

Revolutionizing Prakriti Determination

AI-based Prakriti Analysis Made Simple.

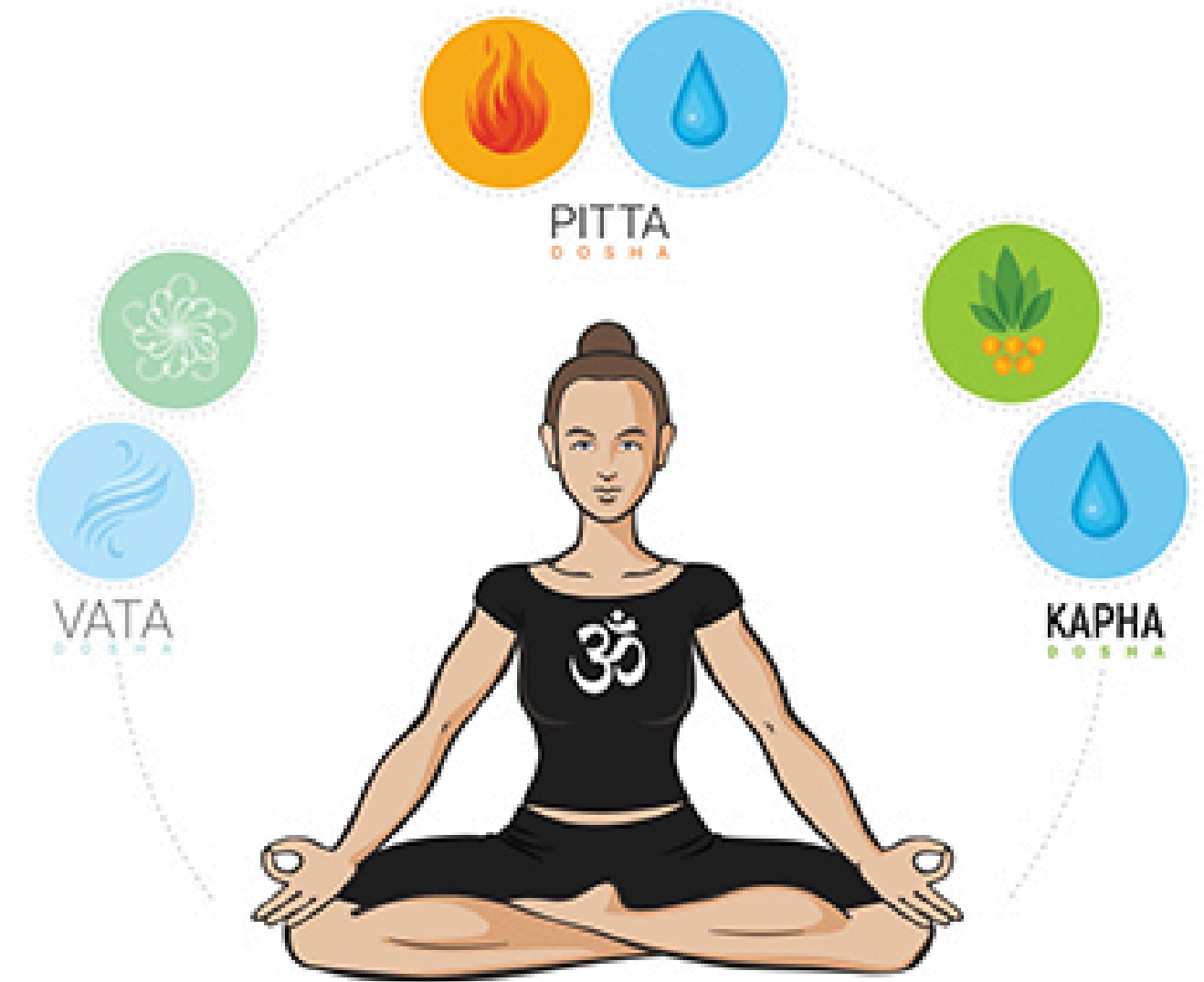
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Outline

1. Introduction
2. Problem Statement
3. Work done, Results and Discussion
4. Future work
5. Conclusion

Introduction

- Prakriti refers to an individual's unique and inherent constitution.
- According to Ayurvedic principles, every person is born with a specific balance of the three doshas—Vata, Pitta, and Kapha that make up their Prakriti.
- These doshas represent different combinations of the five elements (earth, water, fire, air, and ether) and are responsible for various physiological and psychological functions in the body.



TRIDOSHA
AYURVEDA
BODY TYPE

Introduction

- Modern medicine and ancient Ayurveda medicines work independently. However, both targets the same problem of diseases.
- With the help of AI/ML and other technologies we aim to integrate principles of ancient Ayurveda for Prakriti to cure diseases and approach towards P5 medicine framework- Predictive, Preventive, Personalized, Participatory, Promotive.

Problem Statement

- The current obstacle in phenotyping is **notably subjective** and **exceedingly time-consuming**.
- The aim is to address this challenge by integrating digital devices like sensors with AI to swiftly and objectively assess Ayurveda parameters and customize interventions.
- The goal is to create a method that automatically identifies a person's Prakriti based on their phenotypes.

How is Prakriti determined ?

- According to Ayurveda principles, Doshas determine one's Prakriti.
- The visual features of the different parts of the body such as **eyes, skin, face, hair, muscles, teeth, and nails and body proportions**.
- The parameters such as the **shape, size, color, texture, reflectivity, density**, of the body play a critical role in determining the Prakriti.
- The **demography, geography, psychological traits, lifestyle habits and preferences** would also play an important role in Prakriti identification.

We want to learn a ML model to automatically identifying the Prakriti based on the phenotypic traits of an individual.

For training such model, we require large amount of wide data. Hence, firstly we need to conduct a survey of population to gather this data of phenotypic traits.

We aim to conduct survey of more than 1000 individuals initially to capture this data, using questionnaires, sensor integrations and gamification models

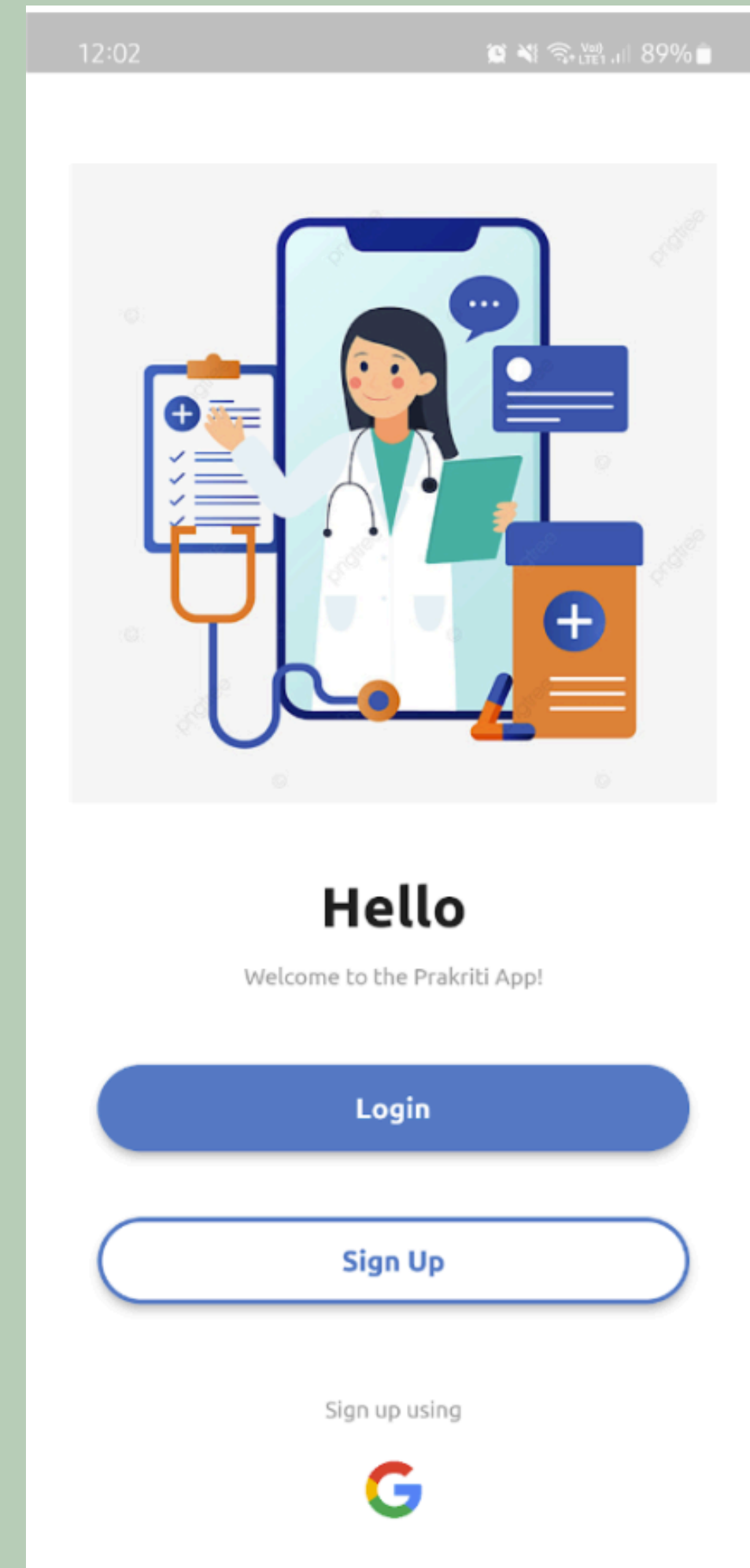
How to conduct Survey ?

→ **Develop an mobile application for conducting user survey**

A mobile application(Android/iOS) which allows user-friendly questionnaire based survey for capturing key physical, physiological and psychological phenotypic features and identifying Prakriti based on the questionnaire response.

Why a mobile application ?

- Wider accessibility and reach
- Highly Scalable
- More flexibility and customization, new features can be added and modified easily.
- More secure, independent of third party tools for data collection
- More user friendly



Prakriti

A mobile application for human phenotypic survey for Prakriti determination

- I have successfully developed a mobile application for both iOS and Android based smartphones. With the help of this mobile application, user surveys can be easily and smoothly conducted.

Development of the mobile application:

Development of the mobile application:

- The application was developed using the - Flutter framework from Google based on the Dart programming language. The Framework allows developers to develop cross platform applications with a single codebase which can be run across multiple platforms including iOS, Android, Web, Windows, MacOS. The Flutter framework defined the UI/UX i.e the frontend of the mobile application ensuring user friendly application use, and smooth questionnaire based survey within the application.
- The backend of the application is developed with Firebase from Google, to store the application data including user details, authentication details, survey data and survey results with optimal security.
- To ensure smooth collaboration and well defined development cycle and code application management GitHub is used. The entire code for the application is pushed into the GitHub repository of the project.

Why this Framework ?

Why Flutter?

- Single Codebase for Multiple Platforms
- Hot Reload
- Expressive and Flexible UI
- Wider Google Services through API
- Integration with Firebase
- Customization and Branding

Why Firebase?

- Real-time Database/ Firestore database (Unstructured data)
- User Authentication
- Hosting
- App release and distribution
- Cloud storage
- Analytics and Machine Learning features

Development roadmap of the application

1. Welcome page of the application
2. User Signup/ Login page
3. User profile registration page for new users.
4. User profile home page
5. User survey screen
6. User survey dashboard screen.

[Click here to watch the video working of the application](#)

Design of the questionnaire

- 1.Body features - Height, Weight, Body Frame and Build
- 2.Lifestyle and behaviour questions
- 3.Physiological and psychological traits - Musculature
- 4.Preferences - Food, Weather, Taste

Asked in form of : Text Inputs, MCQ's and MSQ's

It needs to be ensured that questionnaire is designed correctly and is implemented in correct and required format in the application for smooth survey conduction

Design of the Firebase Database

All of the user data is collected and stored in the Firebase's - Firestore database (NoSQL) with the below schema :

User Survey Collection -> User document -> Profile data, Survey collection -> Survey responses, Survey results, Survey note

The NoSQL allows horizontal scalability to the database, store unstructured data - like videos, images etc.

Challenges faced during application development:

- Ensuring there is no discrepancy in the data format and data ambiguity, we need to store the data in specific format as per the data type - For example, for age - integer, for weight - decimal, for date - date
- In the survey page, it needs to be ensured that user submits current question and only then can proceed ahead, allow user to modify the responses while doing survey, going back to answered questions and changing the answer.
- In the survey, users can choose multiple options if allowed as per questionnaire design.
- Had to do a lot of debugging in all the components of the application - User Authentication, Survey Screen, Downloading and sharing the survey results, storing and fetching the results from firebase, Survey dashboard, consistency in the UI of the application.
- It was ensured that the code written is clean and well documented for easy development and collaboration.
- Designing and Storing the data in firebase for optimal flexibility and retrieval of data

Survey Statistics :

- 343 unique survey conducted till date
-

The collection of user surveys is stored in the JSON format. I have converted the JSON format of the database into excel format by running a python script, fetching the JSON data from Firebase Firestore with the API calls. The same could have done with Firebase features but they are paid and cost high charges.

The excel format makes it easier for data analysis tasks

With the data obtained from the survey of the individuals, the next task was Data Mining and Machine Learning i.e modeling of Prakriti identification.

Before performing any modelling task, its is necessary to perform certain crucial steps in Data Analysis including :

Exploratory data analysis: summarize main characteristics of the data i.e shape, column names, features and their types : categorical (ordinal/nominal) or numerical, target values (identified prakriti in our case)

Data Pre-processing : removing NULL values, data columns not relevant for analysis - name, user ID, contact number, email ID etc.

- Encoding categorical features using label and one hot encoding

Exploratory Data Analysis :

	age	bmi	wristSize	height	waistSize	hipSize	weight	Kapha	Pitta	Vata
count	343.000000	343.000000	343.000000	343.000000	343.000000	343.000000	343.000000	343.000000	343.000000	343.000000
mean	25.317784	22.631272	15.548863	164.748688	33.841983	38.161224	61.687638	34.348368	40.817017	24.834615
std	5.561028	3.858190	2.054886	8.971781	4.516272	18.061983	12.982631	10.370343	10.776318	11.544647
min	17.000000	13.818027	6.000000	140.000000	24.000000	22.000000	35.000000	9.090909	13.333333	0.000000
25%	21.000000	20.141859	14.500000	158.000000	32.000000	35.000000	52.500000	27.272727	33.333333	15.909091
50%	25.000000	22.263451	15.500000	164.500000	34.000000	37.000000	61.000000	34.883721	40.909091	23.255814
75%	28.000000	24.722511	16.000000	171.500000	36.000000	39.000000	68.000000	40.909091	48.837209	33.333333
max	51.000000	39.555397	44.000000	194.000000	88.000000	365.000000	117.000000	67.441860	65.116279	54.545455

Earlier the database had 346 samples and 68 columns

Post pre processing :

1. Removing null values and redundant samples
2. Removing column data which is not required

The shape was reduced to 343 X 56

Label Encoding :

It is necessary to encode the categorical features i.e survey questions into numbers so that computer can understand the variable feature.

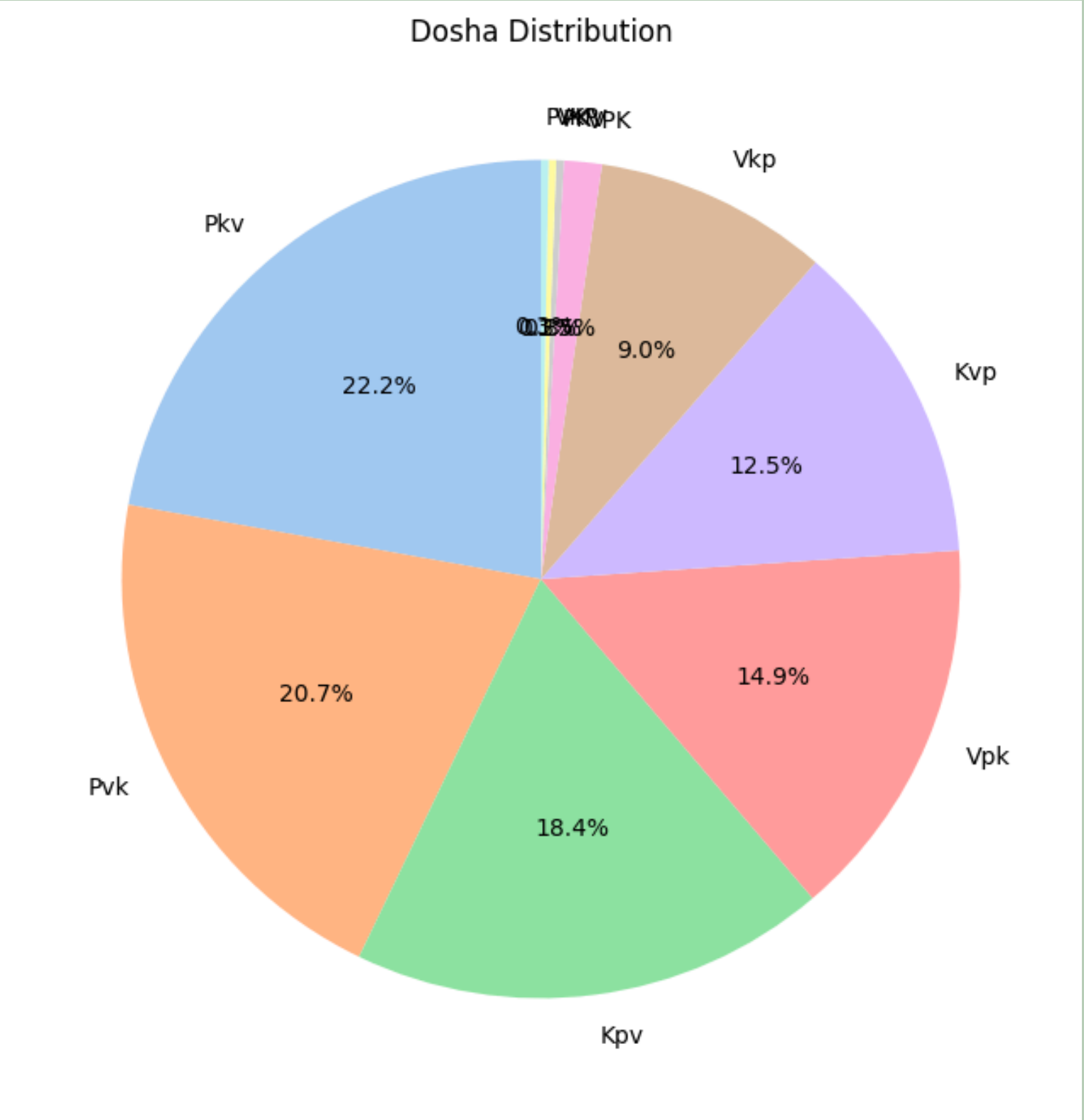
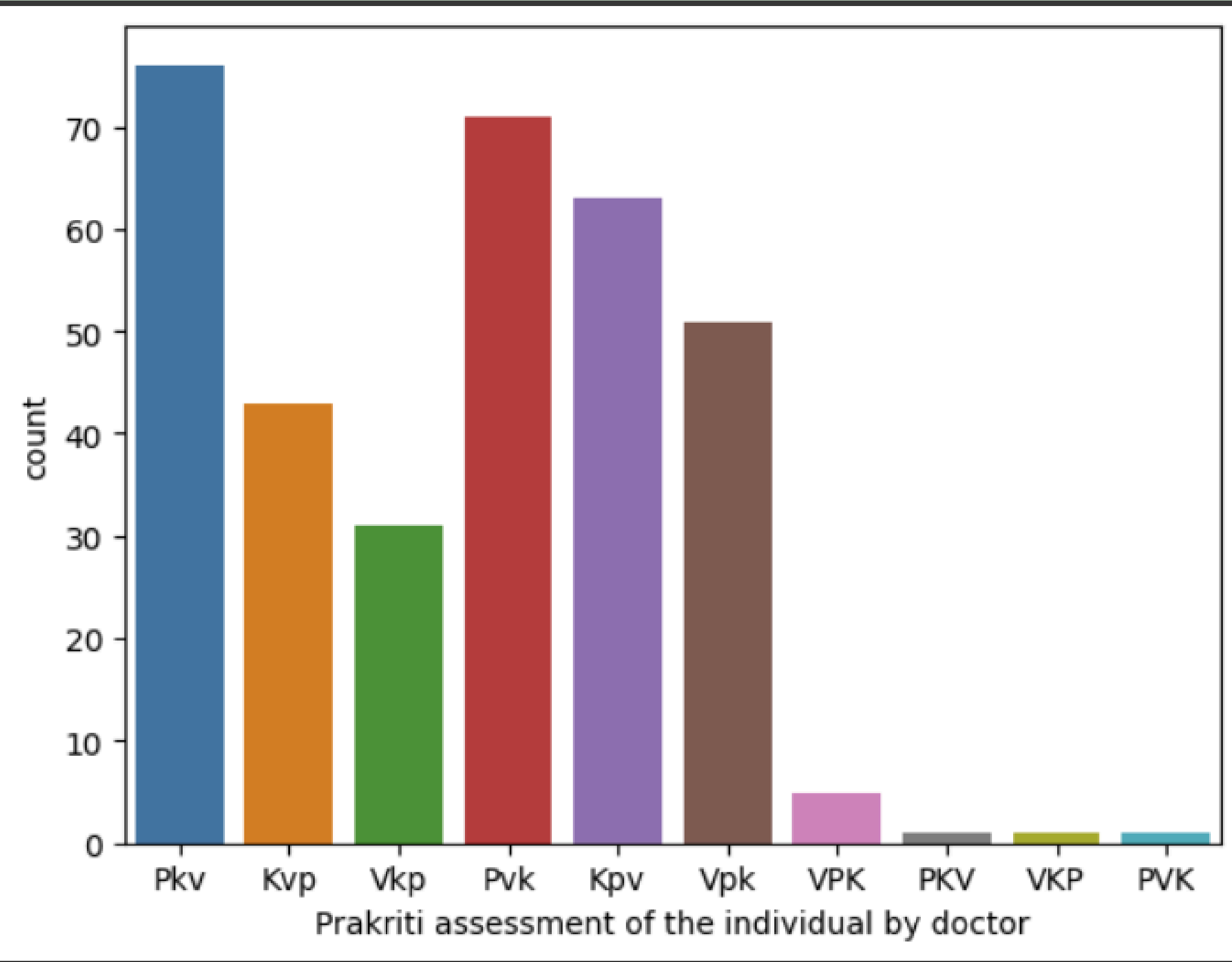
There are two types of categorical features -

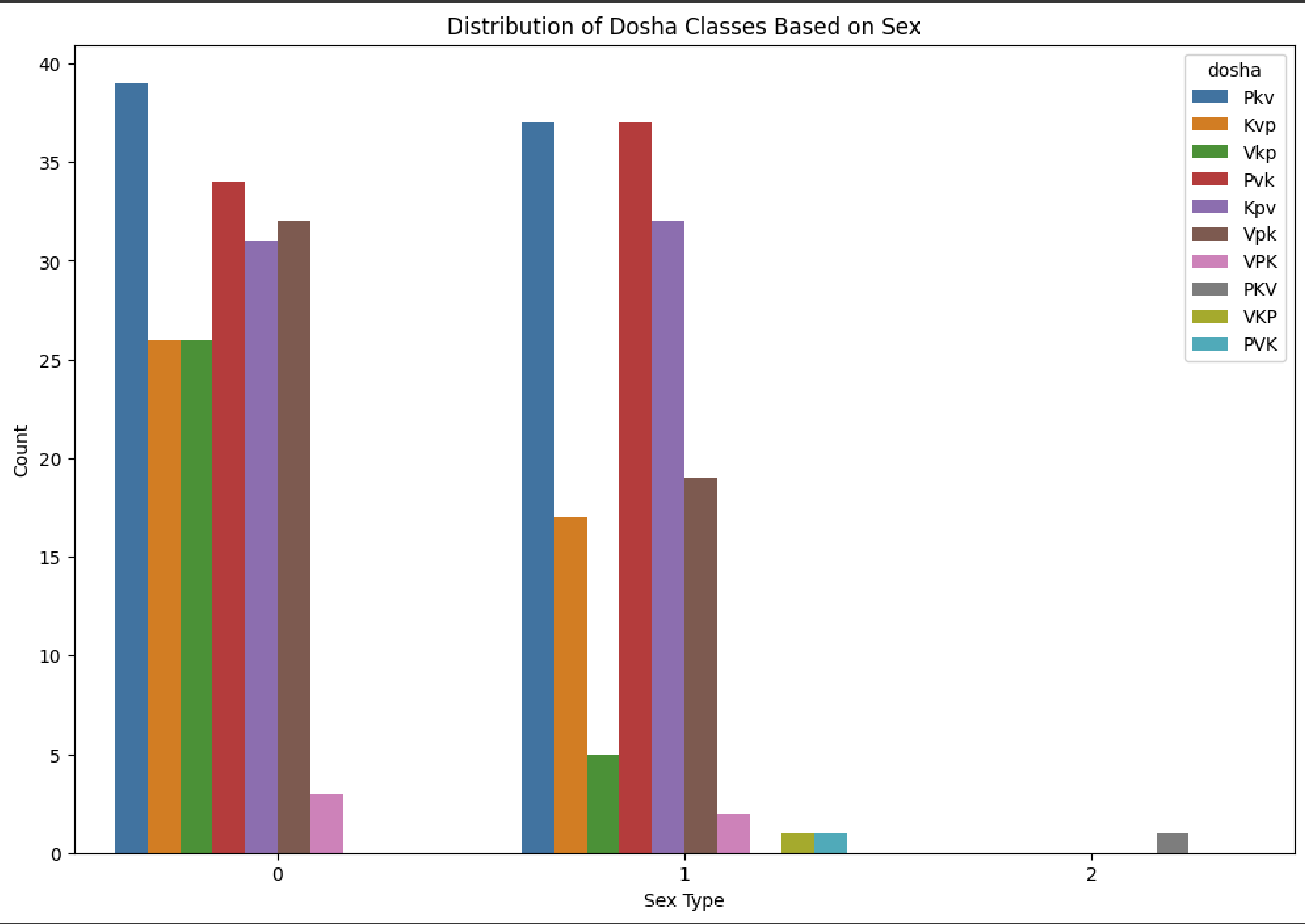
1. **Nominal** - Values have no quantifiable relation among themselves e.g sex - male or female
2. **Ordinal** - values have some ordered relation e.g High, Medium, Low

I encoded the survey questions and other features like sex based on thier type :

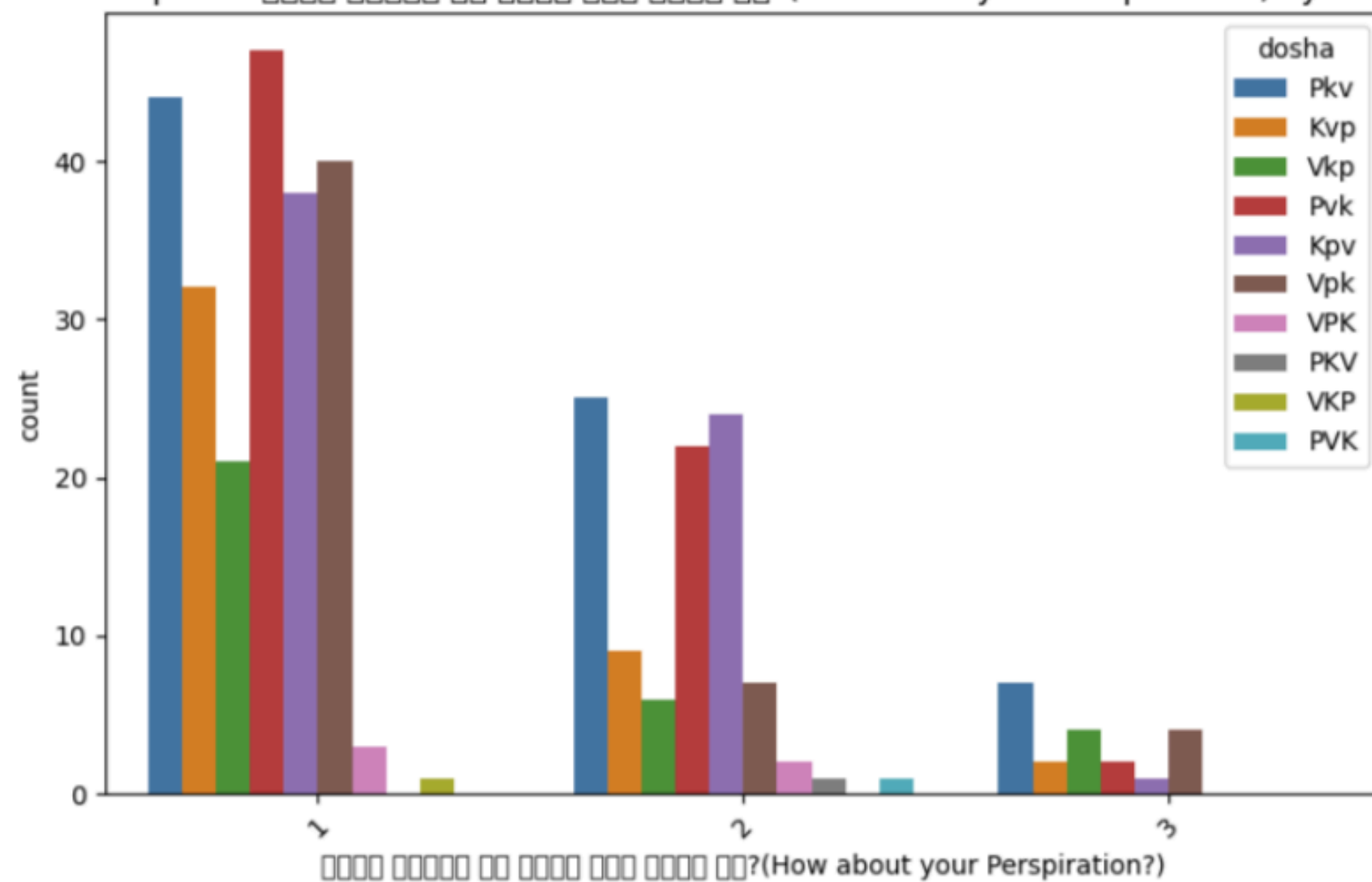
1. **One hot encoding** for Nominal Features
2. **Label encoding** for Ordinal Features

Data Visualization

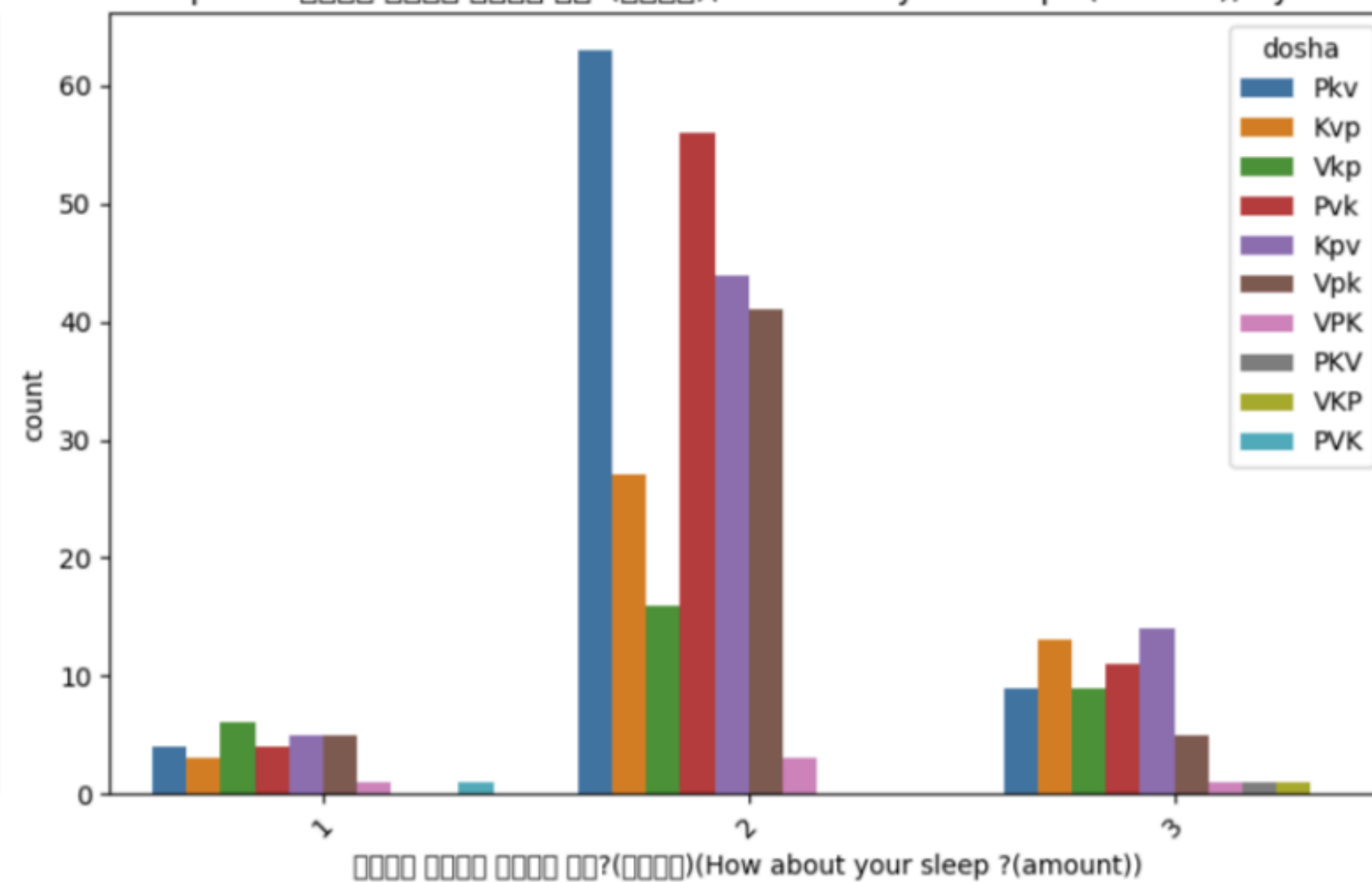




Countplot of **How about your Perspiration?** by Dosha



Countplot of **How about your sleep ?(amount)** by Dosha



Correlation between Prakriti identified by application and that identified by Doctor : 65%

Dimensionality Reduction : Principal Component Analysis

To reduce the dimensionality of the feature set, PCA is performed. With this I retained the features of the dataset with variance contribution of 95% and discarded the other parameters to reduce the dimension of the dataset, before modeling.

Shape Before PCA: 343 X 86

Shape After PCA : 343 X 53

Future Work

1. Gamification and interactive survey within the application
2. Training with more sample size
3. Interactive and Dynamic Dashboard
4. Integrating the ML model with other models for multi-model prakriti evaluation
- 5.5. Insights from Prakriti evaluation and survey data to the patients for better and healthy lifestyle
- 6.6. Integrating other smart sensors - like smart watch for smart healthcare



Thank You