Class 4 Data Wrangling with R Part I

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Section 1

Overview

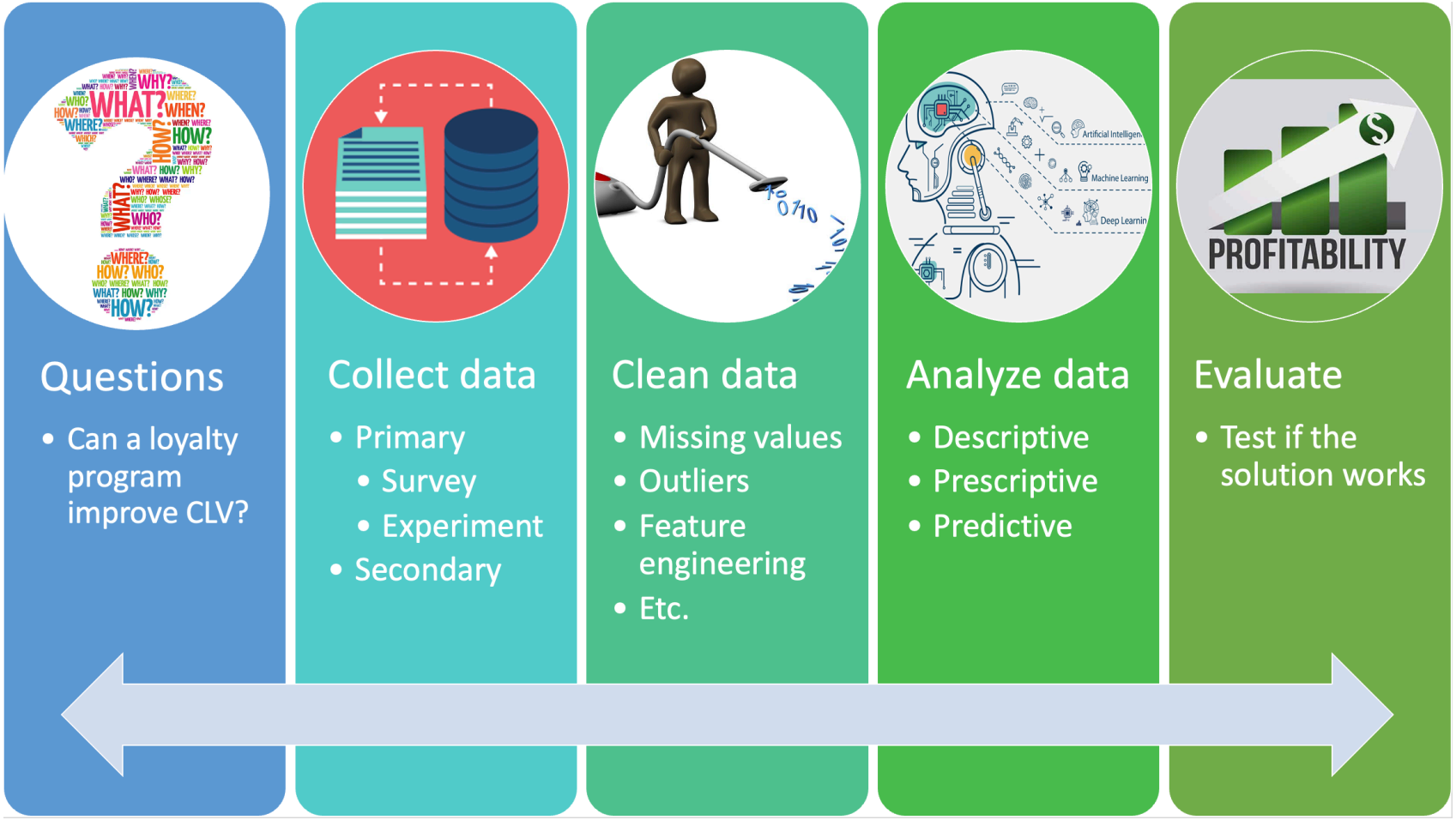
Class Objectives

- Understand the major steps to conduct data analytics
- **Data collection:** Learn how to collect first-hand data
- **Data cleaning:** Learn how to use the `dplyr` package to collect, load, and clean data
- **Data analysis:** Learn how to conduct descriptive analytics

Section 2

Data Analytics Workflow

Overview


Questions
• Can a loyalty program improve CLV?
Collect data
• Primary
• Survey
• Experiment
• Secondary
Clean data
• Missing values
• Outliers
• Feature engineering
• Etc.
Analyze data
• Descriptive
• Prescriptive
• Predictive
Artificial Intelligen
Machine Learning
Deep Learnin
Evaluate
• Test if the solution works
PROFITABILITY

Collect Data

- **Primary Data:** Data that are generated by the researcher himself/herself, surveys, interviews, experiments, specially designed for understanding and solving the research problem at hand.
- **Secondary Data:** Existing data generated by the company's or consumer's past activities, as part of organizational record keeping.

BASIS FOR COMPARISON	PRIMARY DATA	SECONDARY DATA
Meaning	Primary data refers to the first hand data gathered by the researcher himself.	Secondary data means data collected by someone else earlier.
Data	Real time data	Past data
Process	Very involved	Quick and easy
Source	Surveys, observations, experiments, questionnaire, personal interview, etc.	Government publications, websites, books, journal articles, internal records etc.
Cost effectiveness	Expensive	Economical
Collection time	Long	Short
Specific	Always specific to the researcher's needs.	May or may not be specific to the researcher's need.
Available in	Crude form	Refined form
Accuracy and Reliability	More	Relatively less

Collect Data: Marketing Surveys

- In a marketing survey, we typically would like to solicit the following
  - purchase intention
  - willingness to pay (WTP)
  - shopping basket
  - share of wallet (SoW)
  - demographics
- **Let's see an example of how to design a simple marketing survey!**
- Useful supplementary readings if you need to design marketing surveys
  - The quick start guide on how to conduct market research

Section 3

Data Wrangling with R

Data Frames

- Data Frame is the R object that we will deal with most of the time in the MSc program. You can think of `data.frame` as a spreadsheet in excel
- Each row stands for an `observation`
- Each column stands for a `variable`; each column should have a **unique** name.
  - Each column must contain the same data type, but the different columns can store different data types.
    - compare with matrix?
- Each column must be of same length, because rows have the same length across variables.

Install and Load the dplyr package

- In R, we will be using the dplyr package for data cleaning and manipulation.

```
install.packages("dplyr")
```

- Load the package

```
library(dplyr)
```

- Load a built-in dataset called mtcars using data()

```
data("mtcars")
```

- To browse the whole dataset, we can simply click the dataset in the environment
  - It may takes time to view a huge dataset

Subset Rows Based on Conditions: `filter`

- **We can use `filter()` to extract rows that meet logical criteria.**
  - We can also add multiple criteria separated by comma

```
# show all cars with more than 4 gears
filter(mtcars, gear == 4 )
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2

The Pipe Operator %>%

Pipe Operator

%>%, or pipe operator, will forward a value, or the result of an expression, into the next function call/expression.

```
1 mtcars %>% filter(gear == 4) %>% head()
```

Sort Rows: arrange

`arrange()` orders the rows of a data frame by the values of selected columns.

- The default is by ascending order; for descending order, put a minus sign before the variable.

```
# reorder mtcar based on hp
mtcars %>%
  arrange(hp) %>%
  head()
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2

Generate New Variables: `mutate`

`mutate()` adds new variables and preserves existing ones

```
1 mtcars %>%
2   mutate(sqrt_mpg = sqrt(mpg))%>%
3   head()
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb	sqrt_mpg
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4	4.582576
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4	4.582576
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1	4.774935
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1	4.626013
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2	4.324350
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1	4.254410

Important Tips

- Each dplyr operation does not overwrite the original data frame, therefore, we **must assign the object back** if we wish to overwrite the previous data frame.
- Exercises:
  - find car models with `gear` equal to 4 and `mpg` larger than 15
  - reorder the above dataset by `wt` from large to small.
  - generate a new column which computes the ratio of `mpg` to `wt`

After-Class Exercise

- Data camp dplyr exercise
- Read "Preliminary Customer Analyses" dataset, and try to solve the case questions using the techniques learned today