Code

Exploratory Data Analysis of Center for World University Rankings (CWUR)

Hide

```
getwd()
```

```
[1] "G:/"
```

Hide

```
setwd("G:/")
data1<-read.csv("cwurData.csv")
str(data1)
```

```
'data.frame':   2200 obs. of  14 variables:
 $ world_rank          : int  1 2 3 4 5 6 7 8 9 10 ...
 $ institution         : Factor w/ 1024 levels "Ã-rebro University",..: 194 322 520 653 63 442 8
33 1009 106 643 ...
 $ country             : Factor w/ 59 levels "Argentina","Australia",..: 59 59 59 57 59 59 57 59
59 59 ...
 $ national_rank       : int  1 2 3 1 4 5 2 6 7 8 ...
 $ quality_of_education: int  7 9 17 10 2 8 13 14 23 16 ...
 $ alumni_employment   : int  9 17 11 24 29 14 28 31 21 52 ...
 $ quality_of_faculty  : int  1 3 5 4 7 2 9 12 10 6 ...
 $ publications        : int  1 12 4 16 37 53 15 14 13 6 ...
 $ influence           : int  1 4 2 16 22 33 13 6 12 5 ...
 $ citations           : int  1 4 2 11 22 26 19 15 14 3 ...
 $ broad_impact        : int  NA NA NA NA NA NA NA NA NA NA ...
 $ patents             : int  5 1 15 50 18 101 26 66 5 16 ...
 $ score               : num  100 91.7 89.5 86.2 85.2 ...
 $ year                : int  2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
```

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```
data_cwur<-data1
head(data_cwur)
```

```
  world_rank                          institution        country national_rank quality_of_educa
tion
1          1                    Harvard University            USA             1
   7
2          2 Massachusetts Institute of Technology            USA             2
   9
3          3                   Stanford University            USA             3
  17
4          4               University of Cambridge United Kingdom             1
  10
5          5    California Institute of Technology            USA             4
   2
6          6                  Princeton University            USA             5
   8
  alumni_employment quality_of_faculty publications influence citations broad_impact patents  sc
ore year
1                 9                  1            1         1         1           NA       5 10
0.00 2012
2                17                  3           12         4         4           NA       1  9
1.67 2012
3                11                  5            4         2         2           NA      15  8
9.50 2012
4                24                  4           16        16        11           NA      50  8
6.17 2012
5                29                  7           37        22        22           NA      18  8
5.21 2012
6                14                  2           53        33        26           NA     101  8
2.50 2012
```

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```
#Descriptive Statistics
dim(data_cwur)
```

```
[1] 2200   14
```

Hide

```
summary(data_cwur)
```

```
  world_rank                                institution            country    national_rank

 Min.   :   1.0   Ã‰cole normale supÃ©rieure - Paris:   4   USA           :573   Min.   :  1.00

 1st Qu.: 175.8   Ã‰cole Polytechnique              :   4   China         :167   1st Qu.:  6.00

 Median : 450.5   Arizona State University         :   4   Japan         :159   Median : 21.00

 Mean   : 459.6   Boston University                :   4   United Kingdom:144   Mean   : 40.28

 3rd Qu.: 725.2   Brown University                 :   4   Germany       :115   3rd Qu.: 49.00

 Max.   :1000.0   California Institute of Technology:   4   France        :109   Max.   :229.00

                  (Other)                          :2176   (Other)       :933

 quality_of_education alumni_employment quality_of_faculty  publications      influence
 Min.   :  1.0        Min.   :  1.0     Min.   :  1.0      Min.   :   1.0   Min.   :  1.0
 1st Qu.:175.8        1st Qu.:175.8     1st Qu.:175.8      1st Qu.: 175.8   1st Qu.:175.8
 Median :355.0        Median :450.5     Median :210.0      Median : 450.5   Median :450.5
 Mean   :275.1        Mean   :357.1     Mean   :178.9      Mean   : 459.9   Mean   :459.8
 3rd Qu.:367.0        3rd Qu.:478.0     3rd Qu.:218.0      3rd Qu.: 725.0   3rd Qu.:725.2
 Max.   :367.0        Max.   :567.0     Max.   :218.0      Max.   :1000.0   Max.   :991.0

   citations      broad_impact       patents          score             year
 Min.   :  1.0   Min.   :   1.0   Min.   :  1.0   Min.   : 43.36   Min.   :2012
 1st Qu.:161.0   1st Qu.: 250.5   1st Qu.:170.8   1st Qu.: 44.46   1st Qu.:2014
 Median :406.0   Median : 496.0   Median :426.0   Median : 45.10   Median :2014
 Mean   :413.4   Mean   : 496.7   Mean   :433.3   Mean   : 47.80   Mean   :2014
 3rd Qu.:645.0   3rd Qu.: 741.0   3rd Qu.:714.2   3rd Qu.: 47.55   3rd Qu.:2015
 Max.   :812.0   Max.   :1000.0   Max.   :871.0   Max.   :100.00   Max.   :2015
                 NA's   :200
```

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```
#check for missing values
colSums(is.na(data_cwur))
```

```
         world_rank          institution              country        national_rank quality_of_e
ducation
                  0                    0                    0                    0
      0
   alumni_employment   quality_of_faculty         publications            influence            c
itations
                  0                    0                    0                    0
      0
       broad_impact              patents                score                 year
                200                    0                    0                    0
```

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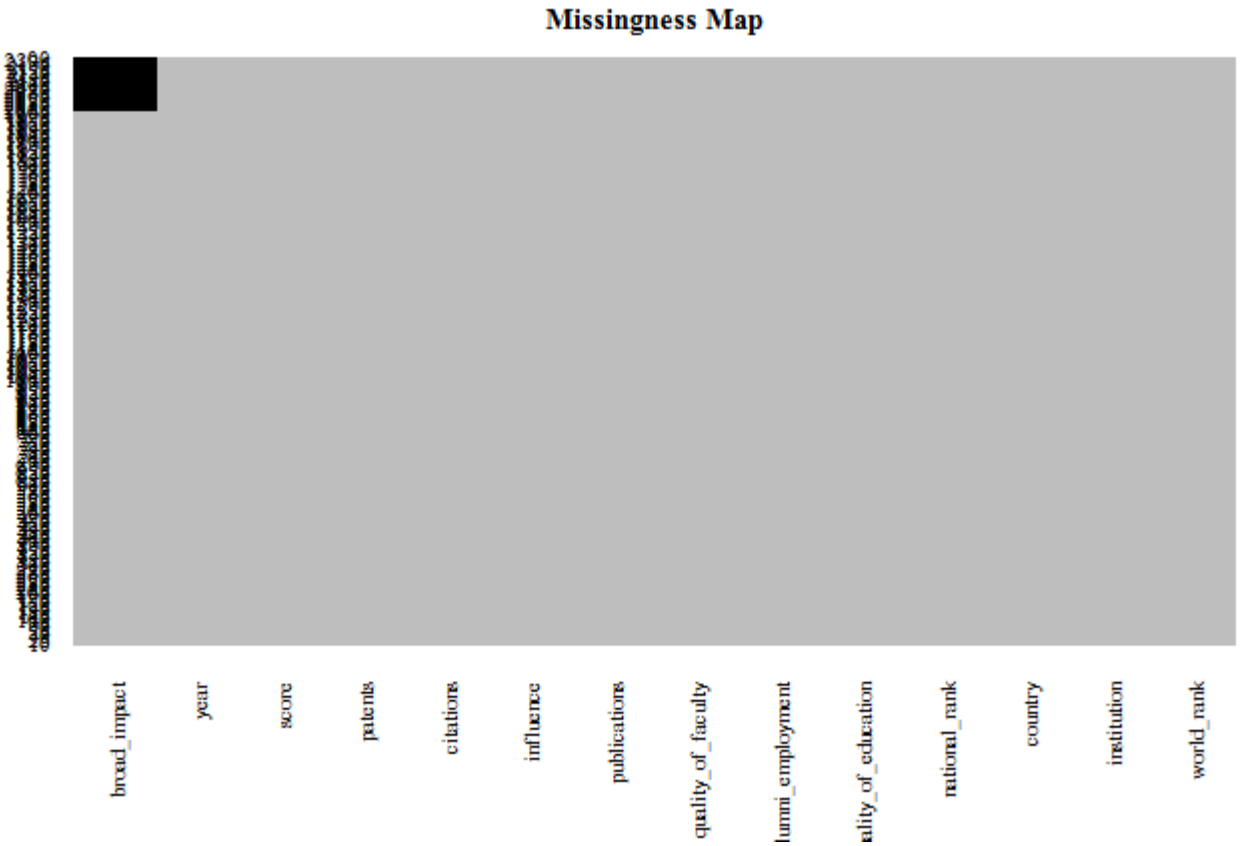
```
library(Amelia)
missmap(data_cwur, col=c("black", "grey"), legend=FALSE)
```



We see that only variable broad impact is having missing values. Removing Broad Impact variable because it contains missing values and imputing it is not a good option and also because it has data of ony two years i.e. 2014 and 2015.

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```
data_cwur$broad_impact<-NULL
str(data_cwur)
```

```
'data.frame':   2200 obs. of  13 variables:
 $ world_rank          : int  1 2 3 4 5 6 7 8 9 10 ...
 $ institution         : Factor w/ 1024 levels "Ã-rebro University",..: 194 322 520 653 63 442 8
33 1009 106 643 ...
 $ country             : Factor w/ 59 levels "Argentina","Australia",..: 59 59 59 57 59 59 57 59
59 59 ...
 $ national_rank       : int  1 2 3 1 4 5 2 6 7 8 ...
 $ quality_of_education: int  7 9 17 10 2 8 13 14 23 16 ...
 $ alumni_employment   : int  9 17 11 24 29 14 28 31 21 52 ...
 $ quality_of_faculty  : int  1 3 5 4 7 2 9 12 10 6 ...
 $ publications        : int  1 12 4 16 37 53 15 14 13 6 ...
 $ influence           : int  1 4 2 16 22 33 13 6 12 5 ...
 $ citations           : int  1 4 2 11 22 26 19 15 14 3 ...
 $ patents             : int  5 1 15 50 18 101 26 66 5 16 ...
 $ score               : num  100 91.7 89.5 86.2 85.2 ...
 $ year                : int  2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
```

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```
#check class of each variable
sapply(data_cwur,class)
```

```
          world_rank          institution              country        national_rank quality_of_e
ducation
           "integer"             "factor"             "factor"            "integer"
"integer"
   alumni_employment   quality_of_faculty         publications            influence            c
itations
           "integer"            "integer"            "integer"            "integer"
"integer"
             patents                score                 year
           "integer"            "numeric"            "integer"
```

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```
#check levels of factor variables
nlevels(data_cwur$institution)
```

```
[1] 1024
```

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```
nlevels(data_cwur$country)
```

```
[1] 59
```

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```
#checking distribution of countries
sort(table(data_cwur$country),decreasing=TRUE)
```

```
               USA              China              Japan      United Kingdom
Germany
               573                167                159                 144
     115
            France              Italy              Spain             Canada          Sou
th Korea
               109                 96                 81                  72
      72
         Australia             Taiwan             Brazil              India          Net
herlands
                58                 46                 36                  31
      29
       Switzerland            Austria             Sweden             Israel
Belgium
                26                 24                 24                  22
      20
           Finland             Turkey             Poland               Iran
Ireland
                20                 20                 18                  16
      16
            Greece           Portugal            Denmark          Hong Kong
Hungary
                14                 14                 12                  12
      12
       New Zealand             Norway      Czech Republic       South Africa
  Russia
                12                 12                 10                  10
       9
             Chile              Egypt       Saudi Arabia          Argentina
Malaysia
                 8                  8                  8                   7
       6
          Thailand          Singapore           Colombia             Mexico
Slovenia
                 6                  5                  4                   4
       4
           Romania           Bulgaria            Croatia             Cyprus
Estonia
                 3                  2                  2                   2
       2
           Iceland            Lebanon          Lithuania        Puerto Rico
  Serbia
                 2                  2                  2                   2
       2
    Slovak Republic             Uganda United Arab Emirates          Uruguay
                 2                  2                  2                   2
```

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```
#Convert year variable into factor variable
data_cwur$year<-as.factor(data_cwur$year)
```

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```
cbind(frequency=table(data_cwur$country),percentage=prop.table(table(data_cwur$country)*100))
```

	frequency	percentage
Argentina	7	0.0031818182
Australia	58	0.0263636364
Austria	24	0.0109090909
Belgium	20	0.0090909091
Brazil	36	0.0163636364
Bulgaria	2	0.0009090909
Canada	72	0.0327272727
Chile	8	0.0036363636
China	167	0.0759090909
Colombia	4	0.0018181818
Croatia	2	0.0009090909
Cyprus	2	0.0009090909
Czech Republic	10	0.0045454545
Denmark	12	0.0054545455
Egypt	8	0.0036363636
Estonia	2	0.0009090909
Finland	20	0.0090909091
France	109	0.0495454545
Germany	115	0.0522727273
Greece	14	0.0063636364
Hong Kong	12	0.0054545455
Hungary	12	0.0054545455
Iceland	2	0.0009090909
India	31	0.0140909091
Iran	16	0.0072727273
Ireland	16	0.0072727273
Israel	22	0.0100000000
Italy	96	0.0436363636
Japan	159	0.0722727273
Lebanon	2	0.0009090909
Lithuania	2	0.0009090909
Malaysia	6	0.0027272727
Mexico	4	0.0018181818
Netherlands	29	0.0131818182
New Zealand	12	0.0054545455
Norway	12	0.0054545455
Poland	18	0.0081818182
Portugal	14	0.0063636364
Puerto Rico	2	0.0009090909
Romania	3	0.0013636364
Russia	9	0.0040909091
Saudi Arabia	8	0.0036363636
Serbia	2	0.0009090909
Singapore	5	0.0022727273
Slovak Republic	2	0.0009090909
Slovenia	4	0.0018181818
South Africa	10	0.0045454545
South Korea	72	0.0327272727
Spain	81	0.0368181818
Sweden	24	0.0109090909
Switzerland	26	0.0118181818
Taiwan	46	0.0209090909

```
Thailand                   6 0.0027272727
Turkey                    20 0.0090909091
Uganda                     2 0.0009090909
United Arab Emirates       2 0.0009090909
United Kingdom           144 0.0654545455
Uruguay                    2 0.0009090909
USA                      573 0.2604545455
```

We can see that USA>China>Japan>UK>Germany>France>Italy has highest no. of top class intitutions. India has 31 institutes out of 2200 top institutions that are listed in university rankings.

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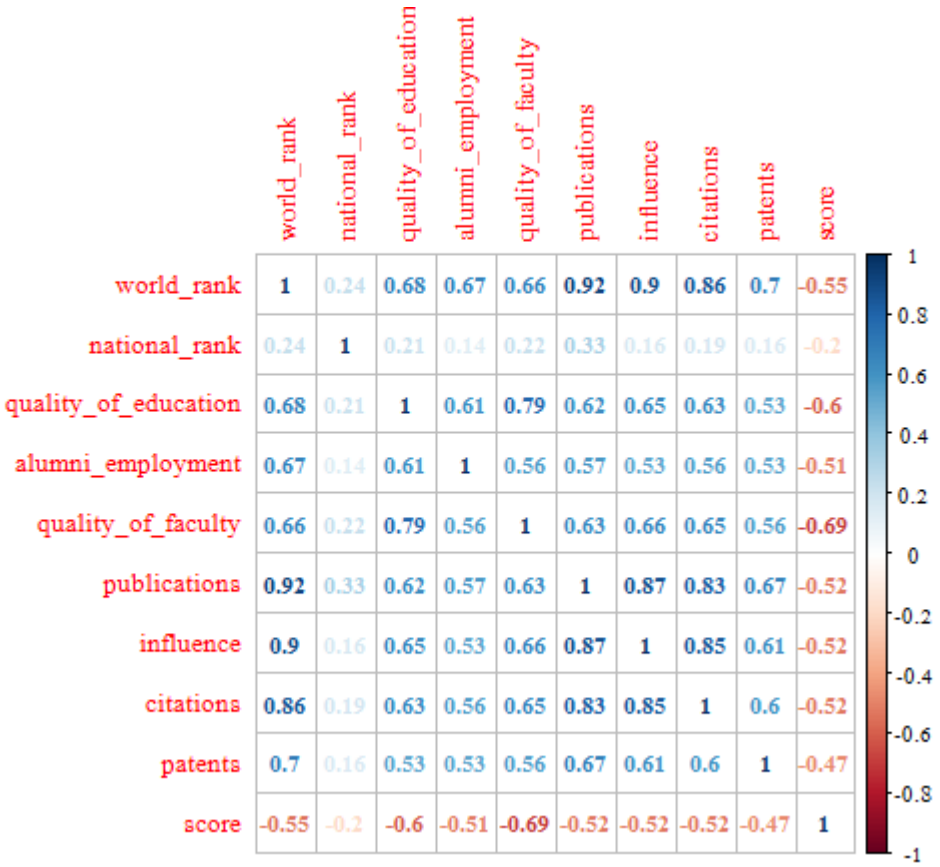
```
library(corrplot)
cor<-cor(data_cwur[,c(1,4,5,6,7,8,9,10,11,12)])
corrplot(cor,method="number")
```



We see that world rank has high correlations with publications, influences and citations. Quality of education has high correlation with quality of faculty

Data Visualization

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```
library(ggplot2)
library(dplyr)
# 1. Top 5 universities according to world rank for all the years 2012-2015
data_cwur %>%
  group_by(year) %>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank)
```

year	world_rank	institution
<fctr>	<int>	<fctr>
2012	1	Harvard University
2012	2	Massachusetts Institute of Technology
2012	3	Stanford University
2012	4	University of Cambridge
2012	5	California Institute of Technology
2013	1	Harvard University
2013	2	Stanford University
2013	3	University of Oxford
2013	4	Massachusetts Institute of Technology
2013	5	University of Cambridge

1-10 of 20 rows Previous **1** 2 Next

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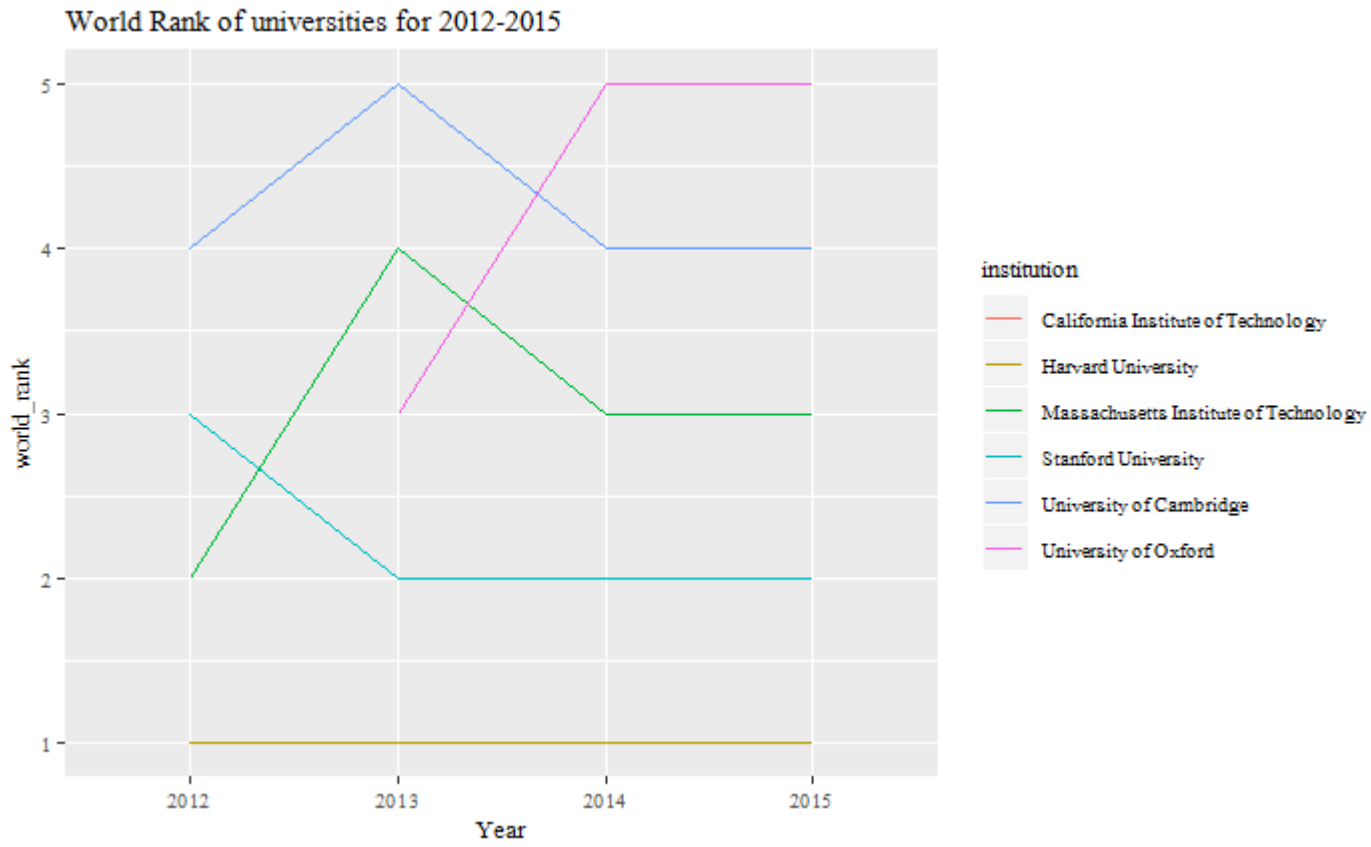
```
data_cwur %>%
  group_by(year) %>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank) %>%
  ggplot(aes(x=year,y=world_rank,group=institution))+
  geom_line(aes(color=institution))+
  labs(x="Year","World Rank",title="World Rank of universities for 2012-2015")
```



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```
NA
```

We can say that Harvard University remained at 1st rank for 2012-2015. Stanford was ranked 3rd in 2012 and then ranked 2nd for 2013-2015.

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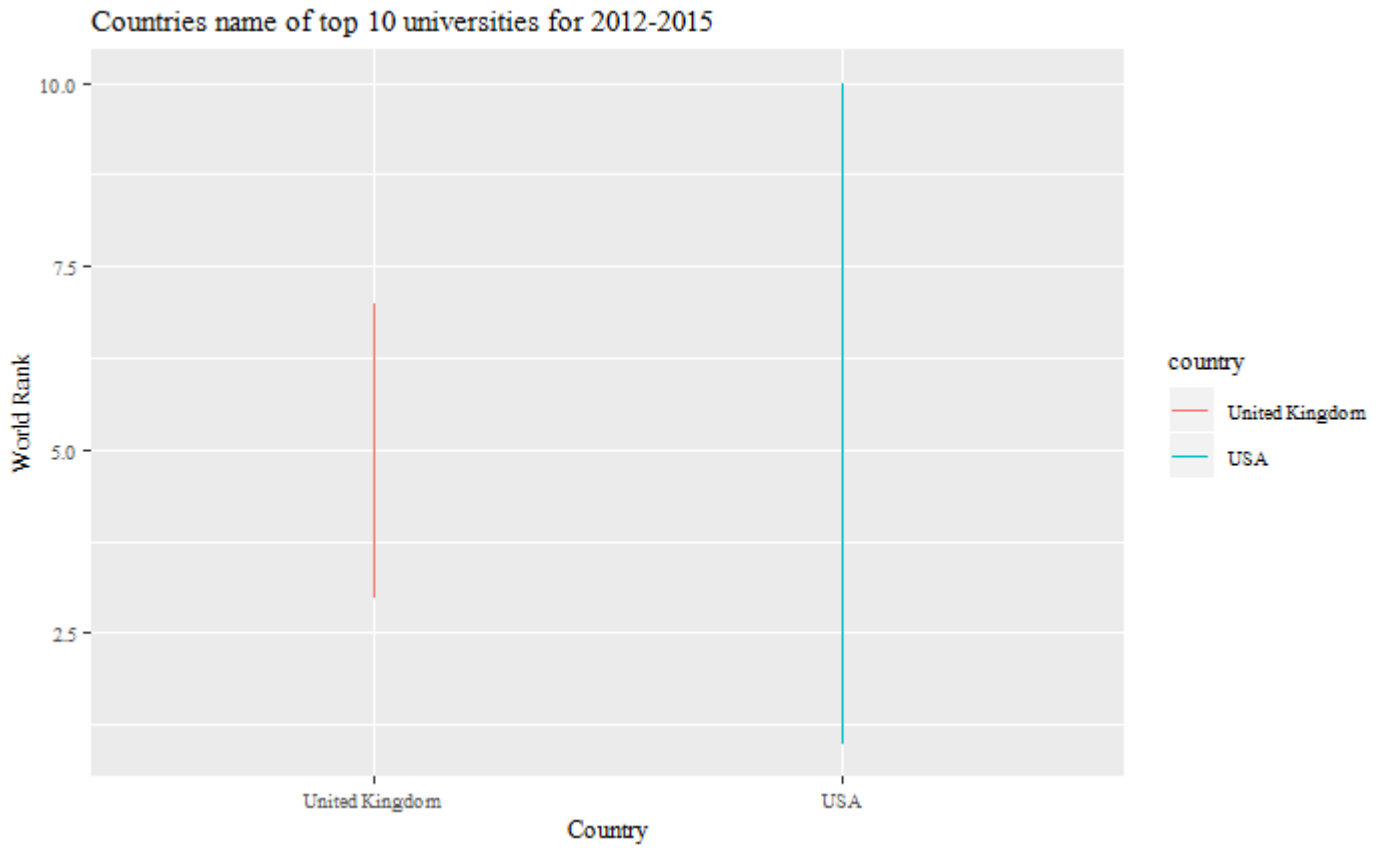
```
# 2. Country name of top 10 universities for the years 2012-2015
data_cwur %>%
  group_by(year) %>%
  select(country,world_rank,institution) %>%
  top_n(-10,world_rank) %>%
  ggplot(aes(x=country,y=world_rank,color=country))+
  geom_line()+
  labs(x="Country",y="World Rank",title="Countries name of top 10 universities for 2012-2015")
```

```
Adding missing grouping variables: `year`
```



We see that only 2 countries are in top 10 i.e. USA and UK.

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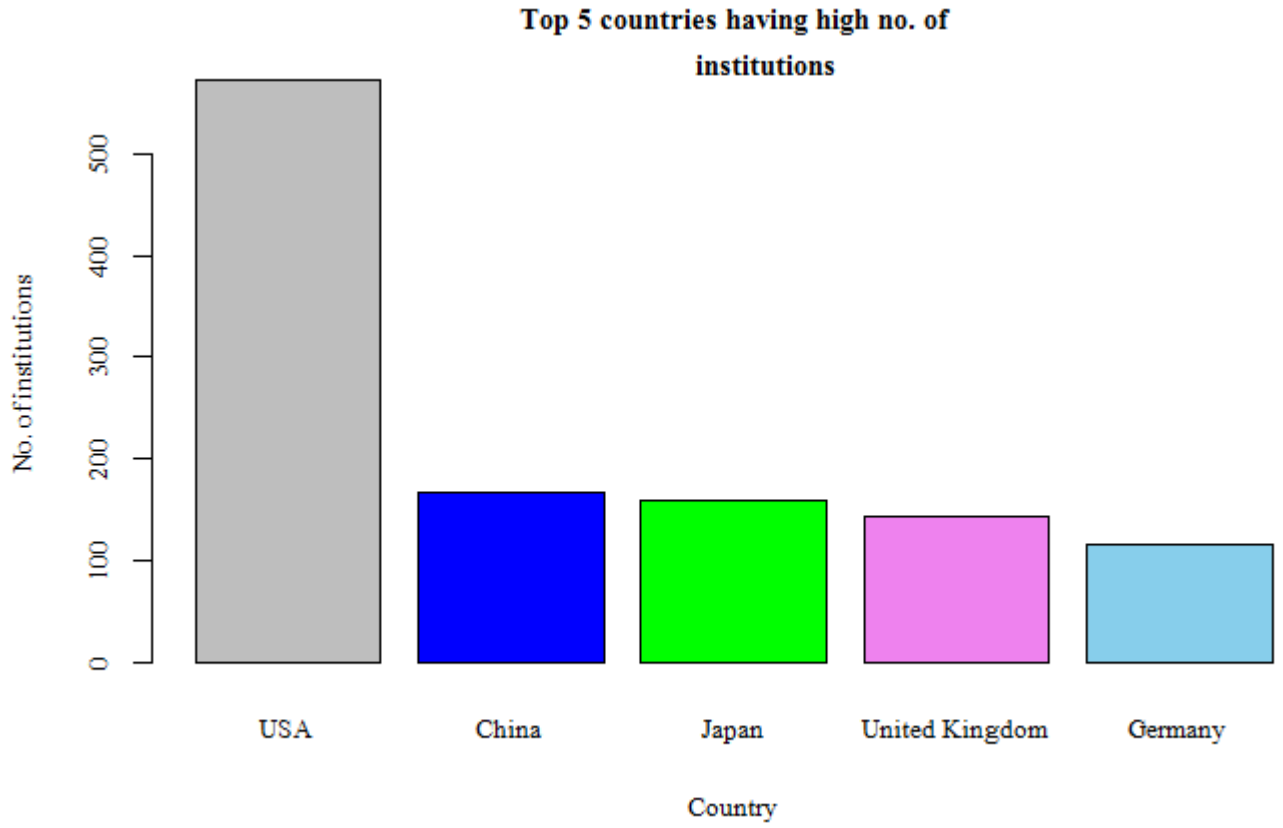
```
# 3. Top 5 Countries having high no. of institutions in world ranking
x<-head(sort(table(data_cwur$country),decreasing=TRUE),n=5)
x
```

```
        USA       China       Japan United Kingdom     Germany 
        573         167         159         144         115 
```

Hide

```
barplot(x,xlab="Country",ylab="No. of institutions",main="Top 5 countries having high no. of
        institutions",col=c("grey","blue","green","violet","skyblue") )
```



We see that top 5 countries having high no. of institutes in world ranking are: USA, China, Japan, UK, Germany

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```
# 4. Year wise Top 5 institute's score
data_cwur %>%
  group_by(year) %>%
  select(year,world_rank,institution,score) %>%
  top_n(-5,world_rank)
```

year	world_rank	institution	score
<fctr>	<int>	<fctr>	<dbl>
2012	1	Harvard University	100.00
2012	2	Massachusetts Institute of Technology	91.67
2012	3	Stanford University	89.50
2012	4	University of Cambridge	86.17
2012	5	California Institute of Technology	85.21
2013	1	Harvard University	100.00
2013	2	Stanford University	93.94
2013	3	University of Oxford	92.54
2013	4	Massachusetts Institute of Technology	91.45

year	world_rank	institution	score
<fctr>	<int>	<fctr>	<dbl>
2013	5	University of Cambridge	90.24

1-10 of 20 rows Previous **1** 2 Next

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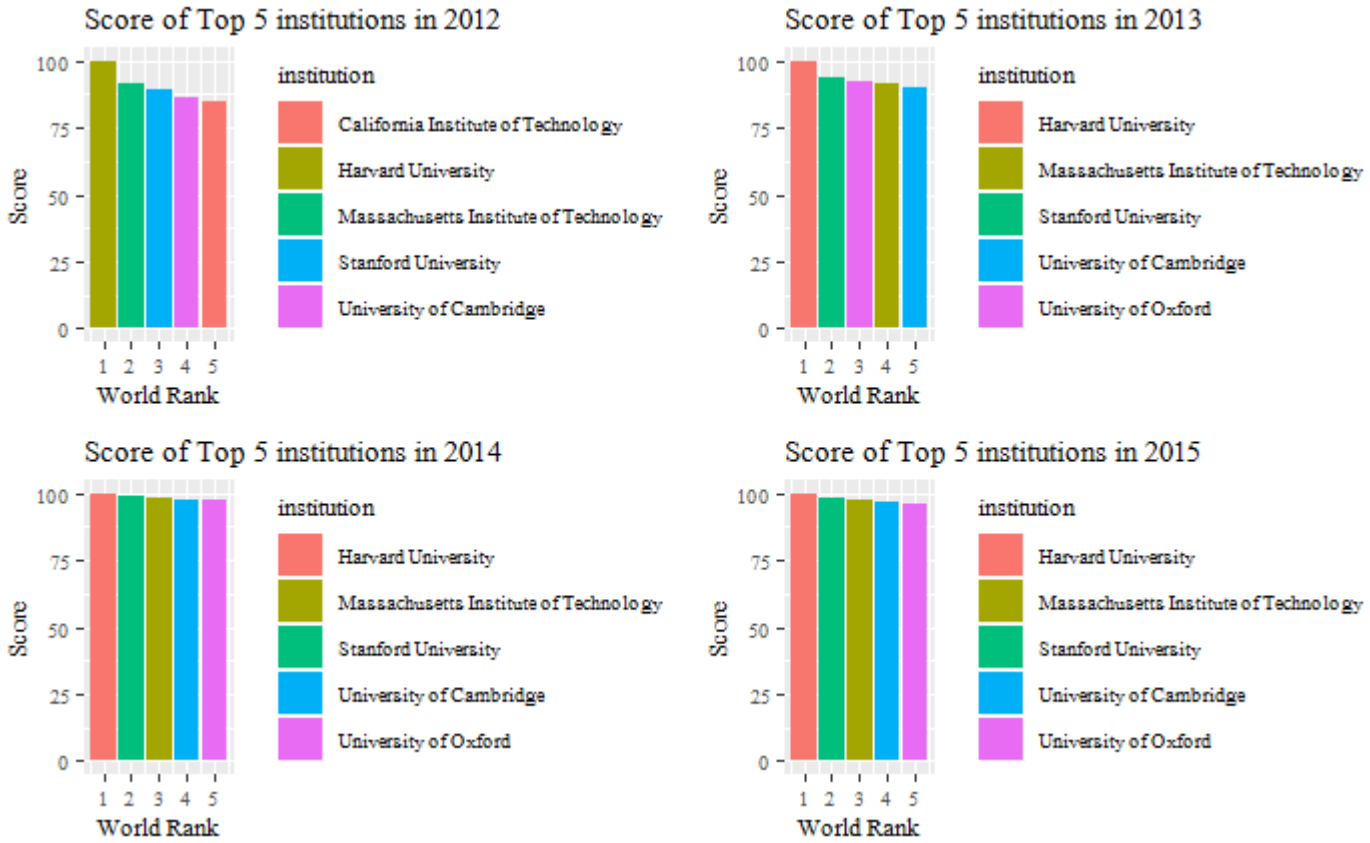
```
fun<-function(yr){
data_cwur %>%
  filter(year==yr) %>%
  select(world_rank,institution,score) %>%
  top_n(-5,world_rank) %>%
  ggplot(aes(x=world_rank,y=score,group=institution))+
  geom_bar(aes(fill=institution),stat="identity")+
  labs(x="World Rank",y="Score",title=paste("Score of Top 5 institutions in",yr))
}
yr_2012<-fun(2012)
yr_2013<-fun(2013)
yr_2014<-fun(2014)
yr_2015<-fun(2015)
library(gridExtra)
grid.arrange(yr_2012,yr_2013,yr_2014,yr_2015, ncol=2)
```



We see that Harvard has highest score of 100 then Stanford for 4 consecutive years 2012-2015

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```
# 5. Year wise Top 5 institutes
data_cwur %>%
  group_by(year) %>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank)
```

year	world_rank	institution
<fctr>	<int>	<fctr>
2012	1	Harvard University
2012	2	Massachusetts Institute of Technology
2012	3	Stanford University
2012	4	University of Cambridge
2012	5	California Institute of Technology
2013	1	Harvard University
2013	2	Stanford University
2013	3	University of Oxford
2013	4	Massachusetts Institute of Technology
2013	5	University of Cambridge

1-10 of 20 rows Previous **1** 2 Next

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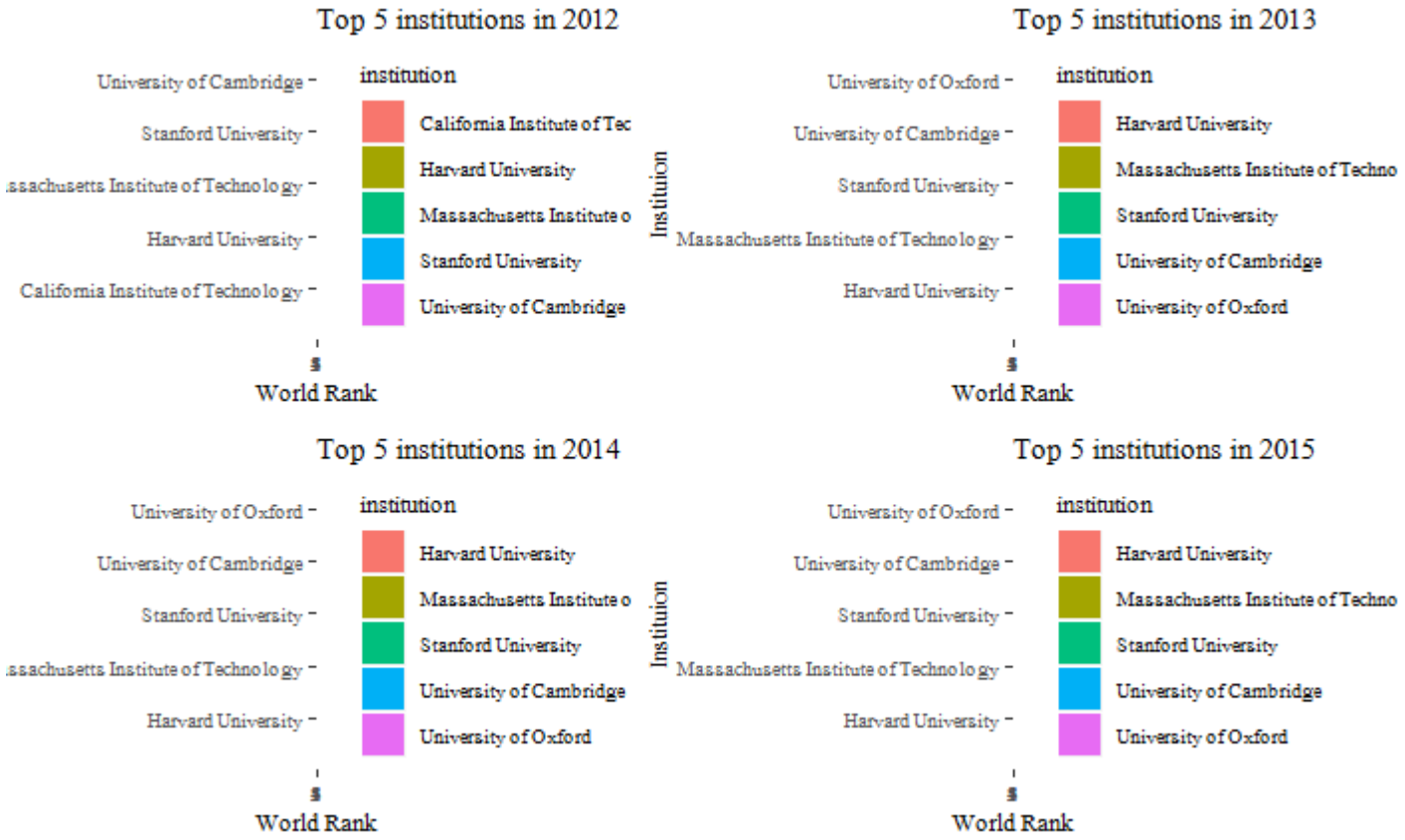
```
fun1<-function(yr){
  data_cwur %>%
    filter(year==yr) %>%
    select(world_rank,institution) %>%
    top_n(-5,world_rank) %>%
    ggplot(aes(x=world_rank,y=institution,fill=institution))+
    geom_bar(stat="identity")+
    labs(x="World Rank",y="Instituion",title=paste("Top 5 institutions in",yr))
}
yr1_2012<-fun1(2012)
yr1_2013<-fun1(2013)
yr1_2014<-fun1(2014)
yr1_2015<-fun1(2015)
library(gridExtra)
grid.arrange(yr1_2012,yr1_2013,yr1_2014,yr1_2015, ncol=2)
```



We see that Harvard was ranked 2nd in 2012 and after that it remained at 1st rank for 2013-2015. Also, in 2012, MIT was ranked 2nd but from 2013-2015, Stanford has got 2nd rank.

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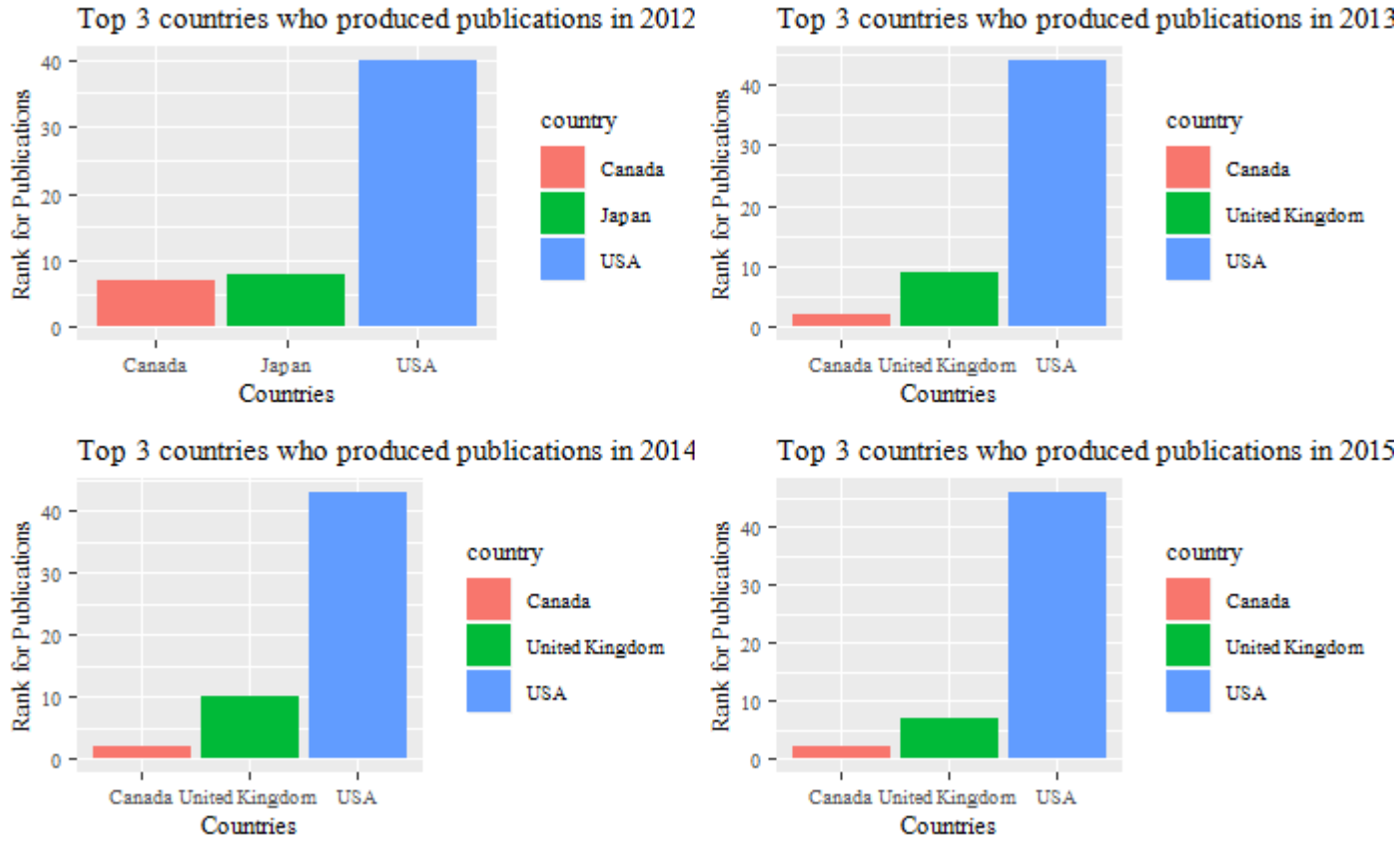
```
# 6. Top 3 countries having high ranking in publications
pub1<-data_cwur %>%
  filter(year==2012) %>%
  top_n(-10,publications) %>%
  ggplot(aes(x=country,y=publications,fill=country))+geom_bar(stat="identity")+
labs(x="Countries",y="Rank for Publications",title=paste("Top 3 countries who produced publicati
ons in 2012"))
pub2<-data_cwur %>%
  filter(year==2013) %>%
  top_n(-10,publications) %>%
  ggplot(aes(x=country,y=publications,fill=country))+geom_bar(stat="identity") +
  labs(x="Countries",y="Rank for Publications",title=paste("Top 3 countries who produced publica
tions in 2013"))
pub3<-data_cwur %>%
  filter(year==2014) %>%
  top_n(-10,publications) %>%
  ggplot(aes(x=country,y=publications,fill=country))+geom_bar(stat="identity") +
  labs(x="Countries",y="Rank for Publications",title=paste("Top 3 countries who produced publica
tions in 2014"))
pub4<-data_cwur %>%
  filter(year==2015) %>%
  top_n(-10,publications) %>%
  ggplot(aes(x=country,y=publications,fill=country))+geom_bar(stat="identity") +
  labs(x="Countries",y="Rank for Publications",title=paste("Top 3 countries who produced publica
tions in 2015"))
grid.arrange(pub1,pub2,pub3,pub4,ncol=2)
```



Top 3 countries having high ranking in quality of education are: USA>UK>Canada>Japan

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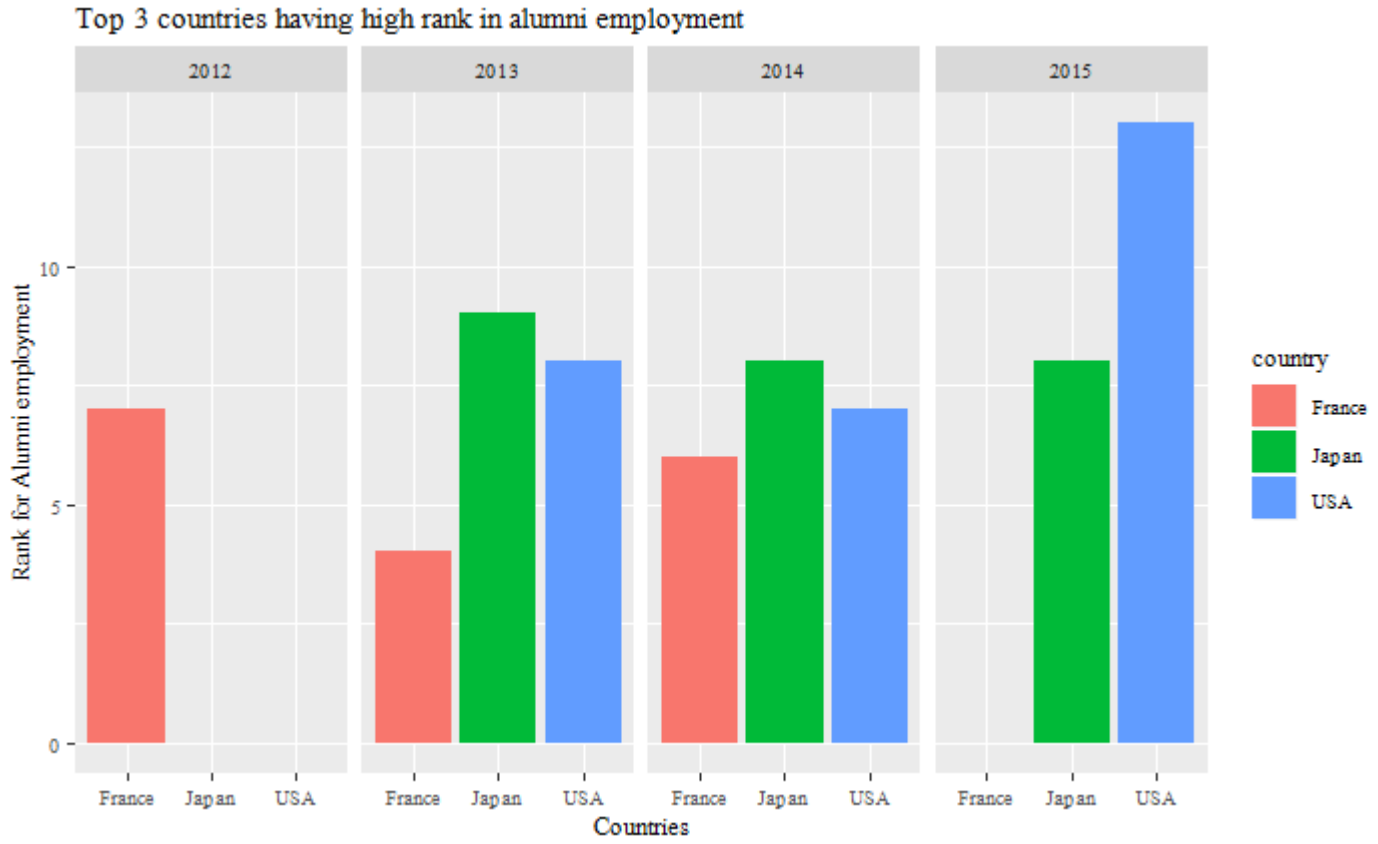
```
# 7. Top 3 countries having high ranking in alumni employment
data_cwur %>%
  top_n(-20,alumni_employment) %>%
  ggplot(aes(x=country,y=alumni_employment,fill=country))+
  geom_bar(stat="identity")+facet_grid(.~year)+
  labs(x="Countries",y="Rank for Alumni employment",
  title="Top 3 countries having high rank in alumni employment ")
```



Top 3 countries having high ranking in alumni employment are: USA>Japan>France

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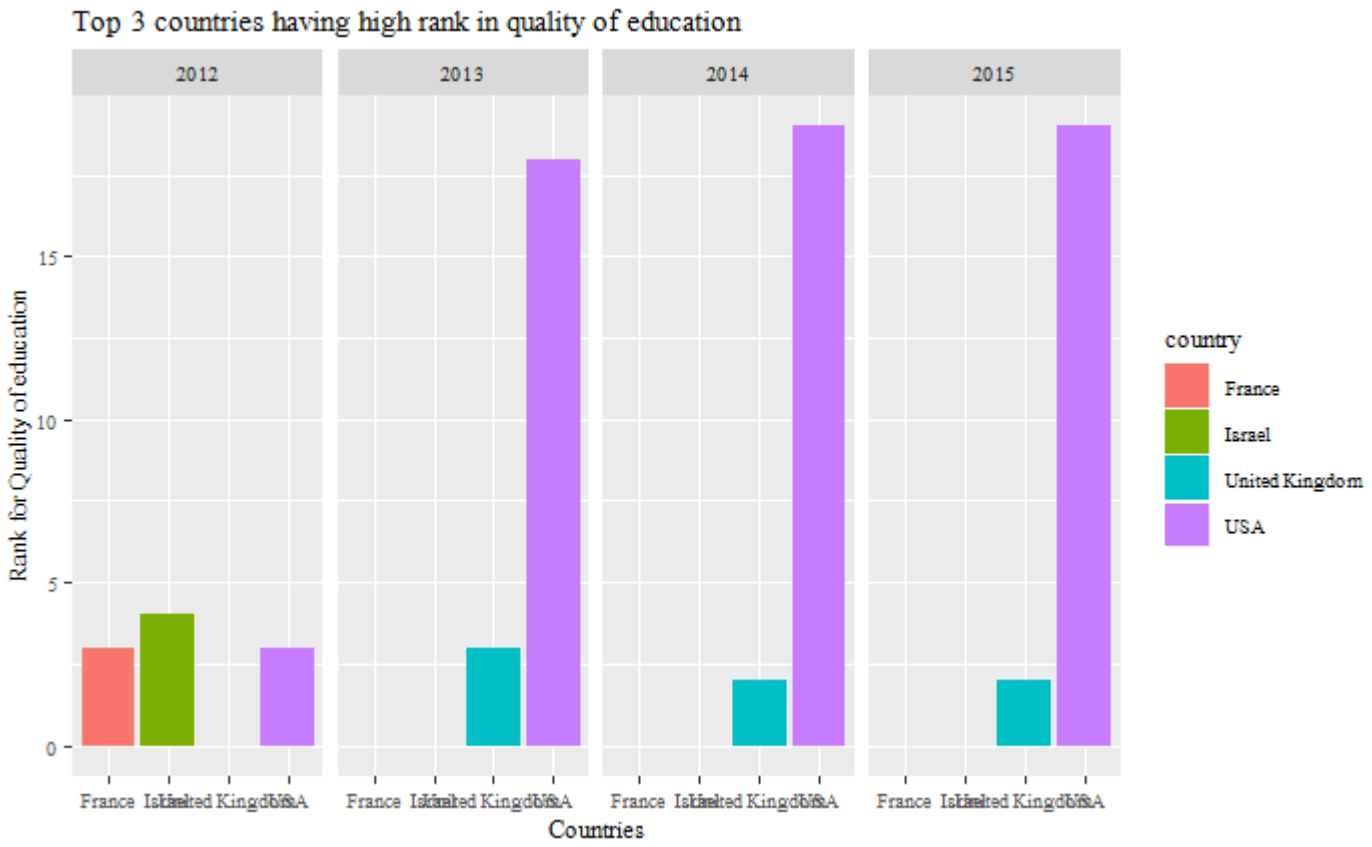
```
# 8. Top 3 countries having high ranking in quality of education

  data_cwur %>%
    top_n(-20,quality_of_education) %>%
    ggplot(aes(x=country,y=quality_of_education,fill=country))+
    geom_bar(stat="identity")+facet_grid(.~year)+
  labs(x="Countries",y="Rank for Quality of education",
       title="Top 3 countries having high rank in quality of education")
```



Top 3 countries having high ranking in quality of education are: USA>UK>Israel>France. For 2013 and 2014, Japan has high rank than USA.

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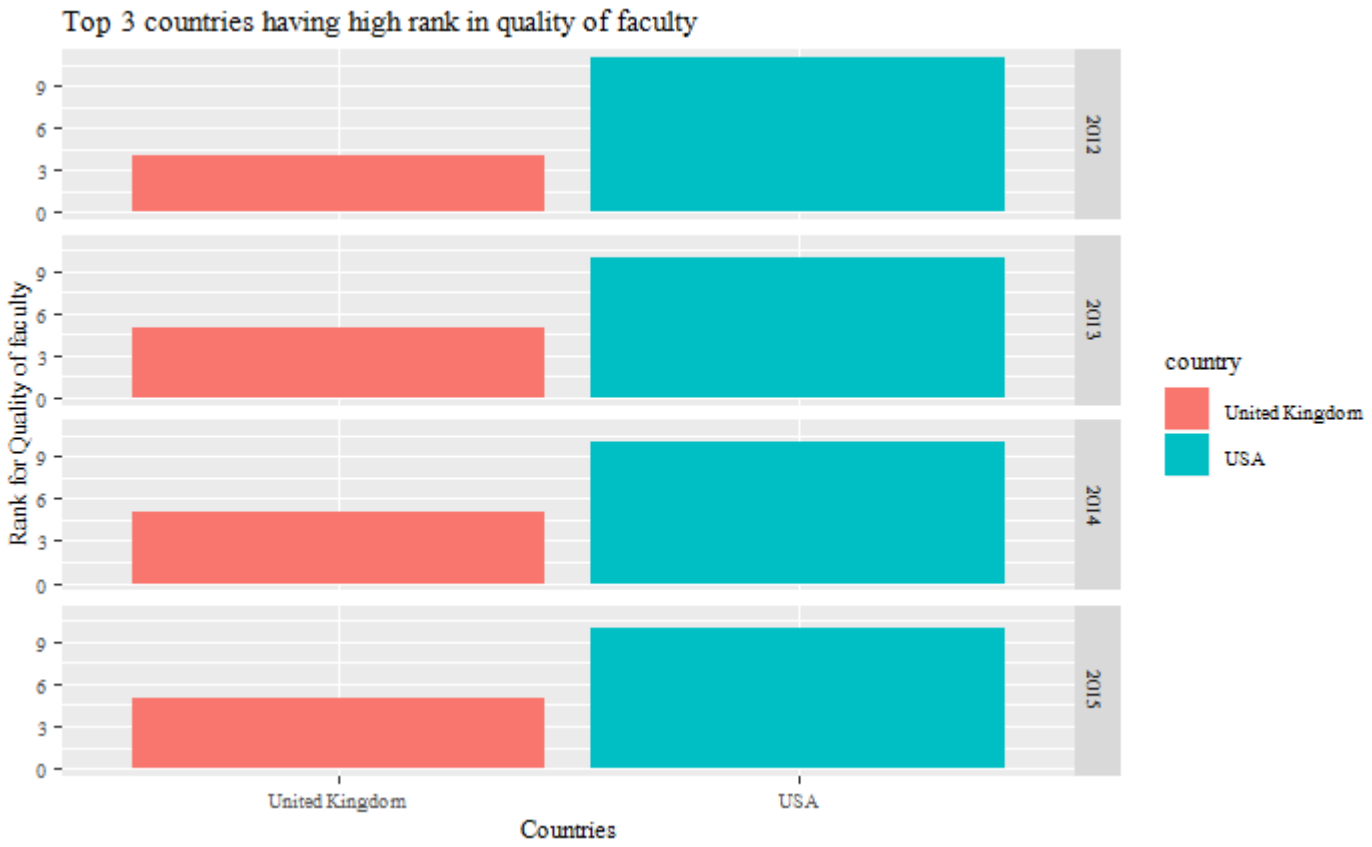
```
#9. Top 3 countries having high ranking in quality of faculty

data_cwur %>%
    top_n(-20,quality_of_faculty) %>%
    ggplot(aes(x=country,y=quality_of_faculty,fill=country))+
    geom_bar(stat="identity")+facet_grid(year~.)+
labs(x="Countries",y="Rank for Quality of faculty",
    title="Top 3 countries having high rank in quality of faculty")
```



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```
NA
```

Top 3 countries having high ranking in quality of faculty are: USA>UK.

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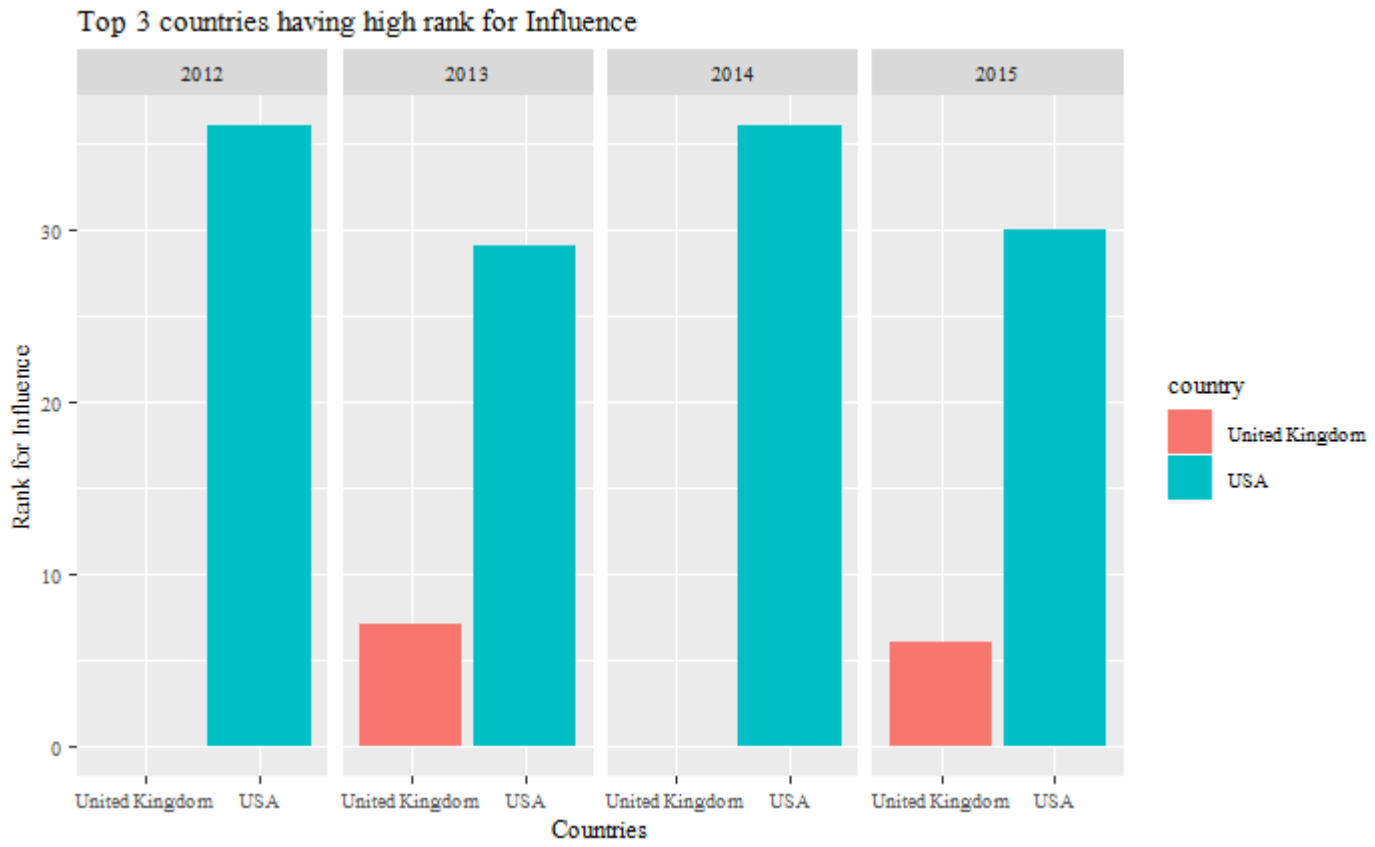
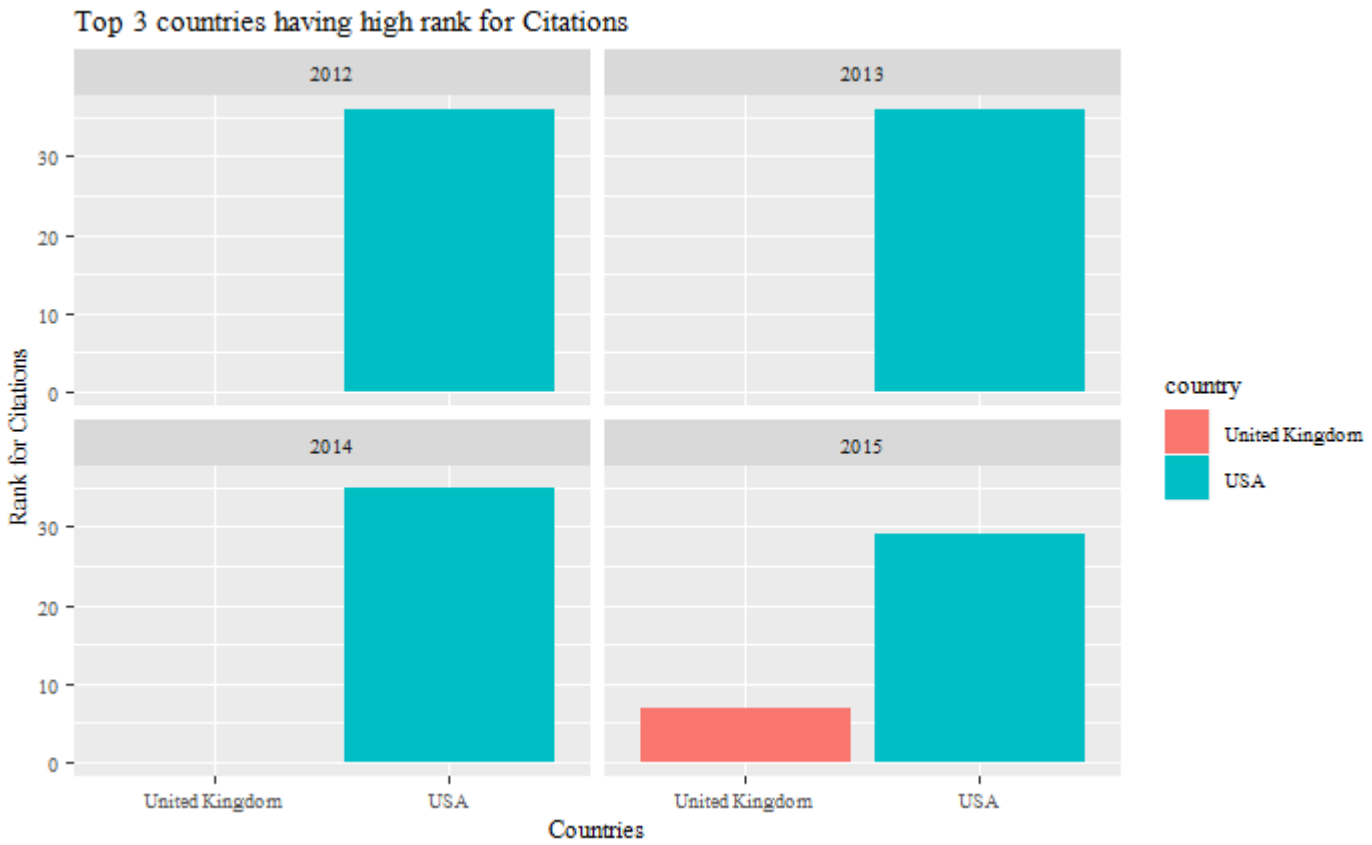
```
# 10. Top 3 countries having high ranking for influence
data_cwur %>%
  top_n(-30,influence) %>%
  ggplot(aes(x=country,y=influence,fill=country))+
  geom_bar(stat="identity")+facet_grid(.~year)+
labs(x="Countries",y="Rank for Influence",
     title="Top 3 countries having high rank for Influence")
```



Top 3 countries having high ranking for Influence are: USA>UK. In top 20 rankings, only USA is there.

Hide

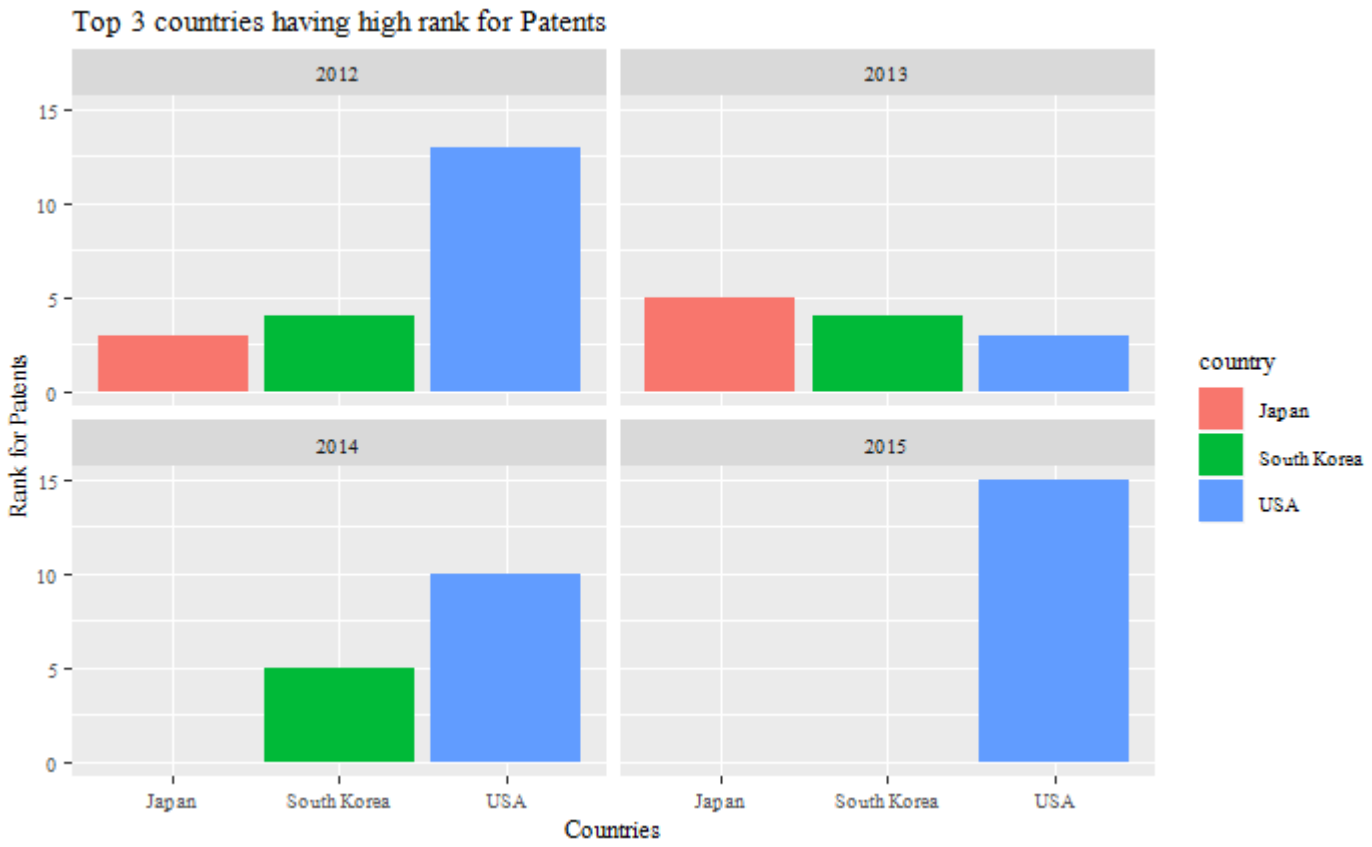
```
# 11. Top 3 countries having high ranking for citations
data_cwur %>%
  top_n(-30,citations) %>%
  ggplot(aes(x=country,y=citations,fill=country))+
  geom_bar(stat="identity")+facet_wrap(~year)+
labs(x="Countries",y="Rank for Citations",
     title="Top 3 countries having high rank for Citations")
```



Top 3 countries having high ranking for Citations are: USA>UK. In top 20 rankings, only USA is there.

Hide

```
# 12. Top 3 countries having high ranking for Patents
data_cwur %>%
  top_n(-20,patents) %>%
  ggplot(aes(x=country,y=patents,fill=country))+
  geom_bar(stat="identity")+facet_wrap(~year)+
labs(x="Countries",y="Rank for Patents",
     title="Top 3 countries having high rank for Patents")
```



Top 3 countries having high ranking for Patents are: USA>South Korea>Japan.

Hide

```
#Top 3 countries having high ranking for Patents are: USA>South Korea>Japan.
#13. Top 5 Indian universities year wise according to world rank
library(dplyr)
data_cwur %>%
  filter(country=="India") %>%
  group_by(year)%>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank)
```

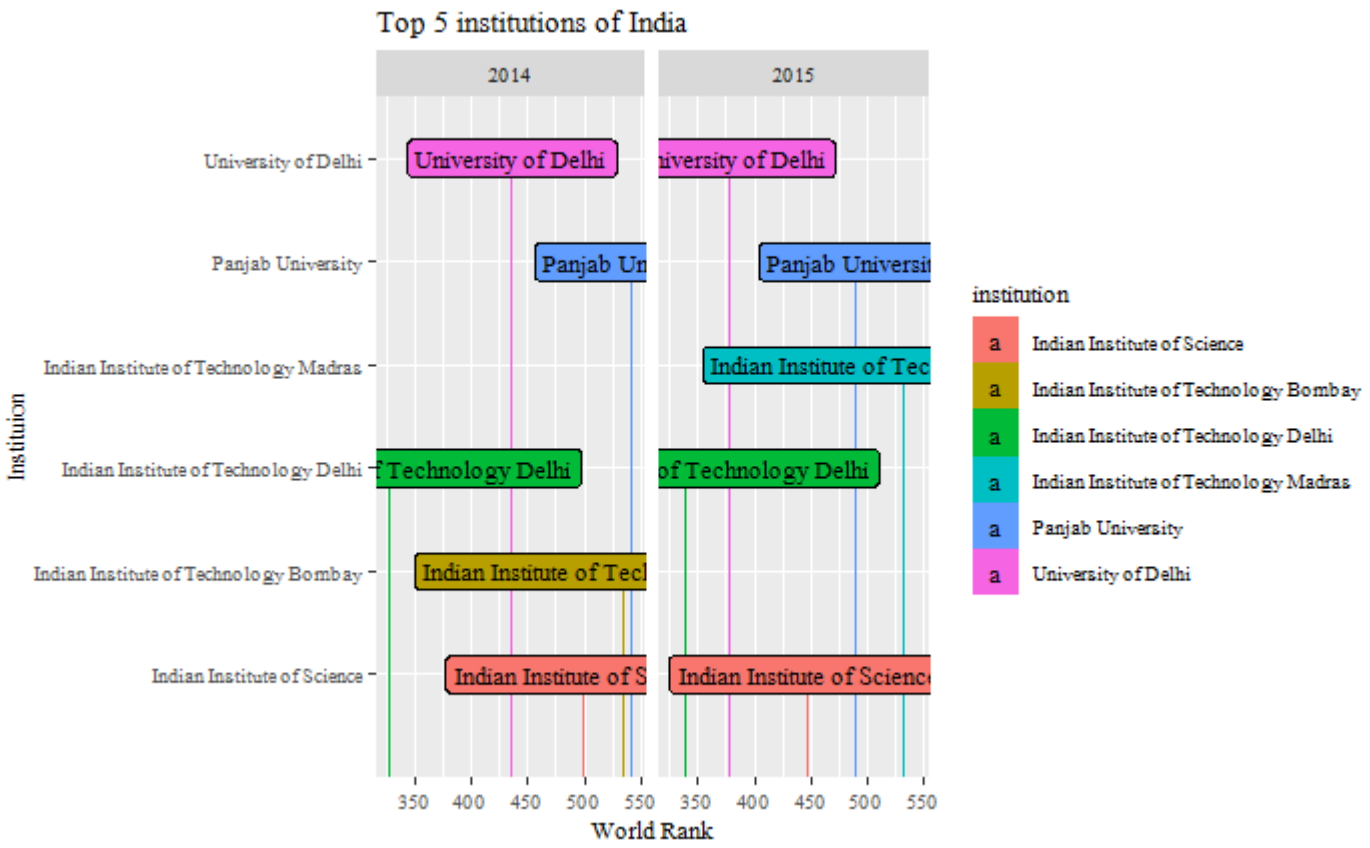
year	world_rank	institution
<fctr>	<int>	<fctr>
2014	328	Indian Institute of Technology Delhi
2014	436	University of Delhi
2014	501	Indian Institute of Science
2014	535	Indian Institute of Technology Bombay
2014	543	Panjab University
2015	341	Indian Institute of Technology Delhi
2015	379	University of Delhi
2015	448	Indian Institute of Science

year	world_rank	institution
<fctr>	<int>	<fctr>
2015	491	Panjab University
2015	534	Indian Institute of Technology Madras

1-10 of 10 rows

Hide

```
library(dplyr)
data_cwur %>%
  filter(country=="India") %>%
  group_by(year)%>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank)%>%
  ggplot(aes(x=world_rank,y=institution,fill=institution))+
  geom_bar(stat="identity")+
  facet_grid(.~year)+
  labs(x="World Rank",y="Instituion",title=paste("Top 5 institutions of India "))+
  geom_label(aes(label=institution))
```



We see that top 5 countries world rank wise in 2015 were: IIT Delhi,Delhi University, IISC Bangalore,Panjab University and IIT Madras.

Hide

```
#14. Score of top 5 Indian universities
data_cwur %>%
  filter(country=="India") %>%
  group_by(year)%>%
  select(year,world_rank,institution,score) %>%
  top_n(-5,world_rank)
```

year	world_rank	institution	score
<fctr>	<int>	<fctr>	<dbl>
2014	328	Indian Institute of Technology Delhi	46.10
2014	436	University of Delhi	45.40
2014	501	Indian Institute of Science	45.11
2014	535	Indian Institute of Technology Bombay	45.00
2014	543	Panjab University	44.97
2015	341	Indian Institute of Technology Delhi	45.54
2015	379	University of Delhi	45.30
2015	448	Indian Institute of Science	44.96
2015	491	Panjab University	44.80
2015	534	Indian Institute of Technology Madras	44.68

1-10 of 10 rows

We see that score of Indian university is between 45-46.

Hide

```
#15. Compare scores of top 5 World rank institutes and top 5 Indian universities in 2015
a<-data_cwur %>%
  filter(year==2015) %>%
  select(year,world_rank,institution,score) %>%
  top_n(-5,world_rank)
b<-data_cwur %>%
  filter(country=="India",year==2015) %>%
  select(world_rank,institution,score) %>%
  top_n(-5,world_rank)
cbind(a,b)
```

```
  year world_rank                          institution  score world_rank
1 2015          1                   Harvard University 100.00        341
2 2015          2                  Stanford University  98.66        379
3 2015          3 Massachusetts Institute of Technology  97.54        448
4 2015          4               University of Cambridge  96.81        491
5 2015          5                  University of Oxford  96.46        534
                           institution score
1  Indian Institute of Technology Delhi 45.54
2                   University of Delhi 45.30
3           Indian Institute of Science 44.96
4                     Panjab University 44.80
5 Indian Institute of Technology Madras 44.68
```

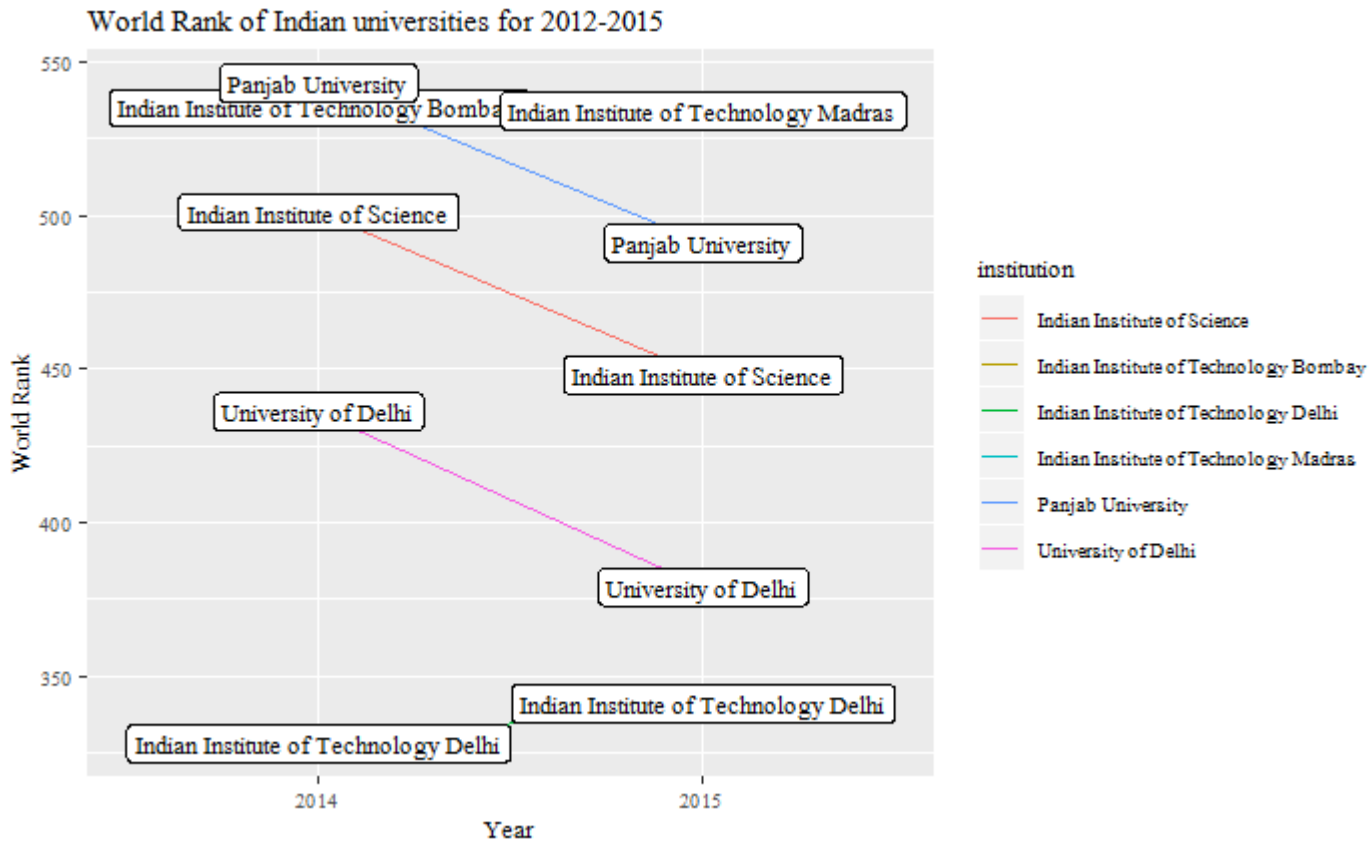
Hide

```
#16. Check world rank, national rank, rank for quality of education,rank for quality of faculty,
 rank for alumni
#employment,rank for influence, rank for publications, rank for citations, rank for patents and
 score of top 5 Indian
#universities in 2015
data_cwur %>%
  filter(country=="India",year==2015) %>%
  select(world_rank,institution,national_rank,quality_of_education,alumni_employment,quality_of_
faculty,
         publications,influence,citations,patents,score) %>%
  top_n(-5,world_rank)
```

```
  world_rank                          institution national_rank quality_of_education alumni_emp
loyment
1        341  Indian Institute of Technology Delhi             1                  367
     59
2        379                   University of Delhi             2                  240
     72
3        448           Indian Institute of Science             3                  367
    332
4        491                     Panjab University             4                  333
    167
5        534 Indian Institute of Technology Madras             5                  367
    147
  quality_of_faculty publications influence citations patents score
1                218          635       943       812     625 45.54
2                218          703       763       812     797 45.30
3                218          315       537       511     239 44.96
4                218          720       786       368     824 44.80
5                218          523       943       812     317 44.68
```

Hide

```
#compare top 5 Indian universities in world rankings for the year 2014 and 2015
data_cwur %>%
  group_by(year) %>%
  filter(country=="India") %>%
  select(year,world_rank,institution) %>%
  top_n(-5,world_rank) %>%
  ggplot(aes(x=year,y=world_rank,group=institution))+
  geom_line(aes(color=institution))+
  labs(x="Year",y="World Rank",title="World Rank of Indian universities for 2012-2015")+
  geom_label(aes(label=institution))
```



We can see rank of Indian universities has improved from 2014 to 2015 except from IIT Delhi