**Intelligent Drug Recommendation System**

**Problem Statement:**

In modern healthcare, selecting the right medication for a patient involves evaluating several physiological parameters. However, this process can be time-consuming, subjective, and prone to variability in decision-making. Automating drug recommendation based on patient data can enhance consistency, reduce errors, and support clinical decision-making.

**Objective:**

The goal of this project is to develop a **Machine Learning-based Drug Classification System** that predicts the most appropriate type of drug to prescribe based on a patient's physiological characteristics. The model is trained using a dataset consisting of patient features such as:

* **Age**
* **Sex**
* **Blood Pressure Level (BP)**
* **Cholesterol Level**
* **Sodium-to-Potassium Ratio (Na\_to\_K)**

The model classifies each patient into one of several predefined drug types (e.g., **DrugA**, **DrugB**, **DrugC**, **DrugX**, **DrugY**), and the deployed application visualizes the prediction along with class probabilities to give transparency in decision-making.

**Solution Overview:**

1. **Model Development**:
   * Preprocessing categorical and numerical features.
   * Training classification models (e.g., Random Forest, Logistic Regression, etc.).
   * Evaluating model performance on classification metrics.
2. **Deployment**:
   * Creating a web-based user interface using Streamlit.
   * Accepting real-time patient input and displaying:
     + The predicted drug class.
     + Probability distribution across all drug classes.
     + Encoded input values and feature processing for transparency.

**Key Features of the Deployed Application:**

* Real-time predictions based on user input for all five input parameters.
* Intuitive UI/UX with interactive sliders, dropdowns, and a clean visual layout.
* Transparent predictions with:
  + Input DataFrame preview
  + Encoded feature values
  + Model output probabilities for all drug classes
* Fast and lightweight deployment suitable for local or cloud hosting (e.g., Streamlit Cloud, Heroku, AWS).

**Use Case:**

This tool can assist healthcare professionals in:

* Quickly identifying a suitable drug based on patient input.
* Making data-driven decisions in outpatient clinics or remote diagnostics.
* Enhancing patient care and treatment personalization.