R Markdown

Andreas Alfons[1] Pieter Schoonees[2]

[1]Erasmus School of Economics, Erasmus Universiteit Rotterdam

[2]Rotterdam School of Management, Erasmus Universiteit Rotterdam

EQI Programming & Visualization for Business Analytics,
October 21, 2016

Software requirements

$\longrightarrow$ Package `rmarkdown` is required

```
R> install.packages("rmarkdown")
```

$\longrightarrow$ Functions from packages `ggplot2` and `knitr` are used inside R Markdown documents

Content

Motivation

Literate programming

Donald Knuth

"Instead of imagining that our main task is to instruct a computer what to do, let us concentrate rather on explaining to human beings what we want a computer to do."

$\longrightarrow$ Idea: Explanation of the program logic in natural language, interspersed with snippets of source code

$\longrightarrow$ Literate programming tools for R can be used to write dynamic statistical reports

R Markdown

Markdown:

$\longrightarrow$ Easy-to-write plain text format for creating web content

$\longrightarrow$ Documentation on
`http://daringfireball.net/projects/markdown/`

R Markdown:

$\longrightarrow$ Integration of code chunks into Markdown

$\longrightarrow$ Multiple programming languages (e.g., R, Python, SQL)

$\longrightarrow$ Multiple output formats (e.g., HTML, PDF, Microsoft Word)

$\longrightarrow$ Documentation on `http://rmarkdown.rstudio.com/`

Markdown

Markdown files

Create new Markdown file:

⟶ *File* → *New file* → *Text File*

⟶ Use file extension .md

Generate and view resulting HTML file:

⟶ Button *Preview HTML*

⟶ Keyboard shortcut *shift+ctrl+K* (Windows/Linux), *shift+cmd+K* (Mac)

Markdown syntax: headers and emphasis

Headers:

```
# Header 1

## Header 2

### Header 3

#### Header 4

##### Header 5

###### Header 6
```

Emphasis:

```
*italic*   **bold**
```

Markdown syntax: lists

Unordered lists:

```
* Item 1
* Item 2
    * Item 2a
    * Item 2b
```

Ordered lists:

```
1. Item 1
2. Item 2
3. Item 3
    a. Item 3a
    b. Item 3b
```

Markdown syntax: tables and links

Tables:

```
First Header  | Second Header
------------- | -------------
Content Cell  | Content Cell
Content Cell  | Content Cell
```

Links:

```
<http://people.few.eur.nl/alfons/>

[My website](http://people.few.eur.nl/alfons/)
```

Markdown syntax: LaTeX expressions

LaTeX equations:

```
$$ y = X \beta + \varepsilon $$
```

Inline LaTeX expressions:

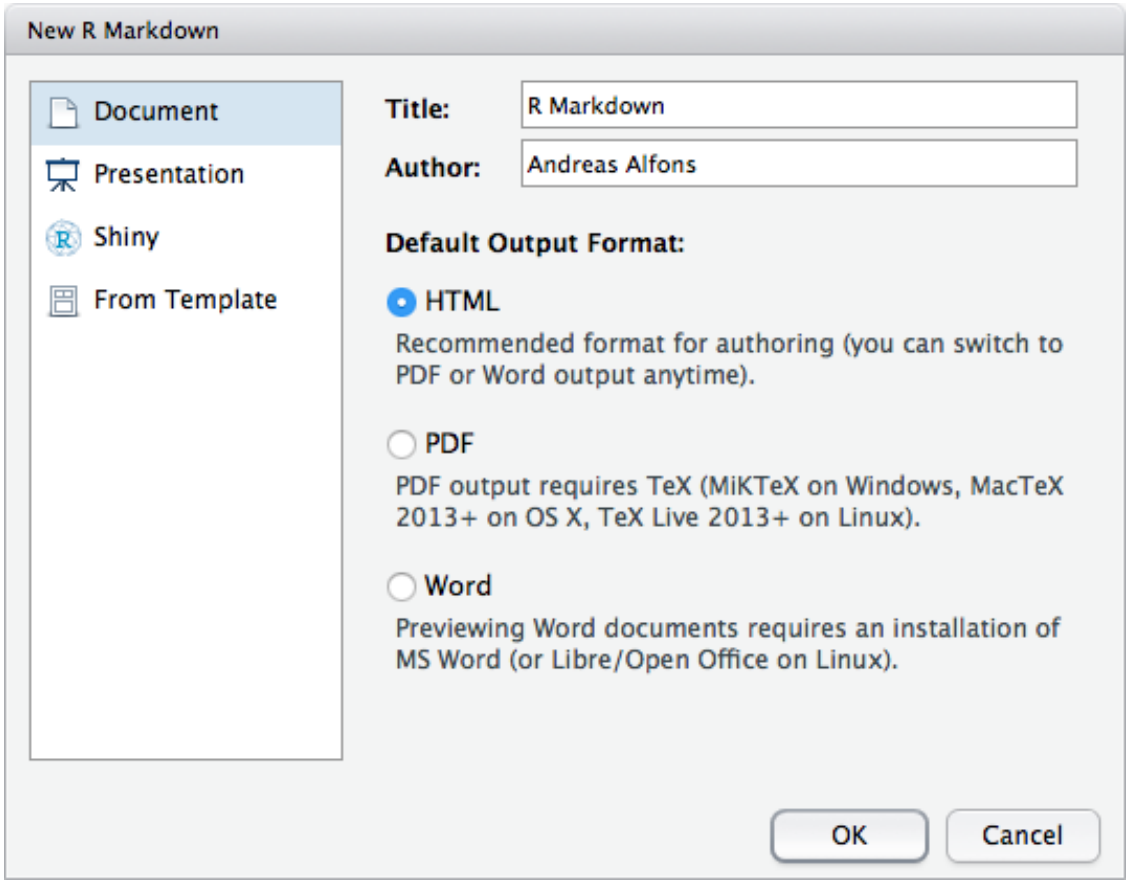
```
$\hat{\beta} = (X^{T} X)^{-1} X^{T} y$
```

R Markdown

R Markdown files

$\longrightarrow$ *File* $\rightarrow$ *New file* $\rightarrow$ *R Markdown*

$\longrightarrow$ Use file extension .Rmd



R Markdown syntax: meta information

Begin of R Markdown file (optional, in YAML format):

```
---
title: "R Markdown"
author: "Andreas Alfons"
date: "October 21, 2016"
output: html_document
---
```

Output formats:

$\longrightarrow$ `html_document`, `pdf_document`, `word_document`

$\longrightarrow$ `ioslides_presentation`, `slidy_presentation`, `beamer_presentation`

R Markdown syntax: R code

R code chunks:

````
```{r}
mean(x)
```
````

Inline R code:

````
The mean is `r mean(x)`.
````

Chunk options

⟶ Package `knitr` is the engine for knitting code into documents

⟶ Full list of chunk options in the R Markdown reference guide

include if `FALSE`, neither the code nor the output will be displayed in the final document (but the code will be run)

echo if `FALSE`, the code will not be displayed in the final document

results if `"hide"`, the output will not be displayed in the final document

Chunk options for figures

fig.align	how to align figures in the final document (`"left"`, `"center"` or `"right"`)
fig.width	width of plots created by the chunk (in inches)
fig.height	height of plots created by the chunk (in inches)
out.width	width to which plots are scaled in the final document (in units understood by the output format, e.g., `100px` for HTML output)
out.height	height to which plots are scaled in the final document (in units understood by the output format, e.g., `100px` for HTML output)

Formatting tables

$\longrightarrow$ Function `kable()` from package `knitr` takes an R object such as a matrix or data frame and turns it into a nicely formatted table for use with R Markdown

$\longrightarrow$ Simple by design, but has some options for customization (e.g., alignment of columns)

R Markdown: document

````
---
title: "Motor Trend 1974"
output: html_document
---

```{r, include = FALSE}
library("ggplot2")
library("knitr")
data("mtcars")
```

## Data

We use data on `r nrow(mtcars)` cars featured in the magazine *Motor Trend*
in 1974.  This it what the data look like:

```{r, echo = FALSE}
kable(mtcars)
```

## Miles per gallon vs weight

Now we look at how fuel consumption is related to weight.

```{r, echo = FALSE, fig.align = "center"}
ggplot(mtcars, aes(x = wt, y = mpg, color = factor(cyl), size = qsec)) +
  geom_point()
```
````

R Markdown: presentation

````
---
title: "Motor Trend 1974"
author: "Andreas Alfons"
date: "October 21, 2016"
output: ioslides_presentation
---

```{r, include = FALSE}
library("ggplot2")
library("knitr")
data("mtcars")
```

## Data

We use data on `r nrow(mtcars)` cars featured in the magazine *Motor Trend*
in 1974.  This it what the data look like:
```{r, echo = FALSE}
kable(head(mtcars, 5))
```

## Miles per gallon vs weight

Now we look at how fuel consumption is related to weight.
```{r, echo = FALSE, fig.align = "center"}
ggplot(mtcars, aes(x = wt, y = mpg, color = factor(cyl), size = qsec)) +
  geom_point()
```
````

Conclusions

Conclusions

$\longrightarrow$ Markdown provides an intuitive way of creating web content

$\longrightarrow$ R Markdown is an extension that ...

- allows to interveave a Markdown document with code from various programming languages (e.g., R, Python, SQL)
- supports multiple output formats (e.g., HTML, PDF, Microsoft Word)
- makes it easy to write statistical reports and presentations