**“Medicine Recommendation System”**

***A***

***Project Report***

*submitted in partial fulfillment of the*

*requirements for the award of the degree of*

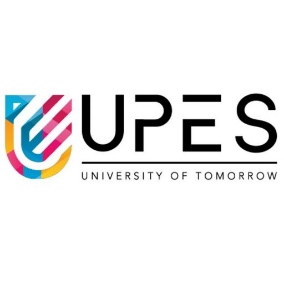
**MASTER OF COMPUTER APPLICATION**

**by**

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**December - 2024**

**CANDIDATE’S DECLARATION**

I/We hereby certify that the project work entitled **“Medicine Recommendation System”** in partial fulfilment of the requirements for the award of the Degree of MASTER OF COMPUTER APPLICATION with specialization in ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING and submitted to the Department of Systemics, School of Computer Science, University of Petroleum & Energy Studies, Dehradun, is an authentic record of my/ our work carried out during a period from **August** **2024** to **December**, **2024** under the supervision of **Asst Prof Ms. Dhiviya J Rose.**

The matter presented in this project has not been submitted by me/ us for the award of any other degree of this or any other University.

**Jayant Dev  
Vinay Kumar Pandey  
Devansh Maheshwari  
Sunil Singh**

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Date: 05-12-2024 **Asst Prof Ms. Dhiviya J Rose.**

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**ABSTRACT**

**“MRS” – Medicine Recommendation System**

The **Classification Model Evaluation System** is a machine learning-based recommendation framework designed to assist in the selection of the most suitable classification model for a given dataset. The system evaluates five widely-used algorithms: Support Vector Classifier (SVC), Random Forest, Gradient Boosting, K-Nearest Neighbors (KNN), and Multinomial Naive Bayes (MNB). By automating the process of model training, testing, and evaluation, the system provides users with comparative performance metrics such as accuracy and confusion matrices.

This project streamlines the model selection process for data scientists, researchers, and machine learning practitioners by offering an efficient way to assess model performance without extensive manual coding. The system is built to handle medium-sized datasets efficiently and supports user-friendly outputs for ease of interpretation.

The modular design ensures scalability for future enhancements, such as the inclusion of additional models or advanced hyperparameter tuning techniques. Through its robust functionality and usability, the system empowers users to make data-driven decisions, facilitating the deployment of machine learning models in real-world applications.

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**1. Introduction**

**1.1 History**

The evolution of healthcare technology has significantly influenced the way medical decisions are made. Traditional systems relied heavily on clinical expertise and general guidelines that often overlooked individual patient needs. With advancements in artificial intelligence and machine learning, systems can now analyze large datasets to deliver personalized solutions. The **Medicine Recommendation System (MRS)** harnesses these capabilities to enhance the decision-making process by offering tailored medicine recommendations based on patient data. It represents a shift towards precision medicine, which focuses on individualized treatment strategies.

**1.2 Requirement Analysis**

The project recognizes the critical need for systems that assist healthcare professionals in making data-driven, patient-specific decisions. These decisions are rooted in patterns identified in patient data, including medical history, symptoms, and demographic information. A robust recommendation system like MRS requires accurate data preprocessing, machine learning model implementation, and performance evaluation to ensure its efficacy and reliability.

**1.3 Main Objective**

The primary goal of the Medicine Recommendation System is to utilize machine learning algorithms to analyze patient-specific data and provide accurate and personalized medicine recommendations. This enhances the efficiency of healthcare professionals and improves treatment outcomes.

**1.4 Sub-Objectives**

* Develop preprocessing techniques to standardize and clean patient data.
* Train and evaluate machine learning models to identify the most effective for this application.
* Compare the performance of **Support Vector Machines (SVM)** and **Random Forest (RF)** models using metrics such as accuracy, precision, recall, and F1-score.
* Create an intuitive interface for healthcare professionals to easily retrieve recommendations.

**1.5 PERT Chart Legend**

The PERT chart outlines the timeline and dependencies of various tasks:

* **Critical Path**: Key milestones like data preprocessing and model training that directly affect project completion.
* **Float Path**: Tasks with some scheduling flexibility, such as hyperparameter optimization.
* **Milestones**: Completion of data preparation, initial testing, and final deployment.

**2. System Analysis**

**2.1 Existing System**

Existing medicine recommendation systems often rely on predefined rules, static databases, or generic algorithms. These systems:

* Lack adaptability to individual patient data.
* Are unable to provide dynamic recommendations based on new information.
* Depend heavily on manual input, which increases the risk of human error.

**2.2 Motivations**

The MRS addresses the challenges faced by traditional systems by:

* Utilizing patient-specific data for accurate recommendations.
* Leveraging machine learning models to dynamically learn and improve over time.
* Reducing dependency on static rules, making the system more versatile and scalable.

**2.3 Proposed System**

The proposed MRS leverages two machine learning models, **SVM** and **Random Forest**, to analyze patient data and provide personalized medicine recommendations. It focuses on:

1. **Preprocessing Data**: Ensuring clean and usable data.
2. **Model Training**: Using advanced machine learning techniques.
3. **Evaluation and Comparison**: Selecting the best-performing model for recommendations.
4. **Output Generation**: Providing user-friendly and actionable results.

**2.4 Modules**

**2.4.1 Data Preprocessing**

This module focuses on:

* Handling missing data through imputation or removal.
* Standardizing numerical data and encoding categorical variables.
* Ensuring the dataset is balanced and representative of the target population.

**2.4.2 Machine Learning Models**

1. **Support Vector Machines (SVM)**: Efficient for high-dimensional data and binary classification problems.
2. **Random Forest (RF)**: Robust and interpretable, capable of handling complex datasets with minimal overfitting.

**2.4.3 Model Evaluation**

This module evaluates the trained models using metrics like:

* **Accuracy**: Overall correctness of predictions.
* **Precision and Recall**: Evaluating false positives and false negatives.
* **F1-Score**: Balancing precision and recall for imbalanced datasets.

**2.4.4 Recommendation Generation**

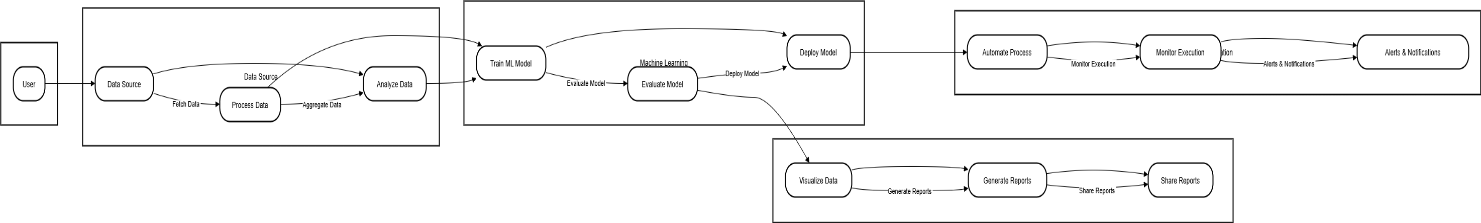
Based on the model output, this module provides a ranked list of recommended medicines tailored to the patient’s specific conditions.

**3. Design**

**3.1 System Workflow**

The workflow includes:

1. Input: Accepting patient data such as medical history and symptoms.
2. Preprocessing: Cleaning and standardizing the data.
3. Model Training: Using SVM and RF algorithms to train on labeled data.
4. Evaluation: Assessing performance using multiple metrics.
5. Output: Generating personalized medicine recommendations.



**3.2 Use Case Model**

**Actors**: Healthcare professionals and patients.  
**Use Cases**: Input patient data, train models, evaluate results, and retrieve recommendations.

**3.3 Object and Class Design**

* **PatientData**: Handles data storage and preprocessing.
* **ModelTrainer**: Facilitates training of machine learning models.
* **Evaluator**: Calculates performance metrics for comparison.
* **Recommender**: Generates the final list of recommended medicines.

**3.4 Activity Diagram**

1. Data is input by the user.
2. Preprocessing ensures data quality.
3. Machine learning models are trained and tested.
4. Results are evaluated and the top-performing model is used to provide recommendations.

**4. Implementation**

**4.1 Data Preprocessing**

Uses libraries such as **Pandas** and **NumPy** to:

* Handle missing values.
* Normalize numerical features.
* Encode categorical variables for compatibility with machine learning algorithms.

**4.2 Model Training**

* **SVM**: Optimized for linear and kernel-based classification tasks.
* **Random Forest**: Combines multiple decision trees to enhance prediction accuracy and robustness.

**4.3 Model Evaluation**

Evaluates each model on:

* Test datasets to measure generalization.
* Metrics like accuracy, precision, recall, and F1-score.

**4.4 Recommendation System**

This module combines model predictions with patient-specific inputs, offering tailored medicine recommendations in a prioritized list.

**5. Limitations and Future Enhancements**

**5.1 Limitations**

* Relies on high-quality data for accurate predictions.
* Limited to the scope of trained diseases and datasets.

**5.2 Future Enhancements**

* Incorporate additional machine learning models for broader coverage.
* Enable real-time feedback from healthcare professionals.
* Deploy the system on the cloud for enhanced scalability and accessibility.

**6. Output Screens**

* **Dashboard**: Displays patient data and predictions.
* **Comparison Report**: Highlights model metrics for easy selection.
* **Recommendations Panel**: Lists suggested medicines with confidence scores.

**7. Conclusion**

The Medicine Recommendation System demonstrates how machine learning can revolutionize healthcare by providing accurate and personalized medicine recommendations. By simplifying the decision-making process, it aids healthcare professionals in delivering improved patient outcomes.

**Appendices**

**Appendix A**: Dataset Details and Sources.  
**Appendix B**: Explanation of Performance Metrics.  
**Appendix C**: Overview of SVM and Random Forest Algorithms.

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