INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD)
© 2026 IJNRD | Volume 11, Issue 1, January 2026 | ISSN: 2456-4184 | IJNRD.ORG

ML-Based Cervical Cancer Diagnostic and Prediction System Using Django

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ABSTRACT: Cervical cancer remains one of the leading causes of mortality among women worldwide, particularly in regions with limited access to early screening and diagnostic tools. This project presents a machine learning–based web application designed to predict the likelihood of cervical cancer using patient health data. The system integrates a user-friendly interface built with Django, allowing healthcare professionals and users to input clinical parameters such as age, sexual health history, smoking habits, HPV status and etc. The backend model, trained on a curated medical dataset, achieves a high prediction accuracy of 96.5%, demonstrating its reliability and potential for real-world deployment. In addition to the prediction module, the application features an awareness section that educates users about cervical cancer symptoms, risk factors, and prevention strategies. The result dashboard provides personalized feedback, visual cues, and motivational support to empower users in understanding their health status. This tool aims to bridge the gap between clinical expertise and accessible technology, promoting early detection and informed decision-making in cervical cancer care.

I. INTRODUCTION

Cervical cancer is forth most common cancer affecting to women's in the worldwide, with an age-standardized incidence rate of 14.1 cases per 100,000 women-years, and the third leading cause of mortality due to cancer in women, with a mortality rate of 7.1 deaths per 100,000 women-years. Regions with the highest Cervical Cancer disease burden include sub-Saharan Africa, Latin America, and Asia. Cervical Cancer is primarily caused by a persistent infection of high-risk Human Papilloma Virus (HR-HPV). In 2020, the World Health Assembly established a strategy for the elimination of Cervical Cancer, which comprises prevention (90% of girls aged 15 years or younger fully vaccinated against HPV), early detection (70% of women aged 35–45 years screened by molecular methods to detect HR-HPV DNA), and guaranteed treatment of women (90% of women) diagnosed with Cervical Cancer. Many advances have been made to improve the technologies available for the early diagnosis of Cervical Cancer, its prognosis, and the treatment of precancerous lesions and Cervical Cancer new technologies have emerged for faster and more accurate diagnosis and improved prognosis prediction.

In recent years, the amount of research in the clinical area using ML and DL models has increased exponentially because these models can help in clinical decision-making, such as early warning, individualization of treatment, and improvement of progress in clinical trials. In particular, several works have emerged in the study of cervical neoplasm using ML and DL models due to immense interest in the field . Therefore, we performed a scoping review to map the body of literature on the use of these models for the diagnosis, prognosis, and treatment of CC in order to provide updated evidence on the application of ML and DL in CC, assess these approaches' potential scope in oncological clinical practice, and encourage their adoption in clinical decision-making support, especially in contexts where qualified personnel are lacking.

II. LITERATURE SURVEY

1. Prediction of Cervical Cancer Using Machine Learning Techniques by Jaswinder Singh and Sandeep Sharma (2019). Concluded that machine learning classifiers can successfully predict cervical cancer stages using clinical data. Among the evaluated models, decision-based classifiers achieved better accuracy, proving the effectiveness of automated prediction systems in healthcare monitoring.

2. **Predicting Cervical Cancer using Machine Learning Methods by Riham Alsmariy, Graham Healy, Hoda Abdelhafez (2020).** Concluded that the cervical cancer mobile apps lack comprehensive, up-to-date HPV information and preventive features needed for effective users engagement.
3. **Women Healthcare Mobile App-An Approach to Predict Early Stage of Cervical Cancer by Naveen R Chanukotimath, Asha K, Keerthi Prasad G, Manjula G M (2021).** Concluded that paper outlines a small and imbalanced dataset, limiting the generalizability of the cervical cancer prediction model.
4. **Machine Learning in Cervical Cancer by Syed S. Abrar et al. (2022).** Concluded that machine learning techniques significantly enhance cervical cancer diagnosis, prognosis, and screening accuracy. However, challenges such as data imbalance, lack of explainability, and limited real-world deployment still need to be addressed for clinical adoption.
5. **A Systematic Review of Cervical Cancer Mobile Applications and a Future Directions for Developers by Ruchira Purohit, Smriti Singh, Devashree Vaishampayan, Yana Sane, Jayshree Pande, Seeta Devi (2024).** Concluded that many medical prediction models perform well in testing but fail in real-world clinical settings due to overfitting and lack of external validation. Based on your app's structure and deployment strategy, you are actively addressing these concerns—but there's room to strengthen it further.
6. **Deep Learning Methods for Cervical Cancer Detection and Classification by Pooja Patre and Dipti Verma (2025).** Concluded that deep learning models, especially CNN-based architectures, outperform traditional methods in cervical cancer detection and classification. The study highlights the importance of quality datasets and supervised learning strategies for achieving reliable diagnostic performance.

III. PROBLEM STATEMENT AND OBJECTIVES

Problem Statement

1. **Dependence on Invasive Screening Methods:** Conventional diagnostic techniques such as biopsies are invasive, costly, and require trained professionals, making them unsuitable for frequent screening.
2. **Lack of Accessibility:** Many women, especially in rural and low-income regions, do not have access to regular screening facilities due to economic and geographical barriers.
3. **Manual Analysis Limitation:** Clinicians rely on manual interpretation of patient history and diagnostic markers, which can be prone to human error and variability.

Objectives

- To analyze and detection cervical cancer using machine learning algorithms that will help doctors accurately diagnose the cancer.
- To identify the correlations between the parameters that are likely to be responsible for cervical cancer.
- Build a Scalable Diagnostic Tool Create a web application using Django that allows real-time predictions with a user-friendly interface for clinical use.

V. METHODOLOGY

1. Methodology to Train the Model

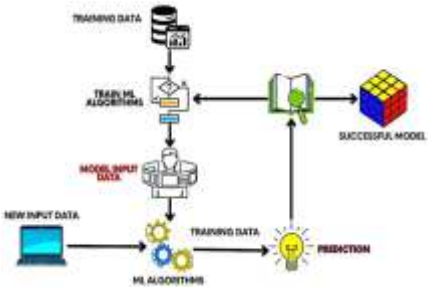

Fig 1: Block diagram to train the model.

This block diagram illustrates the end-to-end process of building and deploying a machine learning model for prediction tasks. It begins with Training Data, which consists of labelled examples used to teach the model how to recognize patterns. This data is fed into the Train ML Algorithms block, where algorithms Logistic Regression learn from the data and produce a Successful Model — a trained system capable of making predictions. Once the model is trained, it can accept New Input Data from users or external sources. This input is processed by the ML Algorithms, which apply the learned patterns to generate a Prediction. The diagram emphasizes the cyclical nature of machine learning: training leads to a model, which then handles new data and produces predictions. It also highlights the separation between training and inference phases, ensuring clarity in how ML systems operate in real-world applications.

2. Methodology of Django

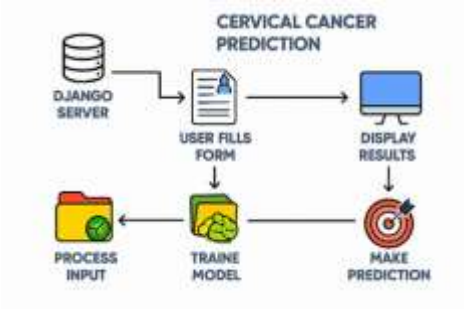

Fig 4.2: Block diagram of Django and Machine Learning integration.

This diagram illustrates the workflow of a cervical cancer prediction system built using Django and machine learning. The process begins with the Django server, which acts as the backend engine managing user interactions and data flow. The user fills a form with clinical inputs such as age, reproductive history, lifestyle factors, and diagnostic markers. These inputs are then processed to ensure compatibility with the machine learning pipeline. The system uses a trained model (e.g., Logistic Regression or HistGradientBoosting) to analyse the processed data and make predictions about biopsy risk or cervical cancer likelihood. Once the prediction is generated, the results are displayed to the user through a web interface. This workflow highlights the integration of web technology and machine learning in a healthcare setting, enabling real-time, non-invasive risk assessment and personalized diagnostics.

VI. ADVANTAGES AND APPLICATIONS

Advantages

The proposed system offers multiple advantages over conventional screening methods:

1. Enables early identification of high-risk patients.
2. Reduces dependency on costly and invasive diagnostic tests.
3. Provides quick and automated prediction results.
4. Minimizes human error in data analysis.
5. Supports decision-making for healthcare professionals.
6. Scalable and easily deployable in remote healthcare centres.
7. Enhances preventive healthcare awareness.

Applications

The project can be applied in several sectors:

1. Healthcare Institutions: Preliminary screening support in hospitals and clinics
2. Rural Medical Centres: Assists healthcare workers with limited diagnostic facilities
3. Medical Research: Used for analysing cervical cancer risk patterns
4. Preventive Healthcare Programs: Supports awareness and mass screening initiatives
5. Educational Institutions: Useful as a case study for machine learning applications in healthcare

RESULT

Home Page

Fig 1: Home Page.

Our home page contains two buttons with Labels "Awareness" and "Prediction"
The functionality of the buttons are:

- Awareness: Leads to educational content about cervical cancer.
- Prediction: Starts the diagnostic process by collecting patient data.

This homepage acts as a gateway to your app's two core features:

- Educating users about cervical cancer (Awareness)
- Allowing users to check their risk through a predictive model (Prediction)

It's designed to be simple, welcoming, and informative, making it easy for users to engage with our app.

Awareness Page

Fig 2: Awareness Page.

When we press the Awareness button Awareness page display's where it serves as the educational pillar of the web-app. It dynamically displays articles with rich text and information, styled for clarity and professionalism. By combining knowledge with prediction, the app empowers users not only to check their risk but also to understand cervical cancer better, promoting prevention and awareness.

Prediction Page

Fig 3: Symptoms check.

Our Symptoms page contains two buttons with Labels "Yes, I have symptoms" and "No, I don't have symptoms"
The functionality of the buttons are:

- No, I don't have symptoms: When this is pressed it will display a message like "There's no immediate need to check, but you may cross-check if you wish.

Fig 4: No Symptoms found page.

Even though there is no symptoms found it might also ask as to cross check by pressing the button "Proceed to Prediction" if not you can press "Back to Home" button to exit from the page.

When the button 'Yes, I have symptoms' is pressed there will be a Prediction Page where patient has to enter the required data to test the cervical cancer result

- Yes, I have symptoms: Leads to direct Prediction page to check whether the cervical cancer is 'Positive or Negative'.

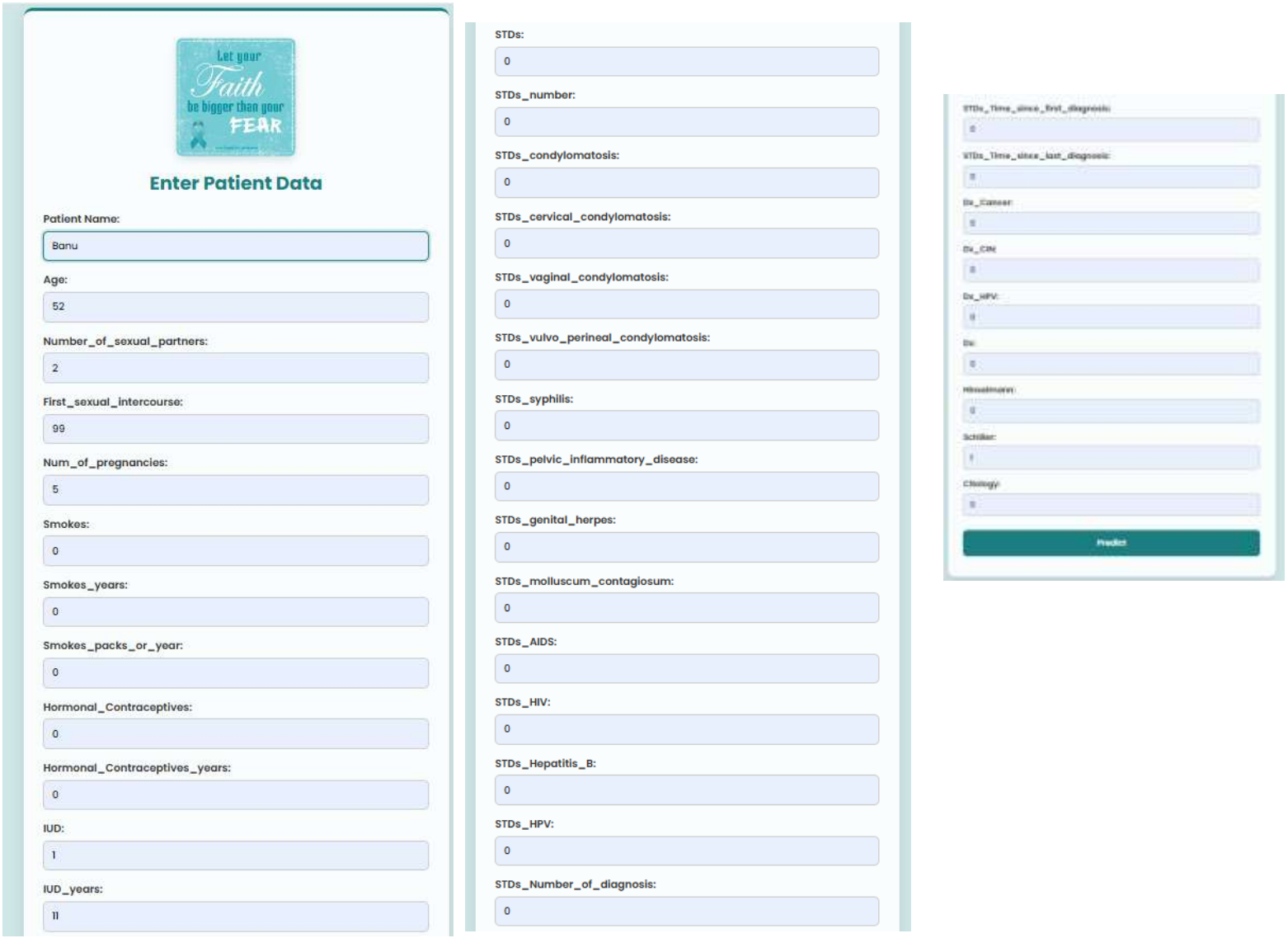

Fig 5: Prediction Page

Result Page

Fig 6: Output of the Patients data.

Result Display's

- Patient Name:
  - Personalized with "Patient: Banu" — builds trust and clarity.
- Prediction Outcome:
  - "🟠 Cervical Cancer Positive 🟠":- It highlight's the result.
  - The orange warning icon adds visual urgency while remaining non-alarming.
  - Helps users interpret the result intuitively.

There is another button called "Run Another Prediction"

- Encourages continued use of the app.
- Useful for testing multiple patients or rechecking with updated data.
- Keeps the user engaged and provides a clear next step.

CONCLUSION AND FUTURE SCOPE

Conclusion

The Cervical Cancer Prediction Using Machine Learning project successfully demonstrates the effectiveness of artificial intelligence in healthcare applications. By leveraging machine learning algorithms and clinical data, the system provides early-stage cervical cancer risk prediction in a non-invasive and cost-effective manner.

The web-based architecture ensures accessibility and ease of use, making the system suitable for both urban and rural healthcare environments. The project highlights how intelligent systems can support medical professionals in early diagnosis and improve patient survival rates.

Future Scope

- Several enhancements can be incorporated into the system in the future:
- Incorporation of deep learning models for improved prediction accuracy.
- Integration with real-time hospital databases and EHR systems.
- Development of mobile applications for nationwide accessibility.
- Inclusion of medical imaging data such as Pap smear images.
- Implementation of multilingual interfaces for broader reach.
- Use of explainable AI techniques to improve transparency and trust.
- These advancements will further enhance system reliability and real-world usability.

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