

Exploratory Data Analysis with R

Introduction to Microsoft Power BI

Xuemao Zhang
East Stroudsburg University

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Outline

- Introduction
- Power BI dashboard
 - ▶ A simple example of Power BI dashboard
 - ▶ Visualization types in Power BI

Introduction

- Business Intelligence (BI) is the practice of turning data into actionable insights which let a business change or maintain a course of action.
- BI answers what has happened and what trends are developing.
 - ▶ You need to have some basic business knowledge to answer these questions.
 - ▶ You need basic stats and data visualization skills.
- BI process
 - ▶ Data storage and ETL (Extract, transform and load)
 - ▶ Data models and analysis
 - ▶ Data visuals, Dashboards, and reporting
 - ▶ Decision making
- BI tools
 - ▶ Traditional Tools: Excel, VBA
 - ▶ Data Transformation: SQL
 - ▶ Visualization: Tableau, Power BI, Qlik
 - ▶ Programming: R and Python
- Video: [What is Business Intelligence](#)

Introduction

- Microsoft introduced the idea of Self-Service Business Intelligence (BI) back in 2009, announcing Power Pivot for Microsoft Excel 2010.
- Power BI is an evolution of the add-ins previously available in Excel: Power Pivot, Power Query, and Power View.
 - ▶ You can use Power BI with or without Excel - you no longer are dependent on the version of Microsoft Office installed at your company.
- For more history of Power BI, see [Introducing Microsoft Power BI](#) and [What is Power BI? \(2021\)](#) <https://www.youtube.com/watch?v=Vqz2d7pTOV8>

Introduction

- What Power BI can do?
 - ▶ Data visualization, reporting and dashboard share within a business!
 - ▶ Data can be imported from a local disk or a server
 - ▶ Power BI DAX (Data Analysis Expressions) functions are used to build formulas and expressions, like Excel formulas.
 - ▶ We can query a database using SQL (Structured Query Language).
 - ▶ Functionality of data visualization can be extended by using R and Python.
- **Power BI components:** The different components of Power BI are meant to let users create and share business insights in a way that fits with their role.
 - ▶ Power Query: a data mashup and transformation tool
 - ★ We can run R script to make the data transformation as well
 - ▶ Power Pivot: a memory tabular data modeling tool
 - ▶ Power View: a data visualization tool
 - ▶ Power Map: a 3D geospatial data visualization tool
 - ▶ Power Q&A: A natural language question and answering engine

Introduction

- **Key features of Power BI:** Microsoft has added a number of data analytics features to Power BI since its inception, and continues to do so. Some of the most important features include:
 - ▶ Artificial Intelligence
 - ▶ Hybrid deployment support
 - ▶ Quick Insights
 - ▶ Common data model support
 - ▶ Cortana integration
 - ▶ Customization
 - ▶ APIs for integration
 - ▶ Self-service data prep
 - ▶ Modeling view

Introduction

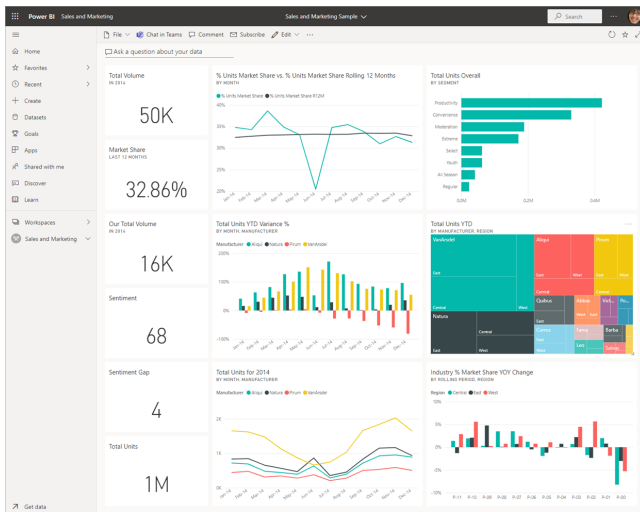
- Installation of [Power BI Desktop](#)
<https://powerbi.microsoft.com/en-us/desktop/>
- Sign up a **free** Power BI license using ESU(school) email address following [Sign up for or purchase the Power BI service as an individual](#)
<https://docs.microsoft.com/en-us/power-bi/fundamentals/service-self-service-signup-for-power-bi>
- For Mac users
 - ▶ <https://app.powerbi.com/>
 - ★ <https://youtu.be/sUAhv54FUag>
 - ▶ <https://hub.turbo.net/hub/powerbi>
 - ▶ ⋮

Introduction

- Basic concepts for designers in the Power BI service <https://docs.microsoft.com/en-us/power-bi/fundamentals/service-basic-concepts>
- Companion content of [Introducing Microsoft Power BI](https://www.sqlbi.com/books/introducing-microsoft-power-bi/companion/)
<https://www.sqlbi.com/books/introducing-microsoft-power-bi/companion/>
- We'll follow some examples in the book [Introducing Microsoft Power BI](#) to check the basic dashboard functionality of Power BI

Power BI dashboard

- A **Power BI dashboard** is a single page, often called a canvas, that uses visualizations to tell a story. Because it is limited to one page, a well-designed dashboard contains only the most-important elements of that story.



Power BI dashboard

- Loading data
 - ▶ Video: [Getting Data from a local disk](#)
 - ▶ The video is from [edX: Analyzing and Visualizing Data with Power BI](#)
<https://www.edx.org/course/data-analysis-in-power-bi>
 - ▶ We'll load the clean data `mtcars` in R so we do not need much **Power Query**
- Our first PowerBI dashboard
 - ▶ Let's use the single file `mtcars` to create our first dashboard
 - ▶ For more, see [Video: Building Our First Report](#)
- Let's get started

Power BI dashboard

Power Query

mtcars.csv

File Origin: 1252: Western European (Windows) Delimiter: Comma Data Type Detection: Based on first 200 rows

	mpg	cyl	displacement	horsepower	weight	quarter mile time	vs	am	gear	carb
Mazda RX4	21	6	160	110	3.9	16.46	0	1	4	4
Mazda RX4 Wag	21	6	160	110	3.9	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	17.02	0	0	3	2
Valliant	18.1	6	225	105	2.76	20.22	1	0	3	1
Duster 360	14.3	8	360	245	3.21	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	20	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	22.9	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	18.3	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	18.9	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	17.4	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	17.6	0	0	3	3
Merc 450SLC	15.2	8	275.8	180	3.07	18	0	0	3	3
Cadillac Fleetwood	10.4	8	472	205	2.93	17.98	0	0	3	4
Lincoln Continental	10.4	8	460	215	3	17.82	0	0	3	4
Chrysler Imperial	14.7	8	440	230	3.23	17.42	0	0	3	4
Fiat 128	32.4	4	78.7	66	4.08	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	18.52	1	1	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	19.9	1	1	4	1

The data in the preview has been truncated due to size limits.

Extract Table Using Examples

Load Transform Data Cancel

Power BI dashboard

Power Query

- We change the data type of cyl, vs, am and gear to **Text**
 - For example, for the cyl column:

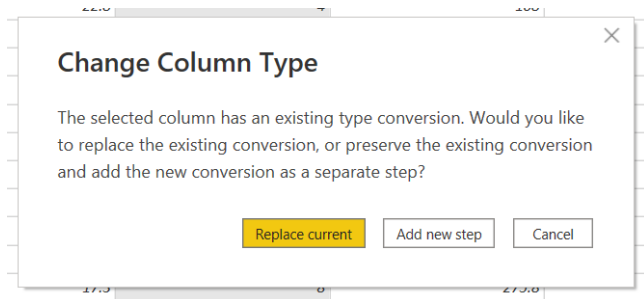
The screenshot shows the Power BI Power Query editor interface. The 'Transform' tab is selected, and the 'Data Type' dropdown menu is open for the 'cyl' column. The menu options include Decimal Number, Fixed decimal number, Whole Number, Percentage, Date/Time, Date, and Text. The 'Text' option is highlighted with a red circle. The 'Query Settings' pane on the right shows the 'APPLIED STEPS' list, where the step 'Changed Type' is highlighted with a red circle. The data table below shows columns: mpg, cyl, disp, hp, drat. The 'cyl' column is currently of type Int64.

	mpg	cyl	disp	hp	drat
1	21	6	160	150	
2	21	6	160	150	
3	22.8	4	108	93	
4	21.4	6	258	150	
5	18.7	8	360	175	
6	18.1	6	225	105	
7	14.3	8	360	245	
8	24.4	4	146.7	62	
9	22.8	4	140.8	95	
10	19.2	6	167.6	123	
11	17.8	6	167.6	123	
12	16.4	8	275.8	180	
13	17.3	8	275.8	180	
14	15.2	8	275.8	180	
15	10.4	8	472	205	
16	10.4	8	460	215	
17	14.7	8	440	230	
18	12.8	4	78.7	66	
19	30.4	4	75.7	52	
20	33.9	4	71.1	65	
21	21.5	4	120.1	97	
22	15.5	8	318	150	
23	15.2	8	304	150	

Power BI dashboard

Power Query

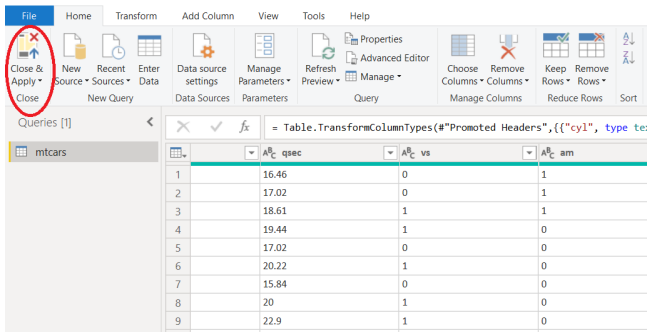
- You can choose either Replace current or Add new step



Power BI dashboard

Power Query

- Click Home and Click on Close & Apply to load the data



The screenshot displays the Power BI interface with the 'Home' tab selected in the ribbon. The 'Close & Apply' button, represented by a document icon with a red 'X' and a blue arrow, is circled in red. Below the ribbon, the 'Queries' pane on the left shows a query named 'mtcars'. The main area displays a table with the following data:

	AB_c qsec	AB_c vs	AB_c am
1	16.46	0	1
2	17.02	0	1
3	18.61	1	1
4	19.44	1	0
5	17.02	0	0
6	20.22	1	0
7	15.84	0	0
8	20	1	0
9	22.9	1	0

Power BI dashboard

- The data set is loaded now

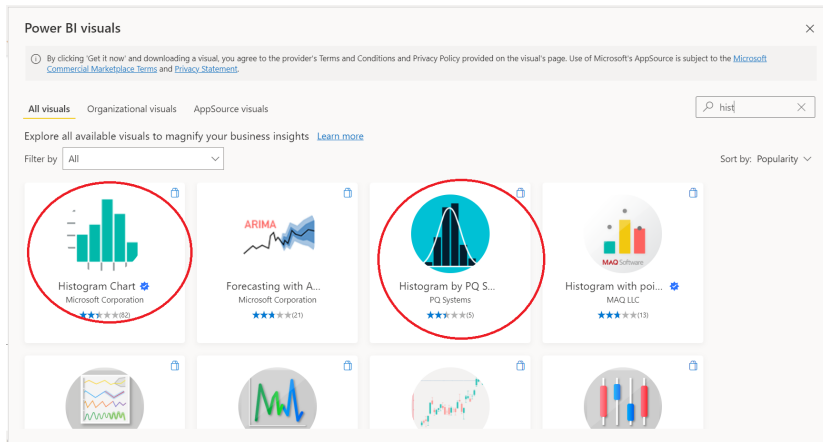
The screenshot displays the Microsoft Power BI desktop application interface. The top ribbon includes tabs for File, Home, Insert, Modeling, View, and Help. The Home tab is active, showing a toolbar with icons for Get data, Refresh, New visual, New measure, Sensitivity, and Publish. Below the ribbon, the main workspace area contains the text "Build visuals with your data" and "Select or drag fields from the Fields pane onto the report canvas." To the right of the workspace is the Fields pane, which is divided into three sections: Filters, Visualizations, and Fields. The Fields section is currently selected, showing a search bar and a list of fields, including "mtcars". The Fields pane is also divided into "Filters on this page" and "Filters on all pages" sections, each with a search bar and a list of fields. The Fields pane is also divided into "Values" and "Drill through" sections, each with a search bar and a list of fields. The Fields pane is also divided into "Cross-report" and "Keep all filters" sections, each with a search bar and a list of fields. The Fields pane is also divided into "Add drill-through fields here" section, which is currently empty.

Power BI dashboard

- Let's create our first PowerBI dashboard
 - ▶ A pie chart of cyl
 - ▶ A histogram of mpg
 - ▶ A cross-table of cyl and am
 - ▶ A cross-table of cyl and gear
 - ▶ Scatterplot matrix of mpg,disp,hp,drat, wt and qsec by cyl

Power BI dashboard

- PowerBI does not have a default histogram visual:
 - We can download a histogram visual or
 - We can include R script for a histogram



Power BI dashboard

- Let's use R to create the scatter-plot matrix above.
- [Enable R visuals in Power BI Desktop](https://docs.microsoft.com/en-us/power-bi/create-reports/desktop-r-visuals)
<https://docs.microsoft.com/en-us/power-bi/create-reports/desktop-r-visuals>
- The following R code needs to be added

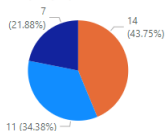
```
library(dplyr)
library(GGally)
dataset$cyl=as.factor(dataset$cyl)
dataset%>%ggpairs(aes(color=cyl,alpha = 0.4))
```

Power BI dashboard

cyl, disp, drat, hp, mpg, qsec and wt



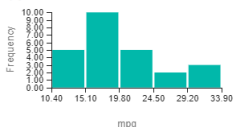
Count of cyl by cyl



cyl	0	1	Total
8	12	2	14
6	4	3	7
4	3	8	11
Total	19	13	32

cyl	3	4	5	Total
8	12	2		14
6	1	8	2	11
4	2	4	1	7
Total	15	12	5	32

mpg



Power BI dashboard

- You then can publish your report/dashboard
- R visuals are a Power BI Pro feature. Only users with a Power BI license can create, view or interact with R visuals.

Power BI dashboard

- **Power BI Dashboard Galleries** <https://community.powerbi.com/t5/Data-Stories-Gallery/bd-p/DataStoriesGallery>
- **Dashboard in a Day:** <https://powerbi.microsoft.com/en-us/diad/>
 - ▶ A one-day, hands-on workshop for business analysts that covers all the capabilities of Power BI

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