R cookbook for the casual dabbler (2nd edition)

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Introduction

G'day and welcome to *R cookbook for the casual dabbler (2nd edition).*

RCCD 1st edition was originally published in 2020 as a side project during the COVID-19 pandemic in Melbourne.

As I wrote in the midst of lockdown:

> I use R a lot for work and for side projects. Over the years I've collated a bunch of useful scripts, from macroeconomic analysis to quick hacks for making map legends format properly.
>
> Historically my code has been stored in random Rpubs documents, medium articles, and a bunch of .Rmd files on my hardrive. Occasionally I feel like doing things properly - and upload code to a repository on github.
>
> It doesn't take a genius to realize this isn't a very sustainable solution - and it also isn't very useful for sharing code with others. It turns out 2-years of lockdown in Melbourne was enough incentive to sit down and collate my best and most useful code into a single place. In the spirit of open source, a book seemed like the most logical format. The following is a very rough book written in **markdown** - R's very own publishing language.

RCCD1e had surprisingly good (and long-lasting reviews). Alas, five-years on, a lot has changed - in both the R community, and the world more broadly. As such, RCCD2e includes significant revisions. The most major of these is a restructure to make the chapters flow more logically. The Australian specific chapters have also been grouped together (e.g. election data).

Usage

In each chapter I've written up the background, methodology and code for a separate piece of analysis.

Most of this code will not be extraordinary to the seasoned R aficionado. However I find that in classic Pareto style ~20% of my code contributes to the **vast** majority of my work output. Having this 20% on hand will hopefully be useful to both myself and others.

Additional resources

The R community is continually writing new packages and tools. Many of these are covered extensively in various free books available on the bookdown.org website.

The rise of LLM's over the past 2-years has also made it significantly easier to find, refine, and expand on R code. I recommend using them as a first point of call.

Limitations

If you find a bug (along with spelling errors etc) please email me at charlesfcoverdale@gmail.com with the subject line 'RCCD2e'.

About the author

Charles Coverdale is an economist based in Melbourne, Australia. He is passionate about economics, climate science, and building talented teams. You can get in touch with Charles on twitter to hear more about his current projects.

Making maps beautiful

Why use a map

Maps are a great way to communicate data.

They're easily understandable, flexible, and more intuitive than a chart. There's been numerous studies showing that the average reader often struggles to interpret the units on a y-axis, let alone understand trends in scatter or line graphs.

Making maps in R takes some initial investment. However once you have some code you know and understand, spinning up new pieces of analysis can happen in minutes, rather than hours or days.

The aim of this chapter is to get you from 'I can make a map in R' to something more like 'I can conduct spatial analysis and produce a visual which is ready for publication'.

Getting started

First up, we need to load a bunch of mapping packages.

```
# Load required packages
library(tidyverse)  # Includes ggplot2, dplyr, tidyr, readxl, purrr
library(ggmap)
library(sf)
library(ggspatial)
library(rlang)
library(broom)
library(Census2016)
library(strayr)
library(absmapsdata)
library(officer)
```

Will Mackey's absmapsdata package contains all the ABS' ASGS shapefiles. The data is now also callable through the strayr package. For example:

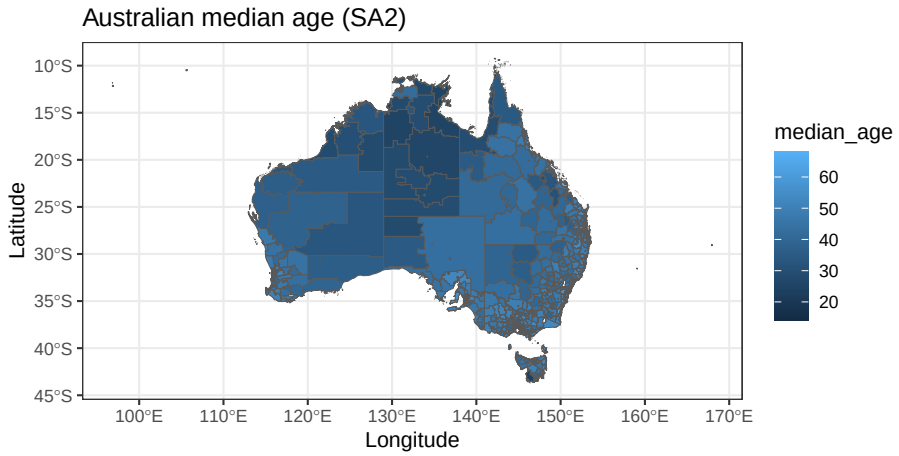
```
strayr::read_absmap("sa12016")
```

Making your first map

To get a basic demographic map up and running, we will splice together the ABS SA2 shapefile and some data from the 2016 Australian Census.

Hugh Parsonage put together a fantastic packaged called Census2016 which makes downloading this data in a clean format easy.

```
#Get the shapefile form the absmapsdata package (predefined in the list above)

#Get the 2016 census dataset
census2016_wide <- Census2016_wide_by_SA2_year

#Select the key demographic columns from the census data (i.e. the first 8 variables)
census_short <- census2016_wide[,1:8]

#Filter for a single year
census_short_2016 <- census_short %>%
    filter(year==2016)

#Use the inner_join function to get the shapefile and census wide data into a single d
SA2_shp_census_2016 <- inner_join(strayr::read_absmap("sa22016"),census_short_2016,
                          by = c("sa2_name_2016" = "sa2_name"))

#Plot a map that uses census data
  map1 <- ggplot() +
          geom_sf(data = SA2_shp_census_2016, aes(fill = median_age)) +
          ggtitle("Australian median age (SA2)") +
          xlab("Longitude") +
          ylab("Latitude") +
          theme_bw() +
          theme(legend.position = "right")

  map1
```



There we go! This looks 'okay'... but it can be much better.

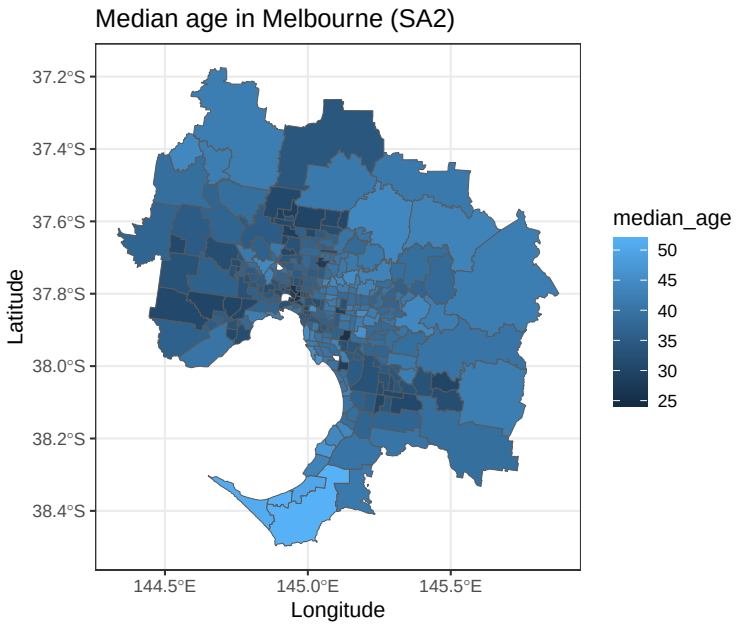
From okay to good

Heat maps don't really show too much interesting data on such a large scale, so let's filter down to Greater Melbourne.

Seeing we have a bunch of census data in our dataframe, we can also do some basic analysis (e.g. population density).

```
#As a bit of an added extra, we can create a new population density column
SA2_shp_census_2016 <- SA2_shp_census_2016 %>%
                       mutate(pop_density=persons/areasqkm_2016)

#Filter for Greater Melbourne
MEL_SA2_shp_census_2016 <- SA2_shp_census_2016 %>%
 filter(gcc_name_2016=="Greater Melbourne")

#Plot the new map just for Greater Melbourne
map2 <- ggplot() +
          geom_sf(data = MEL_SA2_shp_census_2016, aes(fill = median_age, border=NA)) +
          ggtitle("Median age in Melbourne (SA2)") +
          xlab("Longitude") +
          ylab("Latitude") +
```

```
          theme_bw() +
          theme(legend.position = "right")
map2
```



Much better. We can start to see some trends in this map. It looks like younger people tend to live closer to the city center. This seems logical.

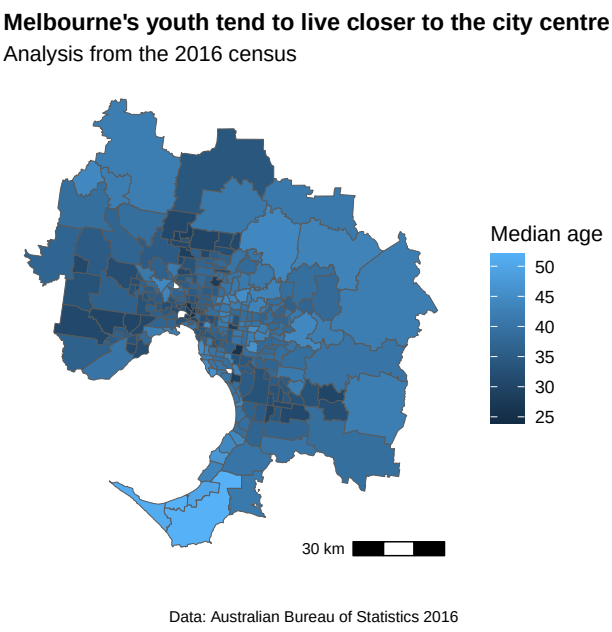
From good to great

The map above is a good start! However, how do we turn this from something 'good', into something that is 100% ready to share?

We see our 'ink to chart ratio' (i.e. the amount of non-data stuff that is on the page) is still pretty high. Is the latitude of Melbourne useful for this analysis...? Not really. Let's get rid of it and the axis labels. A few lines of code adjusting the axis, titles, and theme of the plot will go a long way. Because my geography Professor drilled it into me, I will also add a low-key scale bar.

```
map3 <- ggplot() +
          geom_sf(data = MEL_SA2_shp_census_2016, aes(fill = median_age)) +
          labs(title="Melbourne's youth tend to live closer to the city centre",
               subtitle = "Analysis from the 2016 census",
               caption = "Data: Australian Bureau of Statistics 2016",
```

```
              x="",
              y="",
              fill="Median age") +
          ggspatial::annotation_scale(location="br")+
          theme_minimal() +
            theme(axis.ticks.x = element_blank(),axis.text.x = element_blank())+
            theme(axis.ticks.y = element_blank(),axis.text.y = element_blank())+
            theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank())+
            theme(legend.position = "right")+
            theme(plot.title=element_text(face="bold",size=12))+
            theme(plot.subtitle=element_text(size=11))+
            theme(plot.caption=element_text(size=8))

map3
```

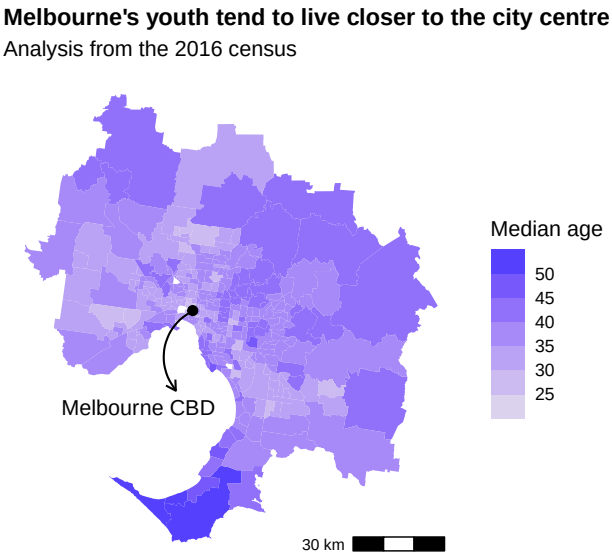


From great to fantastic

The above is perfectly reasonable and looks professionally designed. However, this is where we can get really special.

Let's add a custom colour scheme, drop the boundary edges for the SA2's, and add in a dot and label for Melbourne CBD.

```
#Add in a point for the Melbourne CBD
MEL_location <- data.frame(town_name = c("Melbourne"),
                           x = c(144.9631),
                           y = c(-37.8136))

map4 <- ggplot() +
          geom_sf(data = MEL_SA2_shp_census_2016, aes(fill = median_age),color=NA) +
          geom_point(data=MEL_location,aes(x=x,y=y),size=2,color="black")+
          labs(title="Melbourne's youth tend to live closer to the city centre",
               subtitle = "Analysis from the 2016 census",
               caption = "Data: Australian Bureau of Statistics 2016",
               x="",
               y="",
               fill="Median age") +
          scale_fill_steps(low="#E2E0EB", high="#3C33FE")+
          annotate(geom='curve',
                   x=144.9631,
                   y=-37.8136,
                   xend=144.9,
                   yend=-38.05,
                   curvature=0.5,
                   arrow=arrow(length=unit(2,"mm")))+
          annotate(geom='text',x=144.76,y=-38.1,label="Melbourne CBD")+
          ggspatial::annotation_scale(location="br")+
          theme_minimal() +
            theme(axis.ticks.x = element_blank(),axis.text.x = element_blank())+
            theme(axis.ticks.y = element_blank(),axis.text.y = element_blank())+
            theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank
            theme(legend.position = "right")+
            theme(plot.title=element_text(face="bold",size=12))+
            theme(plot.subtitle=element_text(size=11))+
            theme(plot.caption=element_text(size=8))

map4
```



There we go! A 'client-ready' looking map that can be added to a report, presentation, or with a few tweaks a digital dashboard.

Make sure to export the map as a high quality PNG using the ggsave function.

Charts

Basic modelling

Hypothesis testing

Forecasting

Web scraping

Text mining

Geocoding

Drivetime analysis

Raster data

ABS economic indicators

Australian election data

Bayesian for the common man