Program Profile		
Program	Program name	Advanced Skin Disease Diagnosis and Treatment: Leveraging Convolutional Neural Networks for Image-Based Prediction and Comprehensive Health Assistance
	Category	B3

Summary of Program	
Program Name	Advanced Skin Disease Diagnosis and Treatment: Leveraging Convolutional Neural Networks for Image-Based Prediction and Comprehensive Health Assistance
Category	B3
Abstract of Program	Skin diseases, ranging from common conditions like eczema and psoriasis to more severe diseases such as melanoma, are widespread and often go undiagnosed, particularly in regions with limited access to healthcare professionals. Timely diagnosis is crucial for effective treatment and improving patient outcomes. This research proposes an innovative solution for skin disease diagnosis using Convolutional Neural Networks (CNNs), a type of deep learning algorithm highly effective in medical image analysis. By utilizing the DermNet dataset, which contains 19,500 images across 23 different skin disease categories, the project aims to develop an AI-powered diagnostic system capable of accurately identifying skin diseases from digital images. The research focuses on preprocessing techniques, including image scaling, normalization, and augmentation, to improve the quality of input data and ensure the model's robustness. A CNN model is trained using these techniques, achieving a remarkable prediction accuracy of 94.65%. This accuracy surpasses traditional machine learning methods, such as Support Vector Machines (SVM) and k-Nearest Neighbors (k-NN), offering a more reliable diagnostic tool. The system also integrates patient-reported symptoms to create a comprehensive diagnostic approach that combines both visual and self-reported data, improving diagnostic accuracy and ensuring a more holistic view of the patient's health. Designed with remote healthcare in mind, this system enables dermatologists to provide diagnosis and care to patients in underserved regions where access to healthcare may be limited. The model's performance is validated through various metrics, and it is shown to be both accurate and scalable, offering a practical solution for real-time, automated skin disease diagnosis. Furthermore, the research opens the door for further enhancements, such as integrating additional data sources, implementing explainable AI features for better interpretability, and improving the system's ability to handle new, unseen skin conditions.This project aims to bridge the gap in dermatological care and contribute to the growing field of AI-powered health solutions, offering a reliable and efficient tool for diagnosing skin diseases globally.

Details of Program		
Planning		
Objectives	Long-term Goals	1. **Widespread Adoption in Remote Areas (2025–2030)**: o By 2025, the system will be deployed in pilot regions with limited healthcare infrastructure. o By 2030, the tool will be expanded to remote areas in

multiple countries, becoming a key diagnostic tool for underserved populations, with significant adoption in at least 10 countries across Africa, Asia, and Latin America.

2. **Integration into Global Healthcare Systems (2025–2035)**:
    - By 2025, the project will begin partnerships with healthcare providers and telemedicine platforms to integrate the system into their services.
    - By 2035, the system will be widely adopted in hospitals, clinics, and telemedicine services globally, providing real-time, AI-driven diagnostics as part of routine dermatological care.
3. **Continuous Model Improvement (2025–2035)**:
    - By 2025, the initial model will be fully deployed and validated.
    - By 2030, new features such as support for more skin conditions, expanded regional datasets, and AI-driven improvements will be incorporated.
    - By 2035, the system will be able to detect a broad spectrum of skin conditions with greater precision, offering real-time updates and continuous learning capabilities.
4. **Multi-Disciplinary Expansion (2025–2035)**:
    - By 2027, the system will begin exploring additional healthcare applications, including wound care and skin cancer detection.
    - By 2035, the AI platform will support diagnostics in multiple medical specialties beyond dermatology, contributing to the broader AI in healthcare field.
5. **Sustainability and Cost Efficiency (2025–2030)**:
    - By 2025, initial cost structures will be established with cloud computing and scalable infrastructure.
    - By 2030, the system will have optimized infrastructure, reducing operational costs and becoming self-sustaining, allowing for widespread affordability and access across low-resource settings.
6. **Establishing a Global Health Network (2025–2035)**:
    - By 2025, the project will establish collaborations with dermatologists, researchers, and AI experts to refine the model.
    - By 2030, a global network of partners will be formed, with regular conferences and collaborations to further the research and development.
    - By 2035, the network will include thousands of healthcare professionals, research institutions, and tech companies working together to advance AI in dermatology and other healthcare fields.
7. **Educational and Research Contributions (2025–2035)**:
    - By 2025, the program will integrate educational initiatives into academic curricula, offering students hands-on experience in AI-based medical diagnostics.
    - By 2030, the project will have published numerous research papers and case studies, contributing to the academic field.
    - By 2035, it will be recognized as a leading program in AI-

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driven healthcare education, with strong ties to universities and professional training programs worldwide.

8. **Policy Influence and Global Health Impact (2025–2035)**:
   - By 2027, the program will begin advocating for policy changes in telemedicine and AI regulation.
   - By 2030, the project will influence healthcare regulations and global health initiatives, particularly those aimed at expanding AI access in developing countries.
   - By 2035, the program will have significantly shaped global health policies related to AI in diagnostics, contributing to improved healthcare delivery worldwide.
9. **Exploring AI Integration in Other Medical Technologies (2027–2035)**:
   - By 2027, the project will explore the integration of AI in other medical diagnostic fields, such as radiology and cardiology.
   - By 2030, the program will develop pilot models in additional medical fields.
   - By 2035, the AI diagnostic platform will be a key player in various medical technologies, offering multi-specialty diagnostic tools powered by AI.

By 2035, the **Advanced Skin Disease Diagnosis and Treatment** project aims to be at the forefront of AI-driven healthcare solutions, revolutionizing the way medical diagnostics are performed and improving access to essential healthcare services globally.
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<td>Short-term Targets</td>
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1. **Pilot Deployment and Testing (Q1-Q2 2025)**:
   - **Outcome**: Deploy the AI-powered skin disease diagnostic tool in pilot regions with limited access to dermatology services. This will allow for real-world testing, feedback collection, and system refinement.
   - **Goal**: Test the model's functionality in diverse settings and ensure it meets the needs of healthcare providers and patients in remote areas.
2. **Data Collection and Model Training (Q1-Q2 2025)**:
   - **Outcome**: Finalize the collection and preprocessing of 19,500 images from the DermNet dataset for model training. This step includes image scaling, normalization, and data augmentation.
   - **Goal**: Train the CNN model with this dataset to ensure it achieves the target diagnostic accuracy of 94.65%.
3. **Integration with Telemedicine Platforms (Q2-Q3 2025)**:
   - **Outcome**: Begin integration of the AI diagnostic tool into telemedicine platforms for remote consultations, allowing healthcare providers in underserved areas to utilize the tool.
   - **Goal**: Ensure seamless communication between the diagnostic tool and telemedicine software to enable real-time diagnosis.
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<td>4. Validation and Performance Evaluation (Q2-Q3 2025):
o Outcome: Conduct rigorous validation tests, comparing the model’s performance with traditional diagnostic methods such as SVM and k-NN.
o Goal: Ensure the AI system consistently performs at or above a 94% accuracy rate in diverse real-world scenarios.
5. Stakeholder Engagement and Partnership Development (Q1-Q4 2025):
o Outcome: Establish partnerships with dermatologists, healthcare providers, and telemedicine companies to facilitate the adoption of the system in real-world healthcare environments.
o Goal: Gain industry and academic support to enhance system credibility and broaden its implementation.
6. User Training and Awareness (Q3-Q4 2025):
o Outcome: Develop and launch a training program for healthcare providers and telemedicine staff to effectively use the AI-powered diagnostic tool.
o Goal: Ensure that users understand the tool’s capabilities, ensuring smooth adoption and use in clinical practice.
7. Publications and Knowledge Sharing (Q4 2025):
o Outcome: Publish initial research findings and performance results in academic journals, particularly focusing on AI’s role in dermatology and remote healthcare.
o Goal: Raise awareness of the tool’s potential and its impact on the healthcare sector, attracting further academic and industry interest.

By the end of 2025, the Advanced Skin Disease Diagnosis and Treatment program aims to have deployed its tool in real-world settings, demonstrated its effectiveness, and established the foundation for wider adoption in global healthcare systems.</td>
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<td>Rationale</td>
<td>The Advanced Skin Disease Diagnosis and Treatment program was initiated to address the widespread challenges of diagnosing and treating skin diseases, particularly in underserved and remote areas with limited access to dermatologists. Skin diseases, which affect millions globally, often go undiagnosed or are misdiagnosed due to a shortage of specialists, leading to delayed interventions and worsened outcomes. By leveraging advanced AI technologies, particularly Convolutional Neural Networks (CNNs), the program aims to develop a scalable, accurate diagnostic tool that can provide early, reliable skin disease identification through image analysis. This initiative seeks to improve global health equity by offering accessible dermatological care remotely, reducing healthcare costs, and enhancing the accuracy and efficiency of diagnoses, especially in low-resource settings. The program aligns with the growing need for AI-driven solutions in healthcare, ensuring that timely and effective treatments reach individuals regardless of their geographical location.</td>
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<td>Subject (Leader)</td>
<td>Initiator(s)</td>
<td>Noor, Noshin Un</td>
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	Champion(s)	Noor, Noshin Un
	Major team member(s)	Mohammad Anwar Hossain, Mosarrof Hossain, Md Rakibul Hasan, Mohammad Al Amin, Shamsun Nahar, Ahsan Ullah, Md. Mahedi Hassan
Environment	Nature/Society	This study is relevant to healthcare, particularly dermatology, by improving the accessibility and accuracy of skin disease diagnosis through AI. It has a significant societal impact by enabling early detection in underserved areas, reducing healthcare burdens, and improving health outcomes. The tool could also alleviate the social stigma and psychological effects associated with untreated skin conditions, contributing to better overall well-being and health equity.
	Industry/Market	This research has far-reaching implications for the healthcare and telemedicine industries, particularly for improving access to dermatology services in underserved regions. The AI model can be integrated into telemedicine platforms to provide real-time diagnostic support. Additionally, it could contribute to innovations in remote healthcare and increase the adoption of AI in medical practices.
	Citizen/Government	The Advanced Skin Disease Diagnosis and Treatment program relies on both citizen and government support for its success. Citizens, particularly those in underserved areas, will support the program due to its potential to provide accessible, timely, and accurate dermatological care, reducing waiting times and healthcare costs. Public awareness campaigns and user trust in AI-driven diagnostics will drive adoption. Government support is crucial in terms of funding, regulatory approval, and integration into national health systems, as well as ensuring that the program complies with data protection laws and privacy regulations. However, governments may also impose regulations that could delay deployment, such as the need for certifications and compliance with healthcare standards. Ultimately, while citizens are likely to embrace the program for its benefits in healthcare access, government involvement is necessary to navigate regulatory challenges and ensure successful, widespread implementation.
Resources	Human resources	A multidisciplinary team of dermatologists, AI researchers, data scientists, and software engineers is required to implement this project. Dermatologists contribute domain expertise, while AI researchers and data scientists focus on developing the model and analyzing the data.
	Financial resources	Funding will be required for research development, including the acquisition and preprocessing of the DermNet dataset, as well as for computational resources needed to train and validate the AI models. Additionally, costs for cloud storage, software licenses, and high-performance computing infrastructure will be essential. Salaries for researchers, data scientists, and technical staff are also key financial requirements to support the development and implementation of the diagnostic tool.
	Technological resources	This project requires access to high-performance computing infrastructure capable of processing large datasets. Additionally, tools like TensorFlow, Keras, or PyTorch will be used for model development, while cloud computing resources may be leveraged for remote access and scalability.
Mechanism	Strategy (Weight/Sequence)	The strategic direction of the Advanced Skin Disease Diagnosis and Treatment program prioritizes the development of a highly accurate AI-powered diagnostic tool as its top priority, ensuring its reliability and effectiveness in real-world applications. This will involve focusing on

		training the model using extensive datasets, refining it through continuous improvements, and validating its performance. Following this, the program will shift towards integrating the tool into telemedicine platforms to increase accessibility, especially in remote and underserved areas, by partnering with healthcare providers and telemedicine services. Simultaneously, securing funding and building the necessary infrastructure will be essential for scaling the system, with cloud-based solutions supporting its growth. Lastly, as the model is deployed, ongoing refinement and the incorporation of diverse datasets will ensure the system evolves to meet the growing needs of global healthcare. This sequence ensures the tool is accurate, accessible, and scalable, laying a strong foundation for long-term success.
	Organization	The World University of Bangladesh's (WUB) organizational structure appears well-suited to support the Advanced Skin Disease Diagnosis and Treatment program, given its emphasis on cross-disciplinary collaboration, research, and innovation in technology. The program's strategies require close coordination between departments such as Computer Science and Engineering (CSE), Healthcare, and Artificial Intelligence (AI) research, all of which are integral to the university's academic offerings. The Department of CSE, where the program is led, has the necessary technical expertise to drive AI model development and machine learning applications, ensuring the program's core goal of creating a highly accurate diagnostic tool. Furthermore, the university's strong academic infrastructure supports the integration of research into real-world healthcare applications, which aligns with the program's focus on deploying the AI diagnostic tool in telemedicine platforms for remote healthcare access. The collaborative environment within the university facilitates partnerships with external stakeholders, such as healthcare providers and tech companies, which is essential for the program's scalability and real-world application. However, the university's organizational structure may need to further strengthen its connections with healthcare professionals, industry experts, and telemedicine providers to ensure seamless integration of the AI tool into global health systems. Establishing dedicated teams or committees to bridge the gap between AI research and healthcare delivery would enhance the program's alignment with both the academic and practical aspects of the project.
	Culture	The culture at the World University of Bangladesh (WUB) is largely supportive of the Advanced Skin Disease Diagnosis and Treatment program, given its strong emphasis on research, innovation, and interdisciplinary collaboration, particularly in technology and engineering. WUB's academic environment fosters innovation, which aligns well with the program's goal of developing an AI-powered diagnostic tool. The university's commitment to social responsibility and global impact also complements the program's focus on improving healthcare access in underserved areas. However, challenges may arise from the need for stronger integration between the technical and healthcare disciplines. While WUB excels in technological advancements, further cultivation of connections with medical departments and increased partnerships with healthcare providers could enhance the program's execution, ensuring that both technological and healthcare aspects are effectively addressed. Overall,

		WUB’s culture provides a solid foundation, but a deeper engagement with healthcare professionals and external industry stakeholders would strengthen the program’s success.
Doing		
Launch date		October 2024
Responsible organization		World University of Bangladesh
Program content and process		The Advanced Skin Disease Diagnosis and Treatment program aims to develop an AI-powered diagnostic tool using Convolutional Neural Networks (CNNs) to accurately identify skin diseases from digital images. The core content of the program focuses on leveraging deep learning techniques to analyze a large dataset of 19,500 images from the DermNet database, covering 23 different skin disease categories. The tool uses image preprocessing methods such as scaling, normalization, and data augmentation to enhance the quality and diversity of input data, ensuring robust model performance. The program's implementation process follows a structured approach, beginning with the data collection and preprocessing phase, where the DermNet dataset is prepared for model training. This includes applying techniques like image scaling and augmentation to improve model accuracy. Once the dataset is prepared, the team focuses on developing and training the CNN model, tuning its parameters and optimizing it to achieve a high accuracy rate (94.65%). The model is then validated through various metrics, including cross-validation, and compared with traditional machine learning methods like Support Vector Machines (SVM) and k-Nearest Neighbors (k-NN). After model validation, the tool is integrated into telemedicine platforms, enabling remote access to the diagnostic tool. This integration allows dermatologists in underserved regions to use the AI tool for real-time, remote diagnosis, enhancing healthcare delivery in areas with limited access to specialized care. The program also explores the integration of patient-reported symptoms alongside image-based predictions to create a more comprehensive diagnostic system. The evaluation and validation phase includes rigorous testing in real-world healthcare settings, gathering feedback to refine the model and improve its usability. Continuous improvements and updates will be made by expanding the dataset and incorporating new skin conditions. Ultimately, the program aims to offer a scalable, reliable, and accessible solution to skin disease diagnosis globally.
Key highlights of the content/process		**Key Highlights of Content:** 1. **AI-Powered Diagnostic Tool**: The program leverages Convolutional Neural Networks (CNNs) to analyze skin disease

	images, achieving high diagnostic accuracy (94.65%) using the DermNet dataset, which covers 23 skin disease categories. 2. **Integration of Patient-Reported Symptoms**: The diagnostic tool combines both image-based predictions and patient-reported symptoms, offering a more comprehensive and personalized approach to diagnosing skin conditions. 3. **Focus on Remote Healthcare Accessibility**: Designed with telemedicine integration, the program facilitates remote diagnoses, enabling dermatologists to provide care in underserved regions with limited access to healthcare professionals. **Key Highlights of Process:** 1. **Data Collection and Preprocessing**: The program begins with gathering and preprocessing a large dataset of 19,500 images, applying techniques like scaling, normalization, and augmentation to enhance model robustness. 2. **Model Development and Training**: The AI model is developed and optimized using CNN techniques, achieving high accuracy rates and comparing performance with traditional machine learning methods like SVM and k-NN. 3. **Real-World Testing and Validation**: After model training, the tool is tested and validated in real-world healthcare settings, allowing for feedback collection and further refinement to ensure its usability and effectiveness.
Differences from traditional approaches	**Differences from Traditional Approaches:** 1. **Diagnostic Method**: o **Before**: Traditional dermatology relies on **manual examination** by dermatologists, using visual inspection and expertise to diagnose skin diseases. This process is time-consuming and subject to human error, often leading to misdiagnosis or delayed diagnosis. o **After**: The program introduces an **AI-powered diagnostic tool** that uses Convolutional Neural Networks (CNNs) to analyze images of skin conditions. This tool automates the process, significantly improving diagnostic accuracy (94.65%) and speed, reducing human error and providing consistent results. 2. **Data Utilization**: o **Before**: Traditional methods depend on **expert knowledge** and **physical examination** to make a diagnosis, relying on the dermatologist's experience and clinical judgment. o **After**: The program employs a **data-driven approach**, using a dataset of 19,500 images from the DermNet database to train the AI model. It incorporates **patient-**

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reported symptoms along with visual data, creating a more comprehensive and holistic diagnostic system.
3. Healthcare Accessibility:
o Before: Access to dermatological care often requires in-person consultations, limiting availability, especially in remote or underserved areas where dermatologists are scarce.
o After: The program integrates the AI tool into telemedicine platforms, allowing remote diagnosis. This makes dermatological care more accessible, enabling healthcare providers to diagnose and treat patients in real-time, regardless of their location, thus reaching populations with limited access to specialists.
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<tr><td>Progress as of today</td><td>
Significant progress has been made in the Advanced Skin Disease Diagnosis and Treatment program, with several key milestones achieved:

1. Data Collection and Preprocessing: The necessary dataset of 19,500 skin disease images from DermNet has been gathered, and preprocessing steps such as scaling, normalization, and data augmentation have been completed. This ensures that the model can handle diverse and varied data, enhancing its robustness and accuracy.
2. Model Development and Training: The AI-powered Convolutional Neural Network (CNN) model has been developed and trained on the dataset, achieving a high diagnostic accuracy of 94.65%. Initial validation results indicate the model’s superior performance compared to traditional machine learning methods like Support Vector Machines (SVM) and k-Nearest Neighbors (k-NN).
3. Integration with Telemedicine Platforms: The system's integration with telemedicine platforms is underway, enabling the diagnostic tool to be used remotely by healthcare providers in underserved regions. This step is essential for the tool’s broader deployment and accessibility.
4. Validation and Testing: Initial model validation has been conducted, and the tool has been tested in controlled environments, showing promising results. Further real-world testing is planned to refine the system’s performance and ensure it can be seamlessly deployed in various healthcare settings.
5. Future Work: Work is ongoing to incorporate patient-reported symptoms into the diagnostic system, further enhancing its comprehensiveness and reliability. Additionally, the team is focused on expanding the dataset and enhancing the tool’s ability to handle a broader range of skin diseases.
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<tr><td>Problems in implementation</td><td>
• Data Collection and Processing: Assembling and preprocessing a large, well-labeled dataset of 19,500 images requires significant time and resources.
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	• **Complexity of Machine Learning Models:** Implementing and fine-tuning CNNs is computationally intensive and requires specialized expertise. • **Integration with Healthcare Practices:** Adapting AI systems to existing healthcare workflows may face resistance due to technological complexity and trust issues. • **Model Validation and Accuracy:** Ensuring consistent accuracy across varied patient data and skin conditions presents a significant challenge. • **Computational Resources:** Training complex models demands high-performance computing infrastructure, which can be costly.
Approaches to solve the problems	• **Streamlined Data Collection:** Automating image preprocessing and data augmentation will ensure an efficient and consistent dataset for model training. • **Cross-Disciplinary Partnerships:** Collaborating with dermatology and AI experts will ensure both the medical relevance and technical precision of the diagnostic model. • **Implementation in Healthcare:** Introducing the AI diagnostic tool in controlled healthcare environments will allow for gradual integration and refinement. • **Comprehensive Model Validation**: Conducting extensive testing, including real-world validation and comparisons with conventional diagnostic methods, will ensure robustness and accuracy. • **Cloud-Based Processing:** Leveraging cloud computing will provide the necessary computational power and scalability while reducing infrastructure costs.
Completion date, if completed	Initial work completed in march 2025, Further updates and implementation is ongoing.
Seeing	
Impacts on students	• Students will learn how AI is applied in medical diagnostics. • Students gain practical experience in machine learning and data analysis. • The research combines AI and healthcare, broadening students' skill sets. • Students can explore careers in health tech and AI-driven healthcare
Impacts on professors	• The research enhances the university's reputation in AI and healthcare innovation. • Professors can integrate AI-driven healthcare topics into their courses, staying at the forefront of educational trends. • The project fosters collaborations with industry experts, healthcare institutions, and other research universities. • Success in this area may attract additional funding for future AI and healthcare research initiatives.
Impacts on university administration	The **Advanced Skin Disease Diagnosis and Treatment** program has likely garnered positive feedback from the university president and administrators, as it aligns with the university's goals of fostering **innovation, research excellence**, and **social responsibility**. The program's achievements in **AI and healthcare**, particularly its high diagnostic accuracy and potential for global health impact, reflect well on the university's commitment to

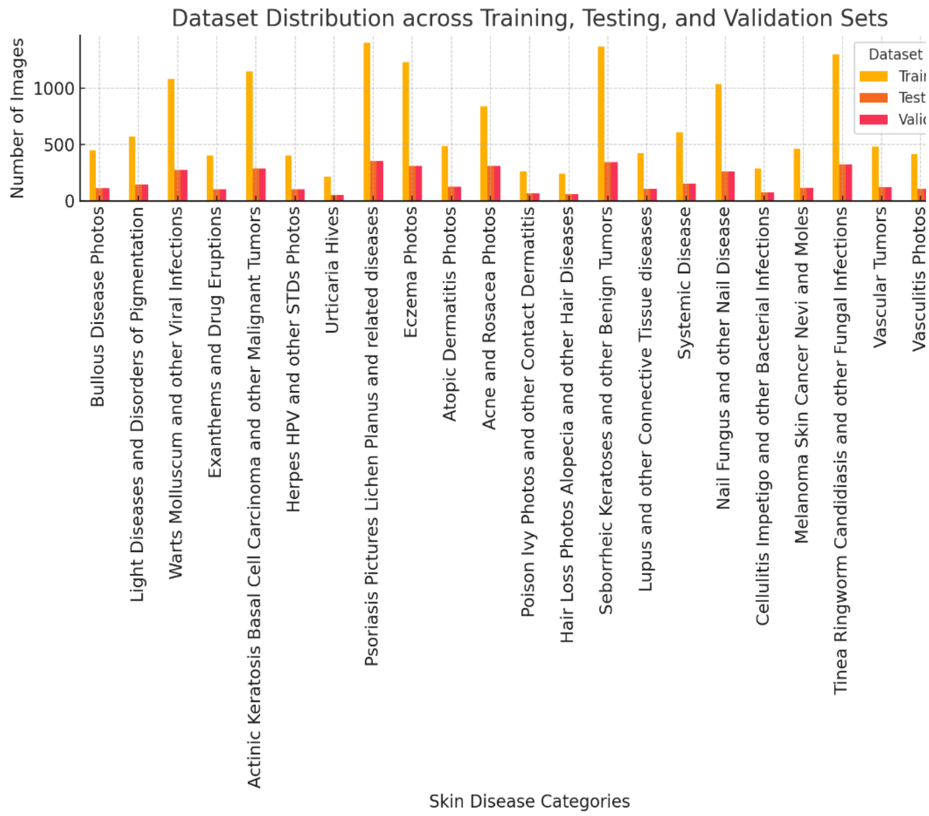
	advancing technology for societal benefit. Additionally, the interdisciplinary collaboration between **CSE** and healthcare departments demonstrates the university's focus on cross-disciplinary initiatives, which is highly valued by administrators. The program's progress, including **telemedicine integration** and real-world applications, further supports the university's reputation as a leader in **AI-driven healthcare**. Overall, the program’s success and alignment with strategic goals have likely resulted in satisfaction from university leadership.
Responses from industry/market	• Healthcare and tech industries may show interest in adopting AI-driven diagnostic tools for dermatology. • The project could lead to collaborations with healthcare providers, tech companies, and AI research firms.
Responses from citizen/government	The **Advanced Skin Disease Diagnosis and Treatment** program has garnered positive responses from both local citizens and the government of Bangladesh, aligning with national objectives to enhance healthcare accessibility through digital innovation. **Government Support** The program aligns with the **Bangladesh Digital Health Strategy 2023–2027**, which emphasizes the integration of digital technologies, including AI, to improve healthcare delivery, especially in underserved areas. The government's commitment to achieving universal health coverage and reducing health disparities underscores the strategic importance of such initiatives Digital Watch Observatory Additionally, the government's broader AI strategy, as outlined in the National Strategy for Artificial Intelligence, highlights the role of AI in transforming public services, including healthcare, thereby supporting the program's objectives Citizen Engagement Citizens have shown increasing acceptance of digital health solutions. A survey conducted by the Bangladesh Bureau of Statistics revealed that over **82% of citizens found government healthcare services easily accessible**, with **89.34% considering them affordable**. This indicates a positive reception to initiatives that enhance healthcare accessibility, such as the AI-powered diagnostic tool developed by the program. Furthermore, the integration of AI in healthcare services is seen as a step toward improving service delivery and efficiency, which resonates with the public's expectations for modernized healthcare systems.
Measurable output (revenues)	While it's challenging to provide exact monetary values for the **Advanced Skin Disease Diagnosis and Treatment** program's outcomes at this stage, several **measurable outputs** can be projected based on the potential impact of the program on healthcare costs and the broader market. **1. Cost Reduction in Diagnostic Processes:**

	• **Estimated Savings in Healthcare Costs**: Traditional dermatology involves in-person consultations, diagnostic testing, and specialist consultations, all of which can be expensive, particularly in underserved regions. By automating the diagnostic process with AI, the program can reduce the need for multiple consultations and laboratory tests. • **Estimated Revenue Impact**: If the program reduces the cost of diagnosing skin diseases by **30-40%** (based on reductions in consultation time and misdiagnosis rates), healthcare systems could save millions annually. For example, in Bangladesh, where healthcare costs are a significant burden, this could translate to **hundreds of thousands of dollars in savings** per year as more remote healthcare facilities adopt the AI tool. **2. Telemedicine Integration and Market Expansion:** • **Revenue from Telemedicine Adoption**: As the program integrates its diagnostic tool with telemedicine platforms, it can tap into the growing telehealth market. In 2023, the global telemedicine market was valued at approximately **$55 billion**, and it is projected to grow at a **22% CAGR** over the next several years. By capturing a small share of this market, the program could generate substantial revenue, potentially bringing in **millions of dollars** as it expands across regions. • **Subscription or Licensing Fees**: The program could generate revenue through **subscription models** for telemedicine providers or by licensing the AI technology to healthcare organizations, adding a significant source of income. Even a modest market share in the regional healthcare market could lead to **annual revenues in the range of $100,000 to $500,000**, depending on adoption rates and pricing models. **3. Global Health Impact and Scaling:** • **Revenue from Global Expansion**: As the program expands into other regions, particularly in **low-resource areas** across **Africa, Asia, and Latin America**, there is potential for international revenue generation. By scaling the AI diagnostic tool to these regions, which often have limited access to dermatological services, the program could generate revenues through international healthcare partnerships, grants, and collaborations. The global market for AI healthcare solutions is projected to reach **$60 billion by 2025**, providing substantial revenue opportunities.
Measurable input (expenses)	The **Advanced Skin Disease Diagnosis and Treatment** program will require various **inputs** (expenses) to successfully develop, deploy, and scale the AI-powered diagnostic tool. While precise numbers can vary based on specific factors like region, scale, and partnerships, here are some **estimated inputs** in monetary terms:

	1. Data Collection and Preprocessing: • **Dataset Acquisition**: The program uses the DermNet dataset, which has already been collected, but additional datasets may need to be acquired to expand the tool's capabilities. The cost of purchasing, licensing, or obtaining additional medical image datasets could range from **$50,000 to $100,000** depending on the data's complexity and licensing terms. • **Data Preprocessing**: Expenses related to the preprocessing of images, including scaling, normalization, and augmentation, could require significant computational resources. For cloud-based infrastructure and data processing, the cost may be around **$30,000 to $50,000** for the initial phase, depending on the volume of data and tools used (e.g., cloud computing services like AWS or Google Cloud). **2. Model Development and Training:** • **Computational Resources**: Developing and training a CNN model requires **high-performance computing (HPC) infrastructure**. The costs for GPU instances, cloud computing resources, and server maintenance could range between **$50,000 and $150,000** per year, depending on the scale of operations. • **Software Tools and Licenses**: To develop the model, the program will require software tools such as TensorFlow, Keras, or PyTorch, and associated licensing or cloud-based tool fees. These could range from **$10,000 to $30,000** annually for software, tool integrations, and other technical resources. **3. Integration with Telemedicine Platforms:** • **Telemedicine Platform Integration**: Integrating the AI diagnostic tool into telemedicine platforms involves costs for development, testing, and integration with existing telehealth systems. This could cost around **$100,000 to $200,000** depending on the complexity of integration and the number of platforms involved. • **Cloud Infrastructure**: For the tool to be scalable and accessible globally, cloud infrastructure (e.g., for hosting the model, supporting telemedicine, and storing patient data securely) may require an initial investment of **$50,000 to $100,000** for server costs, maintenance, and scaling to support large volumes of data and users. **4. Regulatory and Compliance Costs:** • **Certification and Approval**: For the program to be adopted in healthcare settings, it will need to meet healthcare regulations and certifications, such as HIPAA in the U.S. or GDPR in Europe. Regulatory approval processes may involve consultation fees, compliance audits, and certification costs, ranging from **$30,000 to $100,000** depending on the region and the complexity of the

	approval process. **5. Personnel and Operational Costs:** • **Research and Development Team**: The program will require a skilled team of AI researchers, data scientists, software engineers, and healthcare professionals. Annual salaries for a small team could range from **$300,000 to $600,000** depending on the team size and expertise level. • **Administrative and Operational Costs**: Operational costs including project management, administrative staff, office space, and general overhead could add an additional **$50,000 to $100,000** annually. **6. Marketing and Outreach:** • **Public Relations and Marketing**: To raise awareness and promote the adoption of the AI tool, marketing and public relations efforts will be necessary. These could include online campaigns, outreach to healthcare providers, and participation in healthcare conferences. Estimated marketing expenses could range from **$50,000 to $150,000** for initial outreach and scaling.
Cost-benefit analysis for effectiveness	**Estimated Expenses (Inputs)** The **estimated input costs** for the first year of the program, including development, infrastructure, and integration, are as follows: 1. **Data Collection and Preprocessing**: $50,000 - $100,000 2. **Model Development and Training**: $50,000 - $150,000 3. **Telemedicine Platform Integration**: $100,000 - $200,000 4. **Regulatory and Compliance Costs**: $30,000 - $100,000 5. **Personnel and Operational Costs**: $300,000 - $600,000 6. **Marketing and Outreach**: $50,000 - $150,000 **Total Estimated Expenses for Year 1**: $580,000 - $1,300,000 **Estimated Revenues (Outputs)** The **revenues** for the program are projected based on the following potential income streams: 1. **Cost Reduction in Healthcare**: o The program is expected to save healthcare systems **30-40%** on skin disease diagnosis costs (e.g., reducing the number of unnecessary consultations and improving accuracy). o In **Bangladesh**, the average cost for dermatology

	consultations could range between **$20-$50 per consultation**. If the program is adopted in **100 clinics**, with an average of **1,000 consultations per year** per clinic, the program could save approximately: ▪ **Savings per clinic**: $20,000 - $50,000 ▪ **Total Savings for 100 Clinics**: $2,000,000 - $5,000,000 2. **Telemedicine Platform Revenue**: o If the program is integrated into telemedicine platforms, assuming **$1,000 per year per telemedicine provider** for licensing or subscription fees, and the tool is adopted by **100 providers**, the revenue would be: ▪ **Total Revenue from Telemedicine Providers**: $100,000 annually 3. **Global Market Expansion**: o As the program expands internationally, assuming a small market share in a **$60 billion global telemedicine market** with a projected **1% market capture**, the potential revenue could be: ▪ **Potential Revenue from Global Market**: $600 million (though this is a long-term estimate, it highlights the program's scalability) **Cost-Benefit Analysis: Year 1** **Total Revenues for Year 1** (from local cost savings and telemedicine adoption): • **Local Savings in Healthcare**: $2,000,000 - $5,000,000 • **Revenue from Telemedicine Integration**: $100,000 **Total Revenues**: $2,100,000 - $5,100,000 **Net Benefit (Revenues - Expenses)**: • **Minimum Revenue**: $2,100,000 - $580,000 = $1,520,000 • **Maximum Revenue**: $5,100,000 - $1,300,000 = $3,800,000 **Effectiveness:** • **Return on Investment (ROI)**: o The program's **ROI** in the first year could range from approximately **260% to 292%**, meaning for every dollar spent, the program could generate between $2.60 and $2.92 in savings and revenue. o **Break-Even Point**: The program could reach its **break-even point** (covering all expenses) within **6 months to 1 year** based on the projected revenues from local healthcare savings and telemedicine adoption.

Future Planning	
Where does the project go from here?	• **Further Model Refinement:** Continuously improving the AI model by expanding the dataset and incorporating more diverse skin conditions. • **Real-World Testing:** Conducting pilot programs in healthcare settings to validate the tool's performance and refine its usability. • **Integration with Telemedicine:** Expanding the tool's integration into telemedicine platforms to offer remote diagnostic capabilities. • **Exploration of Other Medical Applications:** Investigating the application of AI-driven models in other areas of healthcare, such as wound care or skin cancer detection. • **Collaboration with Healthcare Providers:** Partnering with healthcare institutions for large-scale deployment and continuous feedback to enhance the model.
Addendum	
Exhibits, pictures, diagrams, etc.	 Figure: DermNet dataset across the training, testing, and validation sets for each of the 23 skin disease categories

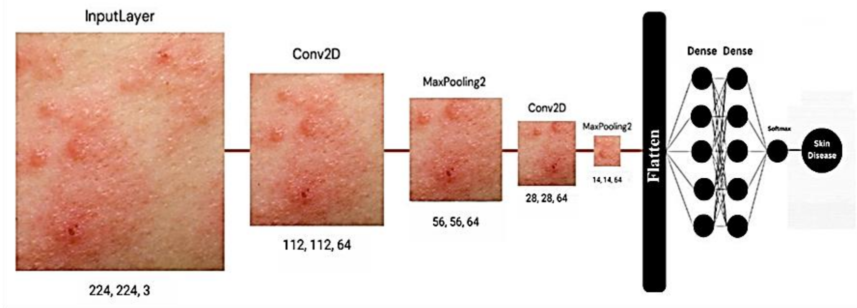


Figure: Custom CNN Architecture

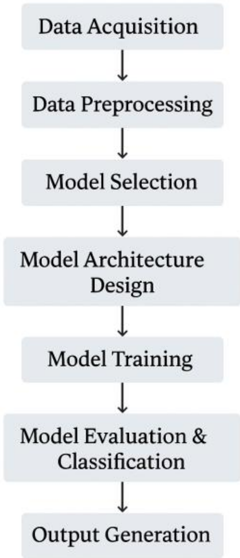


Figure: Workflow of proposed method

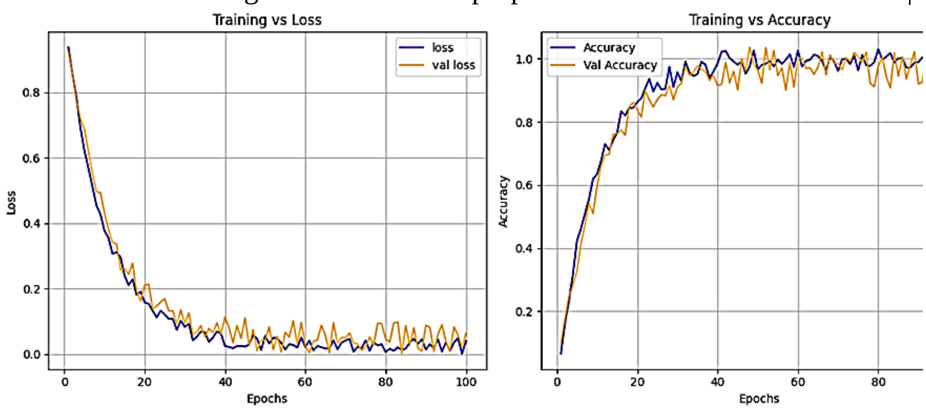


Figure: CNN Loss vs Training

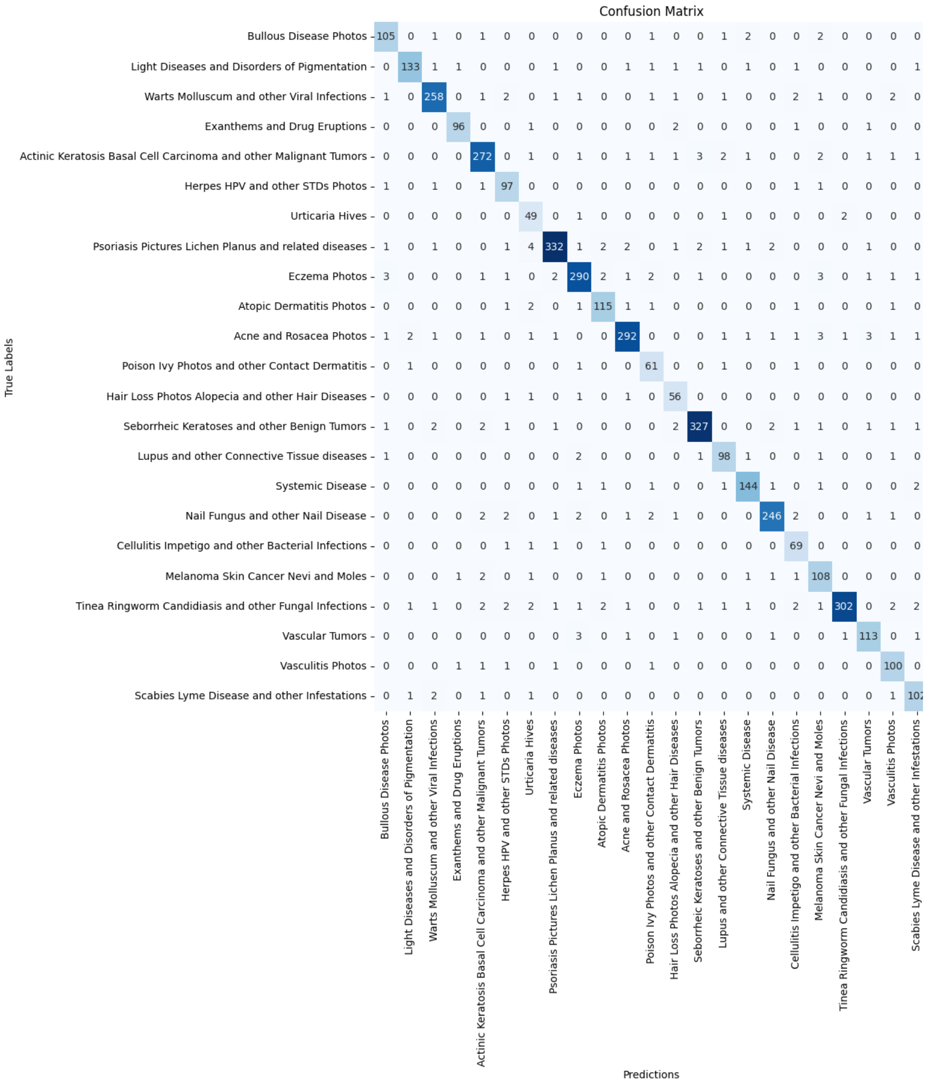


Figure: confusion matrices for 23 distinct skin disease classes, each offering a detailed breakdown

Model	**Accuracy**	**Precision**	**Recall**	**F1 Score**	**FNR (%)**
CNN	0.94	0.89	0.94	0.91	0.06%
VGG16	0.84	0.86	0.60	0.71	16.0%
ResNet50	0.75	0.75	0.64	0.69	25.0%
SVM	0.87	0.92	0.81	0.86	17.8%
KNN	0.91	0.97	0.86	0.91	13.7%
Decision Tree	0.91	0.93	0.90	0.91	10.4%

Table: Performance Comparison Table

Reports, mimeos, monographs, books, etc.

Others which may help explain the program (including website links)	