GLA Task - Exploratory analysis in R

Code

As dataset is large, I did some initial data exploration to demonstrate proof of concept using the first 1 million rows.

```
library(data.table)
library(dplyr)
library(prophet)
```

Read in and prepare data

```
# read in first csv file of 1 million rows
csv_name = 'C:/Users/User/Documents/my_code_files/R_codes/gla_interview_task
_011017/smart_meter_data/separate_csvs/Power-Networks-LCL-June2015(withAcorn
Gps)v2_2.csv'
mydata <- fread(csv_name, drop = c("Acorn", "Acorn_grouped"))
```

```
Bumped column 4 to type character on data row 1932, field contains 'Null'. C
oercing previously read values in this column from logical, integer or numer
ic back to character which may not be lossless; e.g., if '00' and '000' occu
rred before they will now be just '0', and there may be inconsistencies wit
h treatment of ',,' and ',NA,' too (if they occurred in this column before t
he bump). If this matters please rerun and set 'colClasses' to 'character' f
or this column. Please note that column type detection uses a sample of 1,00
0 rows (100 rows at 10 points) so hopefully this message should be very rar
e. If reporting to datatable-help, please rerun and include the output from
verbose=TRUE.
```

```
head(mydata)
```

```
# Compute daily consumption per household
daily_kwh_per_household <- mydata %>%
  # use households on standard tariff only
  filter(stdorToU=="Std") %>%
  # rename variables for ease of reference
  rename(kwh = 'KWH/hh (per half hour)') %>%
  # extract date from datetime
  mutate(
    dt = as.POSIXct(paste(DateTime)),
    day = as.Date(strftime(dt, format = "%D"), "%m/%d/%y")) %>%
  # compute total daily consumption for each household
  group_by(day, LCLid) %>%
  summarise(total_kwh = sum(as.numeric(kwh)))
```

```
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```

```
str(daily_kwh_per_household)
```

```
Classes 'grouped_df', 'tbl_df', 'tbl' and 'data.frame': 20861 obs. of  3 var
iables:
 $ day      : Date, format: "2011-12-07" "2011-12-08" "2011-12-08" ...
 $ LCLid    : chr  "MAC000037" "MAC000037" "MAC000038" "MAC000039" ...
 $ total_kwh: num  0.014 0.445 7.611 10.188 15.707 ...
 - attr(*, "vars")= chr "day"
 - attr(*, "drop")= logi TRUE
```

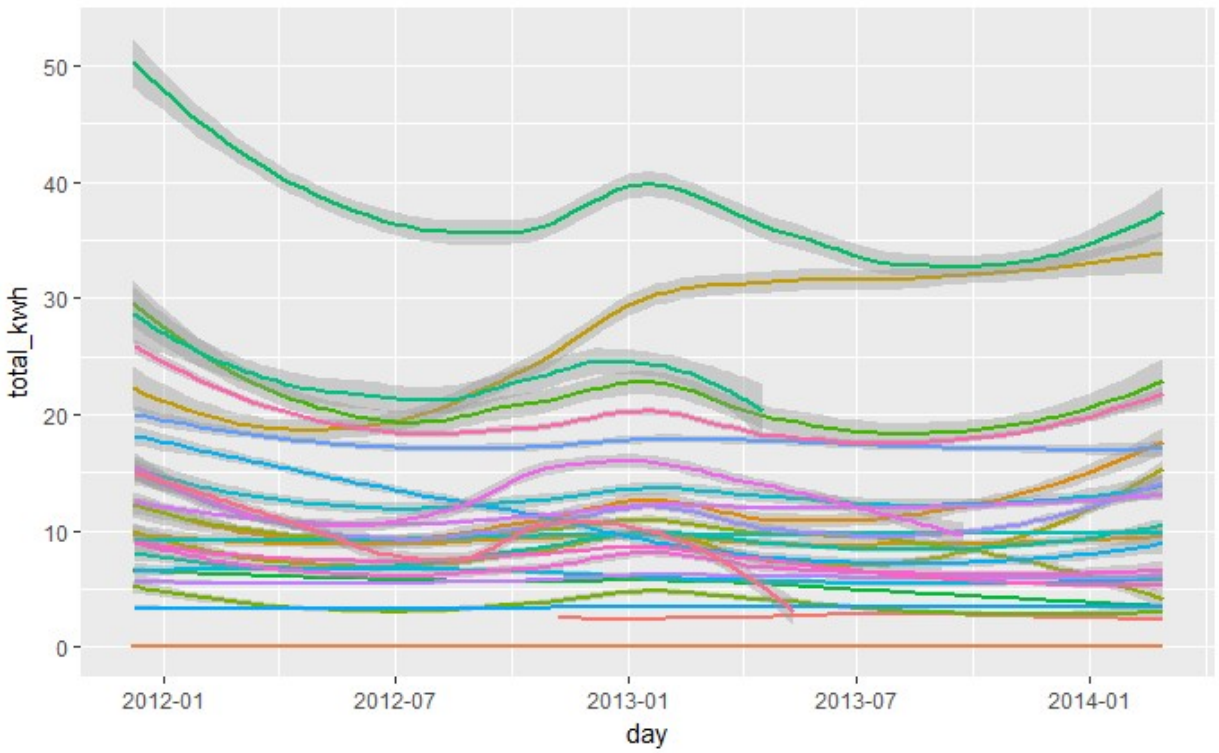
```
length(unique(daily_kwh_per_household$LCLid)) # 27 households
```

```
[1] 27
```

```
# Save as CSV
# fwrite(daily_kwh_per_household, file = "daily_kwh_per_household_csv2_2.cs
v")
```

plots - by household

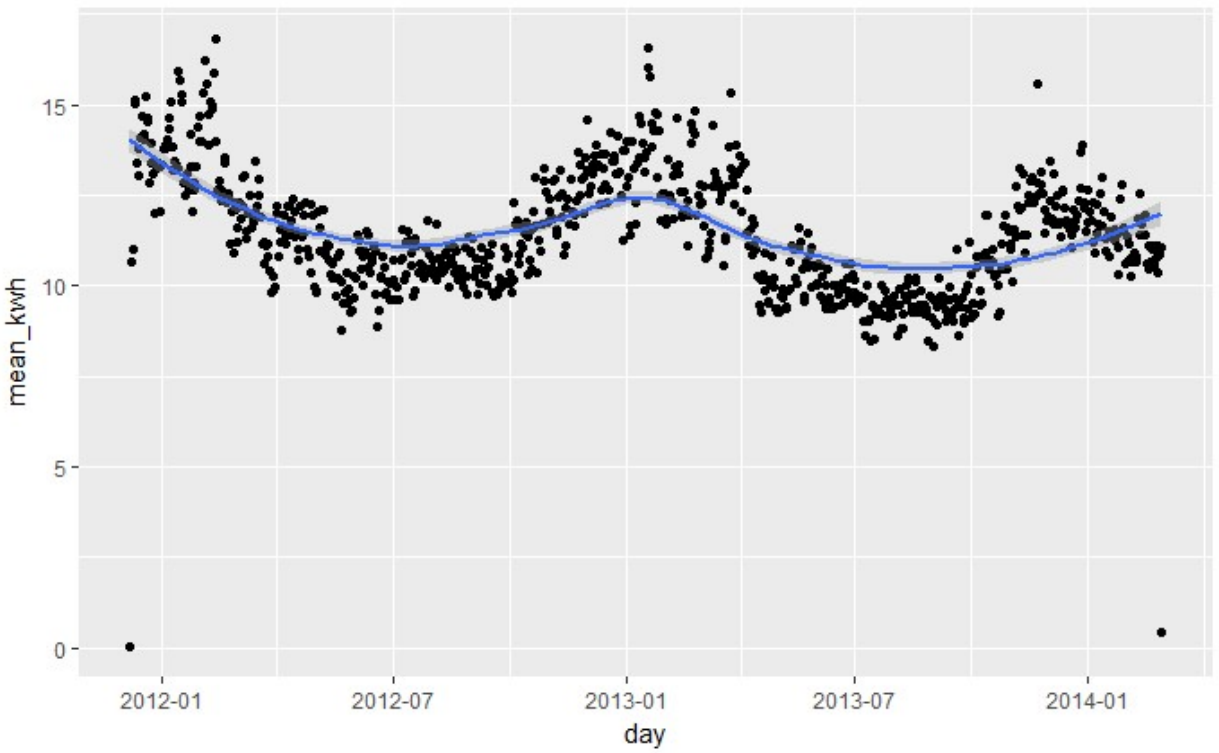
```
# plots
# plot by household
ggplot(data = daily_kwh_per_household,
mapping = aes(x = day, y = total_kwh)) +
  #geom_point(aes(colour = LCLid), show.legend = FALSE) +
  geom_smooth(aes(colour = LCLid), show.legend = FALSE)
```



Get mean per day across households

```
mpd <- summarise(daily_kwh_per_household, mean_kwh = mean(total_kwh))
head(mpd)
```

```
# plot means
ggplot(data = mpd,
       mapping = aes(x = day, y = mean_kwh)) +
  geom_point(show.legend = FALSE) +
  geom_smooth(show.legend = FALSE)
```



Prepare df for time series analysis

```
mdkwh <- select(ungroup(mpd), ds = day, y = mean_kwh)
head(mdkwh)
```

Fit additive regression model

```
arm <- prophet(mdkwh, growth = "linear",
               yearly.seasonality=TRUE,
               weekly.seasonality=FALSE)
```

```
Disabling daily seasonality. Run prophet with daily.seasonality=TRUE to over
ride this.
```

```
Initial log joint probability = -185.96
Optimization terminated normally:
  Convergence detected: relative gradient magnitude is below tolerance
```

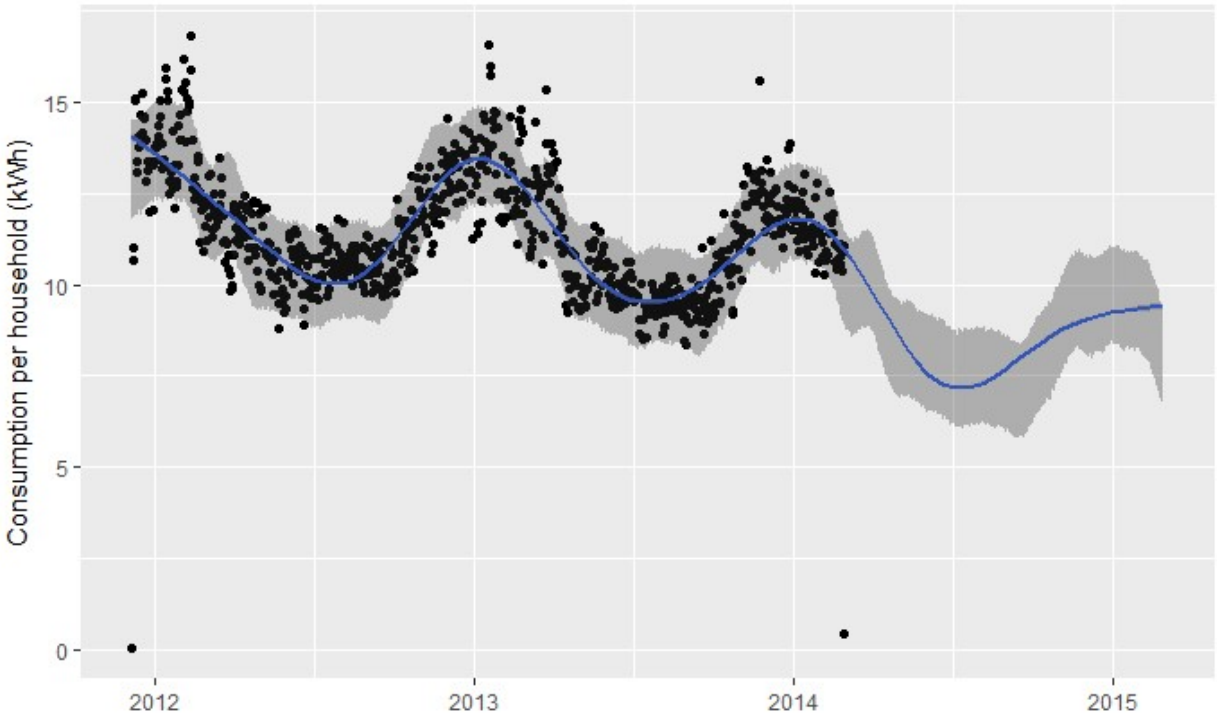
predict consumption for the next year

```
# first make list of dates to predict for
future <- make_future_dataframe(arm, periods = 365)
# make the forecast
forecast <- predict(arm, future)
tail(forecast[c('ds', 'yhat', 'yhat_lower', 'yhat_upper')])
```

simple plot with raw data plus forecast 1y into future

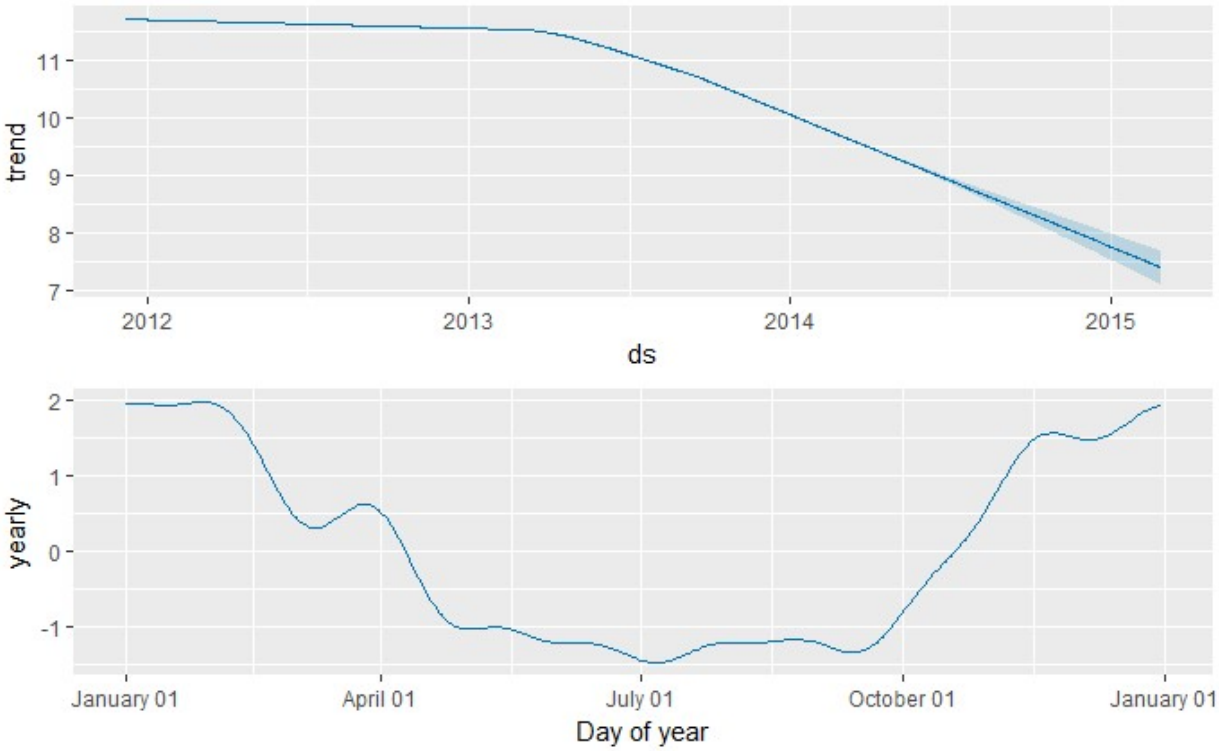
```
ggplot(data = arm$history, mapping = aes(x = ds, y = y)) +
  geom_point() +
  geom_smooth(data = forecast, mapping = aes(x = ds, y = yhat)) +
  geom_ribbon(data = forecast, mapping = aes(x = ds, y = yhat,
                                             ymin = yhat_lower,
                                             ymax = yhat_upper), alpha = 1/
3) +
  ylab("Consumption per household (kWh)") +
  xlab("")
```

```
Ignoring unknown aesthetics: y
```



plot seasonal components

```
prophet_plot_components(arm, forecast)
```


trend
11
10
9
8
7
2012
2013
2014
2015
ds
yearly
2
1
0
-1
January 01
April 01
July 01
October 01
January 01
Day of year