OPIM 5504 Adaptive Business Intelligence

Programming Project Part 2:
A Forecasting DSS for Burger Bounty
Due on December 13, 2023

This programming project can be worked either as a team (strictly two students per team) or individually. Prepare your answers into a Word file, and submit your file via Husky CT, no later than 11:59 p.m. on the due date. Email submissions before the deadline are not acceptable. By submitting the assignment, you are confirming that this represents your team's work, and that no part of the work submitted has been copied from others. The consequences of cheating can be quite serious. It can lead to not only failing the course but also dismissal from the program. If determined that more than two students have worked on the same assignment submission, the participants will only get a fraction of the assignment's grade or not grade at all.

Project Overview

Continuing with the Burger Bounty case. Megan would like to better assess what location to visit in each day by using some of the factors in the dataset. She believes that there are certain factors that have a strong effect on sales, such as weather, day of the week, burger prices, the location, etc. To do so, she would like to enhance the DSS to provide location recommendations based on location data and predicted burger revenues.

Project Specifications/Requirements

I. Write R code to generate six linear multiple regression models, one for each type of burger. The goal of each regression model is to predict sales (in number of burgers) as a function of seven independent variables: burger price, visited town, time spent at the location, average precipitation, average temperature, whether there was an event, and whether it was a weekend. To generate your models, use the original datasets in the "*BurgerBounty.xlsx*" Excel file. For example, Figure 1 shows a summary report with the regression coefficients in the linear model for the Bounty Hunter burger. Notice that the fields entitled "Date" and "Name" must not be used in any of the regressions. In the summary report, the variable named "Prices" (at the bottom of the coefficients list) refers to the column of prices for the Bounty Hunter burger taken from the "Prices" sheet of the Excel file, column B.

Using any of these regression models, we can predict the sales and revenue for any burger. For example, using the Bounty Hunter model from Figure 1, and assuming that the firm is planning to go to downtown Hartford, will spend two hours at the location, average precipitation forecast is 20%, average temperature forecast is 70 degrees, there will be an event at the location, will not

be a weekend day, and the price per burger is $9, then the predicted sales of Bounty Hunter burgers at the location (according to the regression model) is 31.43639 burgers. The corresponding predicted revenue is $9 x 31.43639 = $282.93.

```
Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        1.941e+02  4.909e-01  395.45   <2e-16 ***
TownEast Hartford -2.302e+00  5.732e-02  -40.16   <2e-16 ***
TownGlastonbury   -2.549e+00  7.885e-02  -32.33   <2e-16 ***
TownManchester    -6.449e-01  5.311e-02  -12.14   <2e-16 ***
TownNew Britain   -4.576e+00  8.735e-02  -52.38   <2e-16 ***
TownWest Hartford -2.187e+00  6.660e-02  -32.84   <2e-16 ***
TownWethersfield  -2.070e+00  6.232e-02  -33.22   <2e-16 ***
Time               3.292e+00  1.838e-02  179.15   <2e-16 ***
Precipitation      1.306e+00  7.572e-02   17.24   <2e-16 ***
Temperature        6.790e-02  9.202e-04   73.79   <2e-16 ***
EventYes           6.888e-01  6.841e-02   10.07   <2e-16 ***
WeekendYes        -6.555e-01  5.311e-02  -12.34   <2e-16 ***
Prices            -1.944e+01  5.017e-02 -387.46   <2e-16 ***
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2965 on 280 degrees of freedom
Multiple R-squared:  0.9986,    Adjusted R-squared:  0.9985
F-statistic: 1.636e+04 on 12 and 280 DF,  p-value: < 2.2e-16
```

Figure 1. Regression summary for sales of Bounty Hunter burgers using the original datasets.

II. Design a Shiny app to provide location recommendations to visit. Like before, you are free to design the app as you wish, but the user interface of the app must satisfy the following requirements:

   a) It should contain one input entry for each of these variables that do not depend on the location: hours to be spent at the location, average precipitation, average temperature, and whether the visit will be on a weekend day (a total of four inputs). These variables are common to all locations, so that they only require one input for each in the interface.
   b) For each location, whether there will be an event at that location (a total of seven inputs).
   c) For each burger type, the planned price per burger (a total of six inputs).
   d) A button entitled "Recommendations".

In summary, the interface will have 17 inputs and one action button. Make sure that the interface is user friendly, intuitive to use, well organized, and does not look crowded (see pages 45-46 in the Husky CT textbook).

When the "Recommendations" button is pressed, the app will use your six regression models from part I and the user inputs to compute sales predictions for each burger at each location (town). Since there are six burger types and seven locations, this represents a total of 42 sales predictions. The results should be output in a data table like in Figure 2. The middle columns should contain the predicted sales (round the numbers to the nearest integer), and the last column should contain the aggregated revenue per location. The rows in the table must be presented in decreasing order based on revenues.

Town	Bounty Hunter	Classic Cheeseburger	Spicy Mutiny	Nature Bounty	BEC	Double Veggie	Predicted Revenues
Downtown Hartford	TBA	TBA	TBA	TBA	TBA	TBA	TBA
East Hartford	TBA	TBA	TBA	TBA	TBA	TBA	TBA
West Hartford	TBA	TBA	TBA	TBA	TBA	TBA	TBA
Manchester	TBA	TBA	TBA	TBA	TBA	TBA	TBA
New Britain	TBA	TBA	TBA	TBA	TBA	TBA	TBA
Glastonbury	TBA	TBA	TBA	TBA	TBA	TBA	TBA
Wethersfield	TBA	TBA	TBA	TBA	TBA	TBA	TBA

Figure 2. A sketch of the expected output.

III. Your codes must be self-contained, they can only access (read) the datasets from the "*BurgerBounty.xlsx*" original Excel file (if necessary). The app must not be reactive, the output should be modified only when the button is pressed. In developing your app, do not use any external R packages except for those covered in class, all the tasks should be completed with standard R and Shiny commands. Do not use ChatGPT (or similar) to develop your app, ChatGPT codes will receive a significantly lower grade. Copy-paste all your codes on a Word file to be submitted with your answers, including the commands used to create the regression models and the Shiny app.

Project Grading

The project will be graded according to the following parameters:

Meets specifications	80%
User-friendly	10%
Creativity/Aesthetic	5%
Code clarity/modularity	5%
Total	100%

- **Specifications**: the program meets the requirements indicated above such as correct handling of events, correct updating of data objects, correct outputs, etc.
- **User-friendly**: the program is reasonably easy to use for an operator not very familiar with R.
- **Creativity/Aesthetic**: the layout of the app is pleasing to the eye, elegant, functional, and exhibits creativity.
- **Code clarity/modularity**: the program code is easy to understand and exhibits some modularity. It is also efficient in completing the required tasks.