Centre for infrastructure, Sustainable Transportation and Urban Planning

Indian Institute of Science (IISc), Bengaluru

Winter Internship Program 2023

Name
Deepankar Pawar

Title:

Multinomial Logistic Regression: A Python Implementation for Probability Calculation

Introduction:

Write a Python function to calculate the probability of each alternative in a multinomial choice
setting using the logistic function, given a set of parameters and independent variables. The
function should be generic enough to handle any number of alternatives and independent variables.
In a multinomial logit model, the probability of each alternative is calculated using a logistic
function. For each alternative, a deterministic utility (V) is computed based on a linear
combination of independent variables and their respective coefficients (β). The probability of each
alternative is the exponential of its utility divided by the sum of exponentials of all utilities.

Code Structure and Organization:

Modularity:

The code is well organized into functions, improving readability. Functions are used to encapsulate specific functionalities, such as the logistic function is used for calculating the alternatives and the main calculation loop.

User Input Handling:

The code effectively handles user inputs for parameters
Inputs are converted to the appropriate data types for calculations such as lists, list1,list2,list3

Mathematical Accuracy:

Logistic Function:

The logistic function is correctly implemented to calculate probabilities for each alternative.
Formulas are accurately applied in the logistic function as the given problem statement

Exception Handling:

This code uses try-except blocks to handle potential Index Error when iterating through the lists.
Provides informative messages when an error occurs, making it user friendly.

Readability and Comments:

Variable Naming:

Variable names are meaningful and they follow a consistent style, thus enhancing the code readability.

Comments in Functions:

Add comments within the logistic function and other functions to explain their functionality.

Overall Assessment:

The code successfully implements a multinomial logistic regression model, handling user inputs and calculating probabilities for each alternative. With some additional input

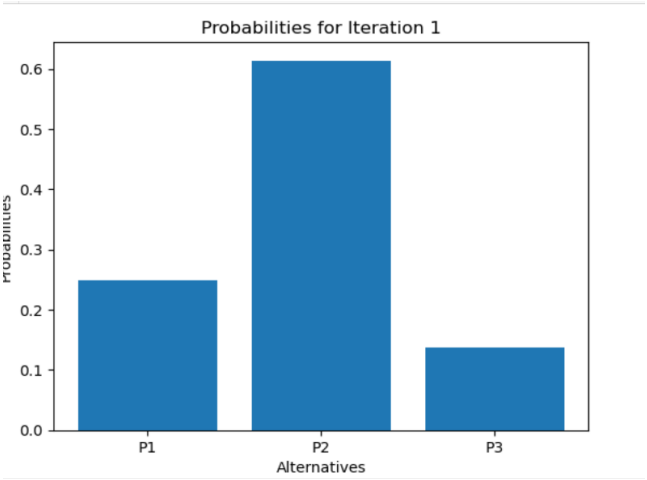
validation and comments, it can further improve readability and robustness.

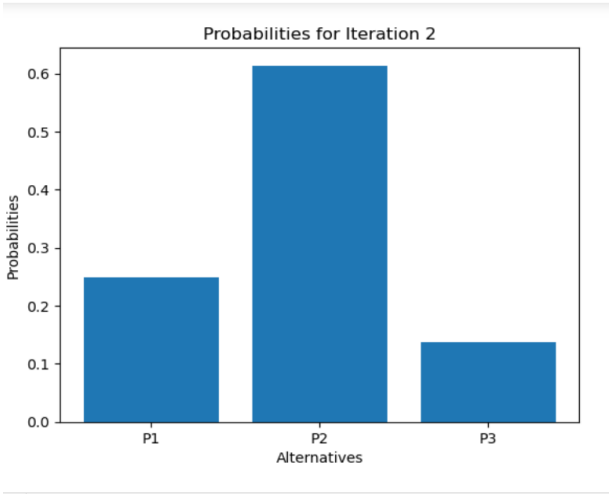
Basic Visualization

If we plot the graph for the below output

```
Enter values for X1 separated by space: 2 4
Enter values for X2 separated by space: 3 5
Enter values for Sero separated by space: 1 4
P1 =
  P1 = 0.2731
  P2 = 0.6717
  P3 = 0.0551

P2 =
  P1 = 0.2495
  P2 = 0.6136
  P3 = 0.1369
```





We can observe that probability of alternative P2 is higher in both the iteration.