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**Performance Assessment for D211: Advanced Data Acquisition  
Part 3: Reflection Paper**

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September 12, 2024

Performance Assessment for D211: Advanced Data Acquisition – Part 3

## C1 – Purpose and Function

The scenario provided with the churn dataset indicates that the senior executives of a telecommunications company (which I will call Bigtel) understand how expensive it is to acquire new customers compared to keeping existing ones. The scenario further states that telecom companies in the US may experience churn rates of up to 25 percent annually. I hypothesize that Bigtel’s management already knew they had a severe churn problem before commissioning this work. However, knowing you have a problem and knowing where to begin working on solving the problem are two very different things. My dashboard and analysis aim to provide Bigtel’s leadership with tools and information to highlight facets of the customer base with the highest churn rates. With these insights, management can implement changes to keep existing customers happier and reduce the overall churn rate.

## C2 – Selection of Business Intelligence Tool

Tableau, a Salesforce product, is the tool our team has selected to develop user-facing data dashboards. Tableau could be considered the grandfather of business intelligence tools, having been available for over 20 years. (Gittleson, 2023) Tableau connects over 100 data sources, including databases and Software-as-a-Service APIs. (Decision Foundry, 2021) These include those that BigTel employs today and many others that provide tremendous flexibility and adaptability for tomorrow. Tableau also provides unmatched deployment flexibility. Tableau is not tied to one vendor’s cloud solution, unlike other popular BI tools. (Francis, 2022) All these benefits would be irrelevant if Tableau didn’t provide industry-leading visualization and interactivity capabilities; both are key features of Tableau. (KnowledgeHut, 2023) All of these features combined in one attractive package make Tableau a market leader among business intelligence tools. (Schlegel, et al., 2024)

## C3 – Data Preparation

In preparation for this analysis, I examined Bigtel’s enterprise data dictionary to select candidate tables from the Customer Relationship Management (CRM) system. Once selected, I used pgadmin4 to perform basic data cleaning steps, including identifying missing data and verifying the representation of the data. Because the CRM database uses referential integrity extensively, no data quality problems were identified. I could not find a data source that grouped states into Bigtel’s region structure. Therefore, I manually created a mapping table for this purpose.

I also selected an open-source dataset to complement the extract from the CRM. The dataset, published by Broadband Now’s Open Data Challenge (BroadbandNow, 2021), details competitive telecommunication service availability and cost for each zip code in the United States. Using this data to augment our internal data allowed me to provide insight into how available competing services might be impacting our churn rate.

## C4 – Dashboard Creation

Please bear with me, as this section will be lengthy.

Environment Preparation

1. Launch the standard ***LabOnDemand*** environment for D211
2. Unzip the file attached to my submission and place these two files in the “c:\users\LabUser\Desktop” folder
   1. stateregion.sql
   2. broadband\_data\_openchallenge.csv

Data Preparation

1. Open ***pgadmin4***
2. Connect to the ***churn*** database
3. Open a query window by clicking “Tools”, then “Query Tool”
4. Click the Open folder button
5. Navigate to “c:\users\LabUser\Desktop”
6. Select “stateregion.sql”
7. Execute the script by clicking the Run triangle button
8. Verify successful completion by clicking on “Schemas”, then “Public”, then “Tables” in the tree view and confirm that the “stateregion” table was created
9. Close ***pgadmin4***

Dashboard Preparation:

1. Open ***Tableau Desktop***
2. Click “File” then “New”
3. In the connections pane, Click “PostgreSQL” under the heading “To a server”. (If PostgreSQL is not visible, click “More…” then find “PostgreSQL”)
4. Enter the appropriate PostgreSQL credentials:
   1. Server: localhost
   2. Port: 5432
   3. Database: churn
   4. Authentication: username and password
   5. Username: postgres
   6. Password: Passw0rd!
5. Click “Sign in”
6. Click “File” then “Save as”
7. Navigate to “c:\users\LabUser\Desktop”
8. Change the file type to “Tableau Packaged Workbook”
9. Name the file “D211\_Churn.twbx”
10. Click “Save”

Dataset Preparation:

1. On the “Data Source” tab, click and drag “New Custom SQL” onto the workspace
2. Paste this text into the “Edit Custom SQL” dialog box:

SELECT

    c.customer\_id,

    c.lat,

    c.lng,

    c.age,

    c.marital,

    c.gender,

    c.tenure,

    c.monthly\_charge,

    c.income,

    c.churn,

    l.city,

    l.zip,

    l.county,

    l.state,

    s.region,

    ct.duration,

    p.payment\_type

FROM

    customer c

    INNER JOIN location l ON l.location\_id = c.location\_id

    INNER JOIN stateregion s ON s.state = l.state

    INNER JOIN contract ct ON ct.contract\_id = c.contract\_id

    INNER JOIN payment p ON p.payment\_id = c.payment\_id

WHERE l.state NOT IN ('AK','HI','PR')

1. Click “OK”
2. Click “Update Now” to verify the connection to the database
3. In the “Connections” pane, click “Add”
4. Under “To a file” click “Text file”
5. Navigate to “c:\users\LabUser\Desktop”
6. Select “broadband\_data\_openchallenge.csv”
7. Click “Open”
8. In the “Files” pane, click and drag “broadband\_data\_openchallenge.csv” and drop it on the workspace to the right of “Custom SQL Query”
   1. Note: it may be shortened to “broadband\_da…hallenge.csv” or similar
   2. Note: ensure that there is a blue arced line connecting “Custom SQL Query” to “broadband\_data\_openchallenge.csv” on the workspace before dropping the file
9. If you get a warning message about cross-database relationships, click “OK”
10. Right-click on the “broadband\_open\_datachallenge” rectangle on the workspace and click “Rename”.
11. Enter “BBN” as the new name
12. In the relationship definition at the bottom of the window, select “zip” under “Custom SQL Query” and select “Zip” under “broadband\_data\_openchallenge.csv”
13. Right-click on the “Custom SQL Query” rectangle on the workspace and click “Rename”.
14. Enter “Customer” as the new name
15. Click “Update Now” to verify that both data sources are connected
16. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work
17. Click on “Sheet 1” at the bottom of the window

Parameters:

1. For this section, use this menu and option to “Create a parameter”

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1. Create a parameter
   1. Name: “N Values”
   2. Data type: “Integer”
   3. Current value: 5
   4. Allowable values: “Range”
   5. Minimum: checked, value 1
   6. Maximum: checked, value 20
   7. Click “OK
2. Create another parameter
   1. Name: “Map View”
   2. Data type: “String”
   3. Current value: “Region”
   4. Allowable values: “List”
   5. Values:
      1. “Region”
      2. “State”
      3. “County”
   6. Click “OK
3. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Calculated Fields:

1. Click on “Analysis” then “Create Calculated Field…”
2. Name the field “Customers”
3. Enter this text: “Count([customer\_id])”
4. Click “OK”
5. Click on “Analysis” then “Create Calculated Field…”
6. Name the field “Churners”
7. Enter this text: “SUM(CASE churn When "Yes" Then 1 Else 0 END)”
8. Click “OK”
9. Click on “Analysis” then “Create Calculated Field…”
10. Name the field “Churn Rate”
11. Enter this text: “[Churners] / [Customers]”
12. Click “OK”
13. Click on “Analysis” then “Create Calculated Field…”
14. Name the field “Price Advantage”
15. Enter this text: “[monthly\_charge]-[Lowest Priced Terrestrial Broadband Plan]”
16. Click “OK”
17. Click on “Analysis” then “Create Calculated Field…”
18. Name the field “Tenure Years”
19. Enter this text: “INT([tenure] / 12)”
20. Click “OK”
21. Right-click on “Tenure Years” under “Customer” and click “Convert to dimension”
22. Click on “Analysis” then “Create Calculated Field…”
23. Name the field “Display Map”
24. Enter this text: [Map View]”
25. Click “OK”
26. Click on “Analysis” then “Create Calculated Field…”
27. Name the field “Number of Competing Providers”
28. Enter this text:  
    (IF MAX(IFNULL([Wired100 3 2020],0),IFNULL([Wired25 3 2020],0)) = 0 then 1 ELSE MAX([Wired100 3 2020],[Wired25 3 2020]) END) - 1
29. Click “OK”
30. Right-click on “Number of Competing Providers” under “BBN” and click “Convert to dimension”
31. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Binned Fields:

1. Right-click on “age” under “Customer” and click “Convert to dimension”
2. Right-click on “age” under “Customer” and click “Create” then “Bins…”
3. Enter “15” for “Size of bins” and click “OK”
4. Right-click on “income” under “Customer” and click “Create” then “Bins…”
5. Enter “50000” for “Size of bins” and click “OK”
6. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Geographic Hierarchy:

1. Right-click on “region” under “Customer” and click “Geographic Role”, then “Create From”, then “state”
2. Right-click on “region.state” under “Customer” and click “Rename”
3. Enter “RegionHierarchy” as the new name
4. Click and drag “county” under “Customer” and drop it just below “state” in “RegionHierarchy”
5. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Default Properties:

1. Right-click on “Churn Rate” under “Customer” and click “Default Properties” then “Number Format…”
2. Choose “Percentage” with 1 decimal place
3. Click “OK”
4. Right-click on “Churn Rate” under “Customer” and click “Default Properties” then “Color…”, then click “Advanced”
5. Choose “Red-Blue Diverging”, reversed, Start = 0.2, End = 0.4
6. Click “OK”
7. Right-click on “gender” under “Customer” and click “Default Properties” then click “Sort…”
8. Select Sort By Manual
9. Arrange the items Male, Female, Prefer not to answer
10. Close the dialog
11. Right-click on “gender” under “Customer” and click “Default Properties” then “Color…”
12. Assign Red to “Male”, Light blue to “Female”, Gray to “Prefer not to answer”
13. Click “OK”
14. Right-click on “income(bin)” under “Customer” and click “Default Properties” then “Color…”
15. Choose “Green-gold” and click “Assign Palette”
16. Click “OK”
17. Right-click on “Price Advantage” under “Customer” and click “Default Properties” then “Number Format…”
18. Choose “Currency (Standard)”
19. Click “OK”
20. Right-click on “Price Advantage” under “Customer” and click “Default Properties” then “Aggregation…”
21. Choose “Average”
22. Right-click on “monthly\_charge” under “Customer” and click “Default Properties” then “Number Format…”
23. Choose “Currency (Standard)”
24. Click “OK”
25. Right-click on “monthly\_charge” under “Customer” and click “Default Properties” then “Aggregation…”
26. Choose “Average”
27. Right-click on “income” under “Customer” and click “Default Properties” then “Number Format…”
28. Choose “Currency (Custom)” with 0 decimal places, ($1234) negative values, no display units, “$” prefix, include thousands separators
29. Click “OK”
30. Right-click on “zip” under “Customer” and click “Default Properties” then “Number Format…”
31. Choose “Custom” with format “00000”
32. Click “OK”
33. Right-click on “Zip” under “BBN” and click “Default Properties” then “Number Format…”
34. Choose “Custom” with format “00000”
35. Click “OK”
36. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Custom Aliases:

1. Right-click on “age (bin)” under “Customer” and click “Aliases…”
2. Edit the “Value (Alias)” column to have these values in order: “15-29”, “30-44”, “45-59”, “60-74”. “75+”
3. Click “OK”
4. Right-click on “Tenure Years” under “Customer” and click “Aliases…”
5. Change the “Value (Alias)” with a value of “0” to “< 1”
6. Click “OK”
7. Right-click on “duration” under “Customer” and click “Aliases…”
8. Change the “Value (Alias)” with a value of “Month-to-month” to “Monthly”
9. Click “OK”
10. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

KPIs:

1. Right-click on “Sheet 1” at the bottom of the window, then click “Rename”
2. Change the name to “KPI Customers”
3. Drag “Customer (Count)” onto the workspace
4. Change the font to Tableau Bold 14
5. Hide the title
6. Create a new worksheet and rename it “KPI Churn Rate”
7. Drag “Churn Rate” onto the workspace
8. Change the font to Tableau Bold 14
9. Hide the title
10. Create a new worksheet and rename it “KPI Price Advantage”
11. Drag “Price Advantage” onto the workspace
12. Change the font to Tableau Bold 14
13. Hide the title
14. Create a new worksheet and rename it “KPI Churn Rate”
15. Drag “Churn Rate” onto the workspace
16. Change the font to Tableau Bold 14
17. Hide the title
18. Create a new worksheet and rename it “KPI Bill Avg”
19. Drag “monthly\_charge” onto the workspace
20. Change the font to Tableau Bold 14
21. Hide the title
22. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Maps:

1. Create a mew worksheet and rename it to “Region Map”
2. Drag “region” onto the workspace
3. Change mark type to “Map”
4. Drag “Churn Rate” to Color
5. Drag “Customers” to Tooltip
6. Drag “Churners” to Tooltip
7. Drag “Display Map” to Filters
8. Choose “Condition” and “By formula” entering this text: [Map View] = "Region"
9. Drag “region” to Filters and select All
10. Right-click on the “Map View” parameter and click “Show Parameter”
11. Set the “Map View” parameter drop-down to “State” to verify that the filter hides the map. Set back to “Region” to verify that the filter shows the map. Change to “State”
12. Duplicate the “Region Map” sheet and rename it to “State Map”
13. Remove “region” from the Marks card and replace it with “state”
14. Change mark type to “Circle”
15. Drag “Churn Rate” to Color
16. Drag “Customers” to Size
17. Click Size and increase to 50%
18. Drag “state” to Filters and select All
19. Edit “Display Map” filter and change formula text to: [Map View] = "State"
20. Right-click on the “Map View” parameter and click “Show Parameter”
21. Set the “Map View” parameter drop-down to “Region” to verify that the filter hides the map. Set back to “State” to verify that the filter shows the map. Change to “County”
22. Duplicate the “State Map” sheet and rename it to “County Map”
23. Remove “state” from the Marks card and replace it with “county”
24. Change mark type to “Circle”
25. Drag “Churn Rate” to Color
26. Drag “Customers” to Size
27. Click Size and increase to 50%
28. Drag “state” to Filters and select All
29. Edit “Display Map” filter and change formula text to: [Map View] = "County"
30. Right-click on the “Map View” parameter and click “Show Parameter”
31. Set the “Map View” parameter drop-down to “Region” to verify that the filter hides the map. Set back to “County”
32. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Worst/Best Churn Viz:

1. Create a new worksheet and rename it to “Worst Churn States”
2. Drag “state” to Rows
3. Drag “Churn Rate” to Text
4. Drag “state” to Filters
5. Choose “Top”, “By field”, “Top”, “N Values” by “Churn Rate”
6. Sort by descending Churn Rate within State
7. Center the title
8. Hide field labels for rows
9. Duplicate the “Worst Churn States” sheet and rename it to “Best Churn States”
10. Change the “state” filter to “Bottom”
11. Change the sort to ascending Churn Rate within State
12. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Tenure/Contract Viz:

1. Create a new worksheet and rename it to “Tenure”
2. Drag “Tenure Years” and “duration” to Columns
3. Drag “Churn Rate” to Rows
4. Drag “Customers” and “Churners” to Tooltip
5. Drag “duration” to Color
6. Drag “Tenure Years” and “duration” to Filters and select All for both
7. Right-click on both filters and select “Show Filter”
8. Hide the x-axis header
9. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Demographics Viz:

1. Create a new worksheet and rename it to “Demographics”
2. Drag “marital” and “gender” to Columns
3. Drag “Churn Rate” to Rows
4. Drag “Customers” and “Churners” to Tooltip
5. Drag “gender” to Color
6. Drag “marital” and “gender” to Filters and select All for both
7. Right-click on both filters and select “Show Filter”
8. Hide the x-axis header
9. Hide field labels for columns
10. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Age/Income Viz:

1. Create a new worksheet and rename it to “Age/Income”
2. Drag “age(bin)” to Columns
3. Drag “Churn Rate” to Rows
4. Drag “Customers” and “Churners” to Tooltip
5. Drag “income(bin)” to Color
6. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Alternatives Viz:

1. Create a new worksheet and rename it to “Alternatives”
2. Drag “Number of Competitors” to Columns
3. Drag “Customers” to Rows
4. Change mark type to “Bar”
5. Drag “Customers” and “Churners” to Tooltip
6. Drag “Customer” to Color
7. Drag “Number of Competitors” to Columns to create a second graph
8. Drag “Churn Rate” to Rows
9. Change mark type to “Circle”
10. Change mark color to Green
11. Right-click on “AGG(Churn Rate)” on the columns shelf and select “Dual axis”
12. If “<x> nulls” appears on the bottom right, click it and select “Filter Data”
13. Click on the column header “13” and select “Exclude”
14. Hide field labels for columns
15. Change the title to “Churn by Number of Competing Providers” centered
16. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Filters:

1. Click on the “Region Map” worksheet
2. Right-click on the “region” filter and select “Apply to worksheets” then “All using this data source”
3. Click on the “State Map” worksheet
4. Right-click on the “state” filter and select “Apply to worksheets” then “Selected worksheets”
5. Choose all worksheets other than “Region Map”, “Worst Churn States”, and “Best Churn States”
6. Click “OK”
7. Click on the “Tenure” worksheet
8. Right-click on the “Tenure Years” filter and select “Apply to worksheets” then “Selected worksheets”
9. Choose all worksheets other than “Worst Churn States”, and “Best Churn States”
10. Click “OK”
11. Right-click on the “duration” filter and select “Apply to worksheets” then “Selected worksheets”
12. Choose all worksheets other than “Worst Churn States”, and “Best Churn States”
13. Click “OK”
14. Click on the “Demographics” worksheet
15. Right-click on the “marital” filter and select “Apply to worksheets” then “Selected worksheets”
16. Choose all worksheets other than “Worst Churn States”, and “Best Churn States”
17. Click “OK”
18. Right-click on the “gender” filter and select “Apply to worksheets” then “Selected worksheets”
19. Choose all worksheets other than “Worst Churn States”, and “Best Churn States”
20. Click “OK”
21. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

Dashboard:

1. Create a new dashboard named “Churn Dashboard”
2. Set Size to “Automatic”
3. Drag a text item to the top pane of the worksheet and enter “Churn Dashboard”. Set font to Tableau Bold 20, centered, color black
4. Place a horizontal container below the title
5. Add the four KPI worksheets followed by a Blank to the container
6. Simplify the titles and set font to Tableau Book 10
7. Place a vertical container below the horizontal container
8. Place all three Map worksheets in the vertical container
9. Hide the titles of all three
10. Place the Tenure worksheet to the right of the vertical container
11. Place the Age/Income worksheet to the right of the Tenure worksheet
12. Place the Worst Churn States worksheet below the Maps
13. Place the Best Churn States worksheet to the right of the Worst Churn States worksheet
14. Place the Demographics worksheet to the right of the Worst Churn States worksheet
15. Place the Alternatives worksheet to the right of the Demographics worksheet
16. Make the title text as narrow as possible
17. Make the horizontal container as narrow as possible
18. Expand the top row of viz to take about 2/3 of the remaining space
19. Make the Churn Rate legend floating and place it over the map viz
20. Drag the Income legend under the Age/Income viz
21. Drag the Gender legend under the Demographics viz and make as narrow as possible
22. Drag the Duration legend under the Tenure viz and make as narrow as possible
23. Remove all other legends from the rightmost section
24. Make Map View parameter selector floating and place it over the map viz
25. Delete the empty container to the right of the Age/Income viz
26. Change Map View to “State”
27. Click this button and select Filters  
    A screenshot of a computer

    Description automatically generated
28. Enable these filters: Region, State, Duration, Gender, Marital Status, Tenure Years
29. For each filter displayed to the right, click this button  
    A screenshot of a computer

    Description automatically generated
30. Choose “Multiple Values (dropdown)”
31. Click the same button again, then click “Customize” and select “Show Apply Button”
32. Repeat for all the filters
33. Drag each filter and place in the horizontal container
34. Resize objects to your liking
35. Press <Ctrl>-<S> or click the “Save” icon on the toolbar to save your work

## C5 - Results

My dashboard provides visualizations that can help executives zoom in on segments of customers and lines of business that are more closely correlated to customer churn. One of these is the Length of Service / Contract Type visualization. With this chart, viewers can see that the longer customers stay with Bigtel, the less likely they are to churn. In addition, the chart shows that customers on a contract rather than month-to-month are far less likely to churn at all tenures. These insights should inform management that churn might be improved by rewarding loyalty and promoting one- and two-year service agreements.

A graph with different colored bars

Description automatically generated

Figure - Length of Service and Contract Type versus Churn Rate

Another key finding enabled by my dashboard is that churn rate is seldom consistent across a region or state. By drilling down to the county level, region vice presidents can see which counties have a high churn problem and focus attention on resolving issues impacting those counties.

A map of the state of california

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Figure - Churn Rate by County for California

## C6 – Limitations of Analysis

As I mentioned in my Panopto presentation to the team, one major limitation of this analysis is that it has identified some correlations with churn but cannot identify causations. For example, while the study demonstrates that customers on a month-to-month plan are 2x more likely to churn than those on contracts, further investigation would be required to determine why this is so. Such investigation might include customer interviews, surveys, or perhaps even some A/B testing of new promotions and offers to encourage people to sign-up for a contract.

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