Data-based Statistical Decision Model

Lecture 4 (Part IV) - Data Wrangling

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Where are we?

- *the grammar of graphics*
- a grammar of data manipulation

We now motivate the need of understanding a grammar of data manipulation for statistical tables-not unlike SQL for databases. The verbs for this data manipulation are presented for single tables and two tables.

Motivating example

- Vater et al., “Trends in Cancer-Center Spending on Advertising in the United States, 2005 to 2014” published in 2016 in JAMA Internal Medicine,
- Hospital Ad. Media
- Hospital Ad. Article

Data?

- The raw data for the analysis was purchased from Kantar Media.
- I can only show you a scrambled, fake data set

Reproducing the analysis

Think about reproducing the figure and the table in the article.

How will you summarize your data to plot the time series?

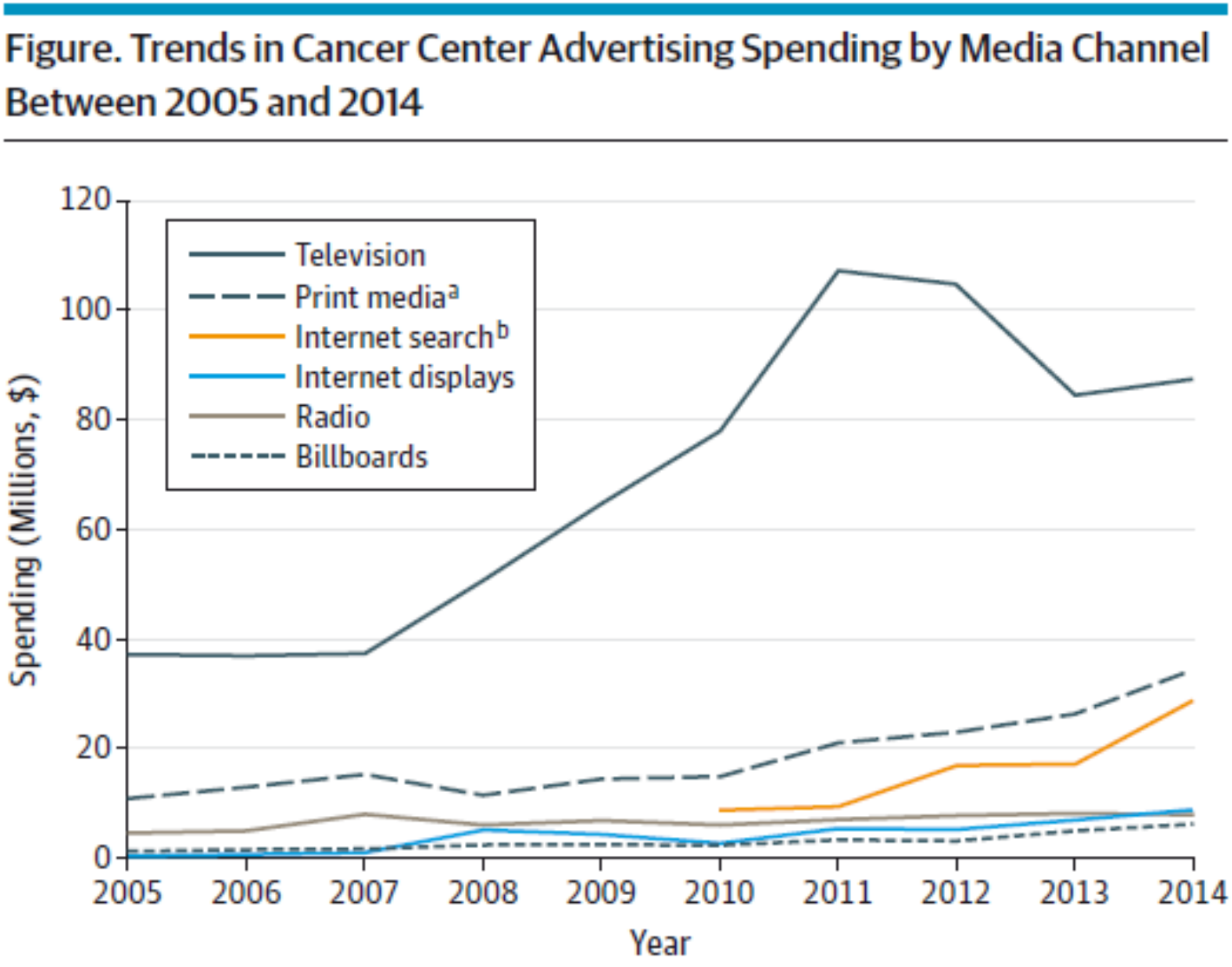


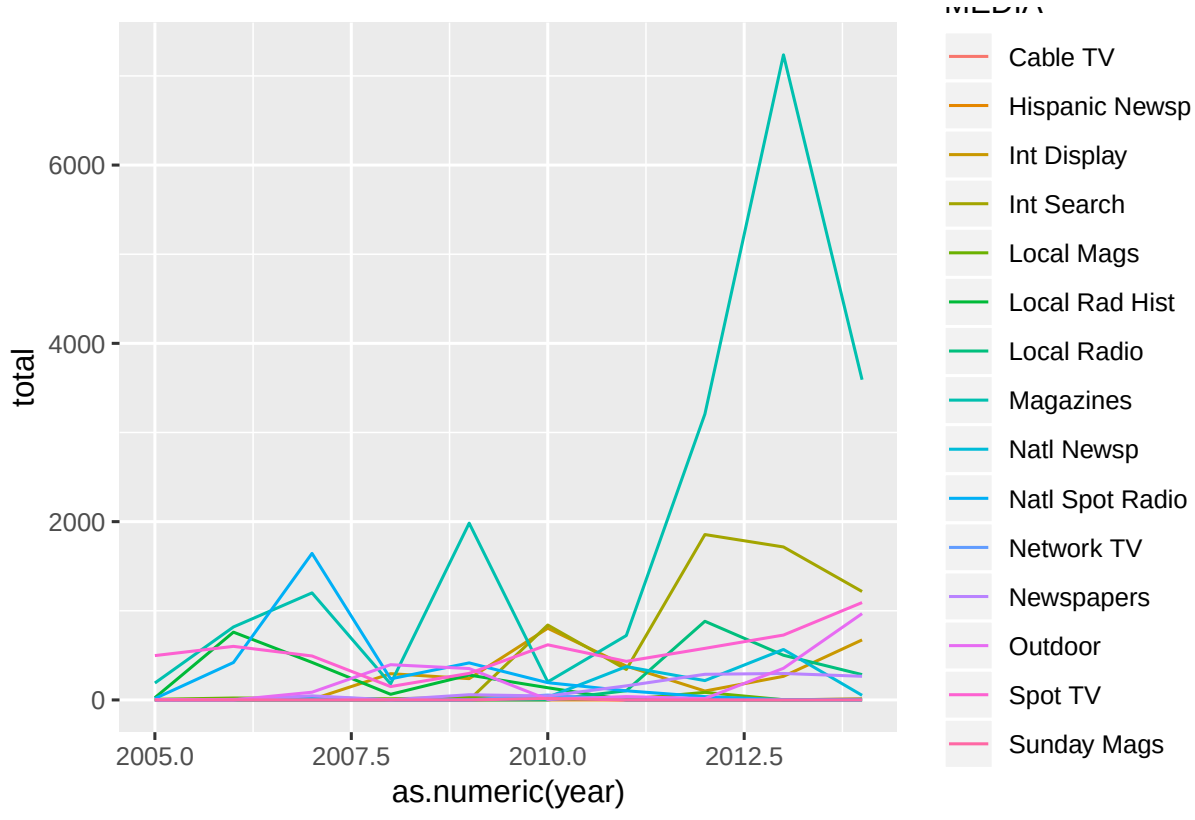
Figure 1:

The data set you need is something like this:

```
## # A tibble: 150 x 3
## # Groups:   MEDIA [?]
##    MEDIA    year    total
##    <chr>    <chr>   <dbl>
##  1 Cable TV " 2005"  1.48
##  2 Cable TV " 2006"  0
##  3 Cable TV " 2007"  0
##  4 Cable TV " 2008"  0
##  5 Cable TV " 2009"  0
##  6 Cable TV " 2010" 21.1
##  7 Cable TV " 2011"  0
##  8 Cable TV " 2012"  0
##  9 Cable TV " 2013"  0
## 10 Cable TV " 2014" 11.5
## # ... with 140 more rows
```

Using ggplot2, creating a time series is now easy.

```
# 1 MEDIA-wise total
Transformed_data %>%
  ggplot(aes(x = as.numeric(year), y = total)) +
  geom_line(aes(color = MEDIA))
```



Problem?

Problem

The categorical values of `MEDIA` are not exatly what we want.

We would need to create another categorical variable by combining many values of `MEDIA` into one value. E.g. `Local Mags` and `Magazines` into `Print Media`.

Two types of data sets

- The raw data set you see is called **wide**. Note that `year` does not appear as a variable in the data set.
- Strange? In `Transformed_data`, however, `year` is a variable.
- For our purpose of creating the time series plot, a form of **thin** data set is more useful. Within the thin data set, we can treat `year` and `Expenditure` as variables.
- Both forms are useful for different occasions.

Re-creating the data table.

Table. Cancer Centers in the United States With the Highest Advertising Spending in 2014[a]

Rank	Cancer Center	US Locations[b]	National Cancer Institute Designated	Commission on Cancer Accredited	Nonprofit	Total 2014 Advertising Spending (Millions of Dollars)	Advertising Expenditure as % of Total Spending		
							National	Local	Internet
1	Cancer Treatment Centers of America	Atlanta, GA Chicago, IL Philadelphia, PA Phoenix, AZ Tulsa, OK	No	Yes	No	101.7	57.8	23.8	18.4
2	MD Anderson Cancer Center	Houston, TX Albuquerque, NM Camden, NJ Gilbert, AZ	Yes	Yes	Yes	13.9	47.4	27.5	25.1
3	Memorial Sloan Kettering Cancer Center	New York, NY	Yes	Yes	Yes	9.1	32.7	44.2	23.0
4	Fox Chase Cancer Center	Philadelphia, PA	Yes	Yes	Yes	3.5	0	66.0	34.0

Figure 2:

You need

1. *metadata* (or codebook): a set of data that describes and gives information about other data
2. to *combine* two datasets into one
3. to *filter* cases whose year is 2014 (in the thin form), or *select* the variable with name `DOI (000) 2014` (in the wide form)
4. to create a categorical variable that to tell whether a given MEDIA is National, Local or Internet (Perhaps by creating another metadata and combining)
5. to summarize all expenditure, for each of Cancer Center. (*summarize* expenditure *grouped by* Center)
6. *arrange* from the largest to the smallest