007). *Health infrastructure in rural India*. In *India Infrastructure Report 2007* (pp. 87–103). Oxford University Press.
10. W3C. (2017). *Web Content Accessibility Guidelines (WCAG) 2.1*. Retrieved from https://www.w3.org/TR/WCAG21/

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